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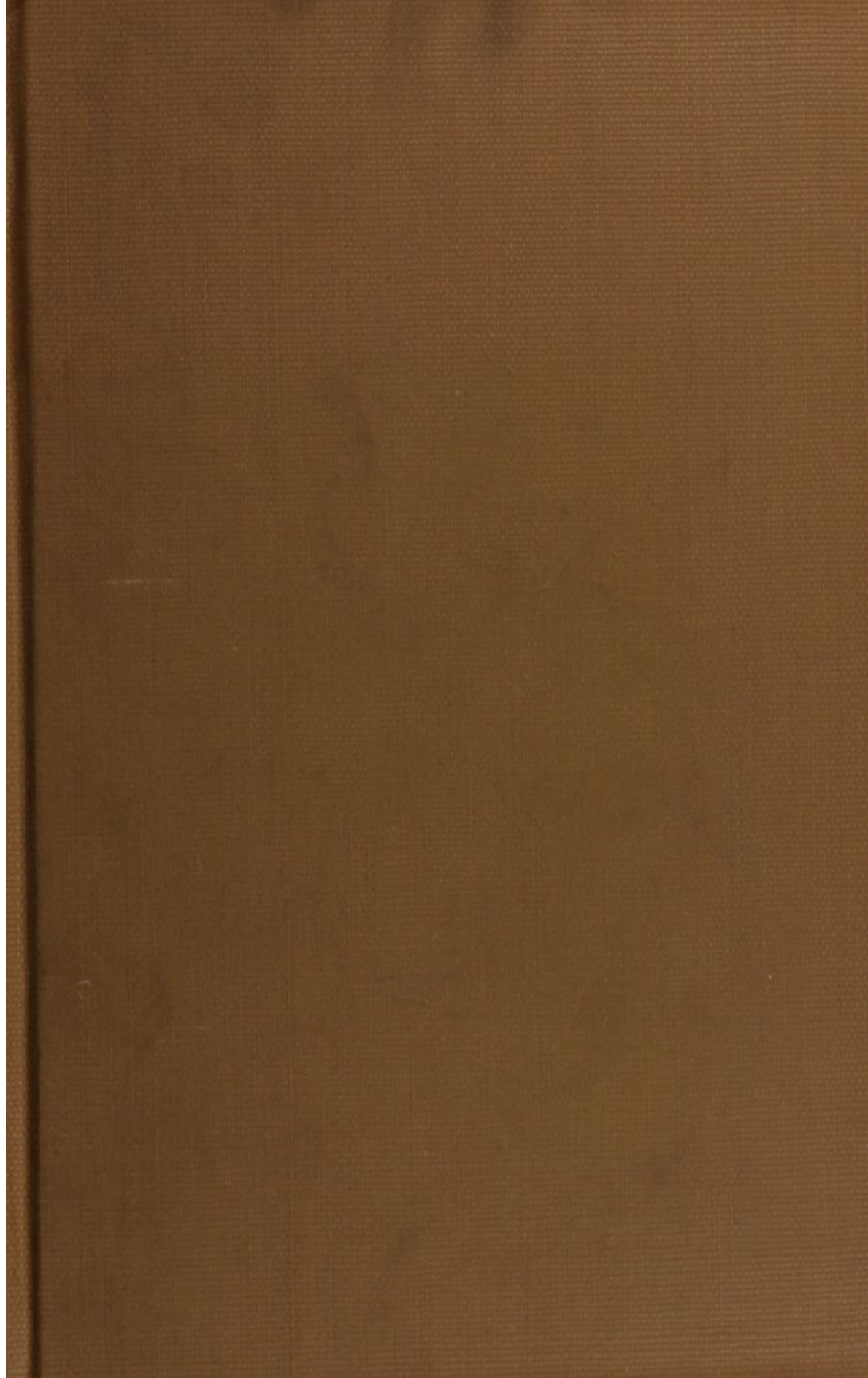
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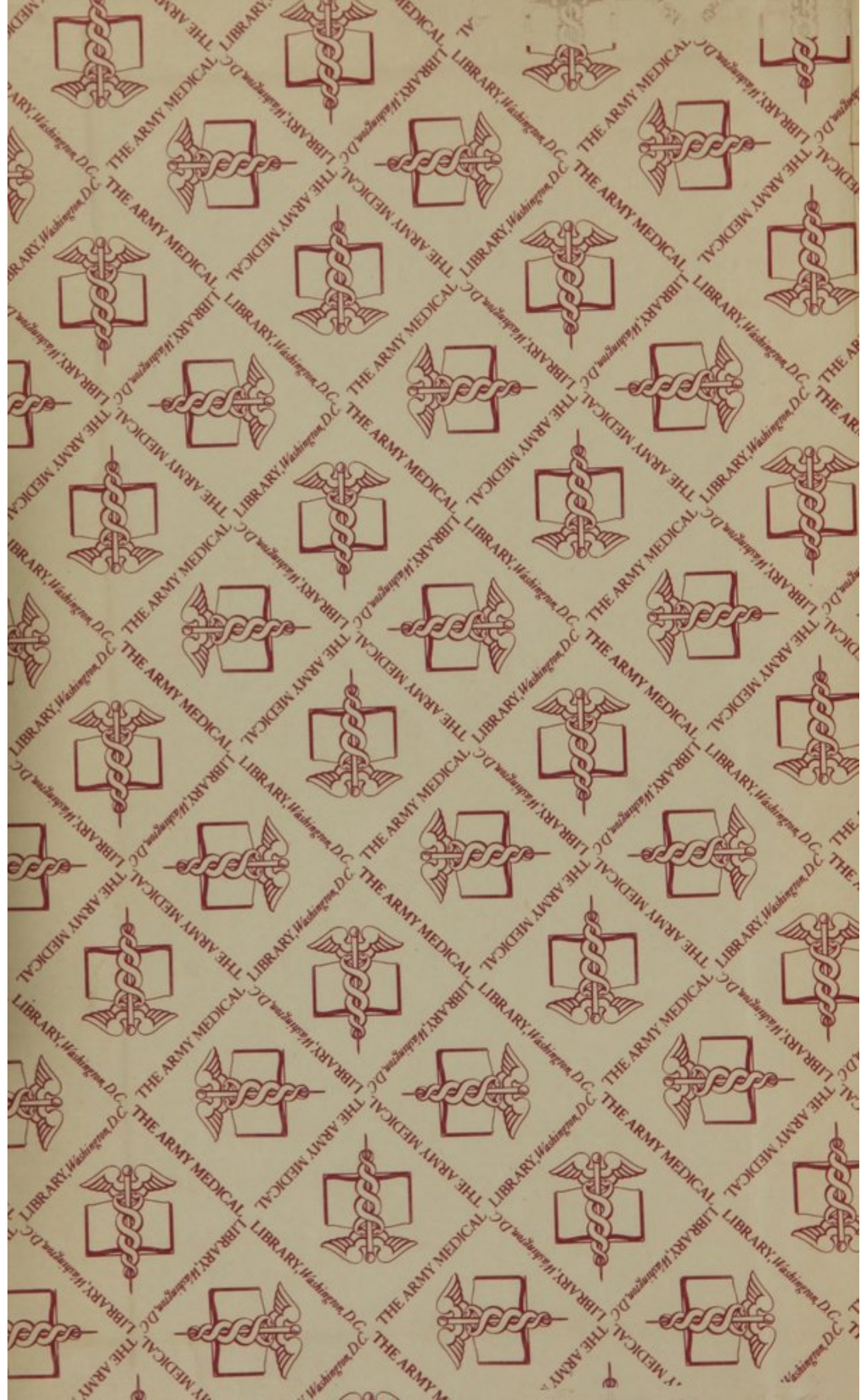
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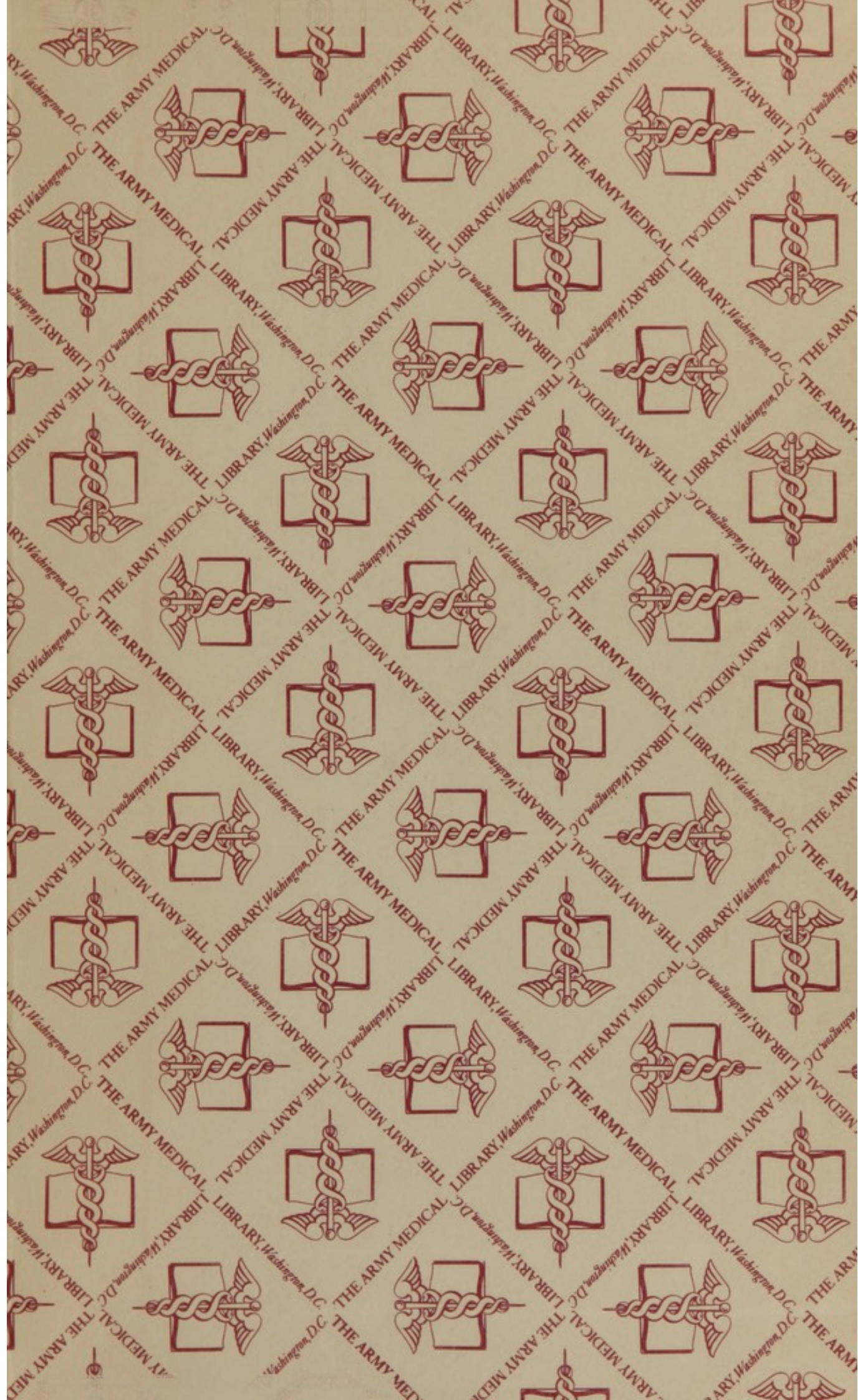
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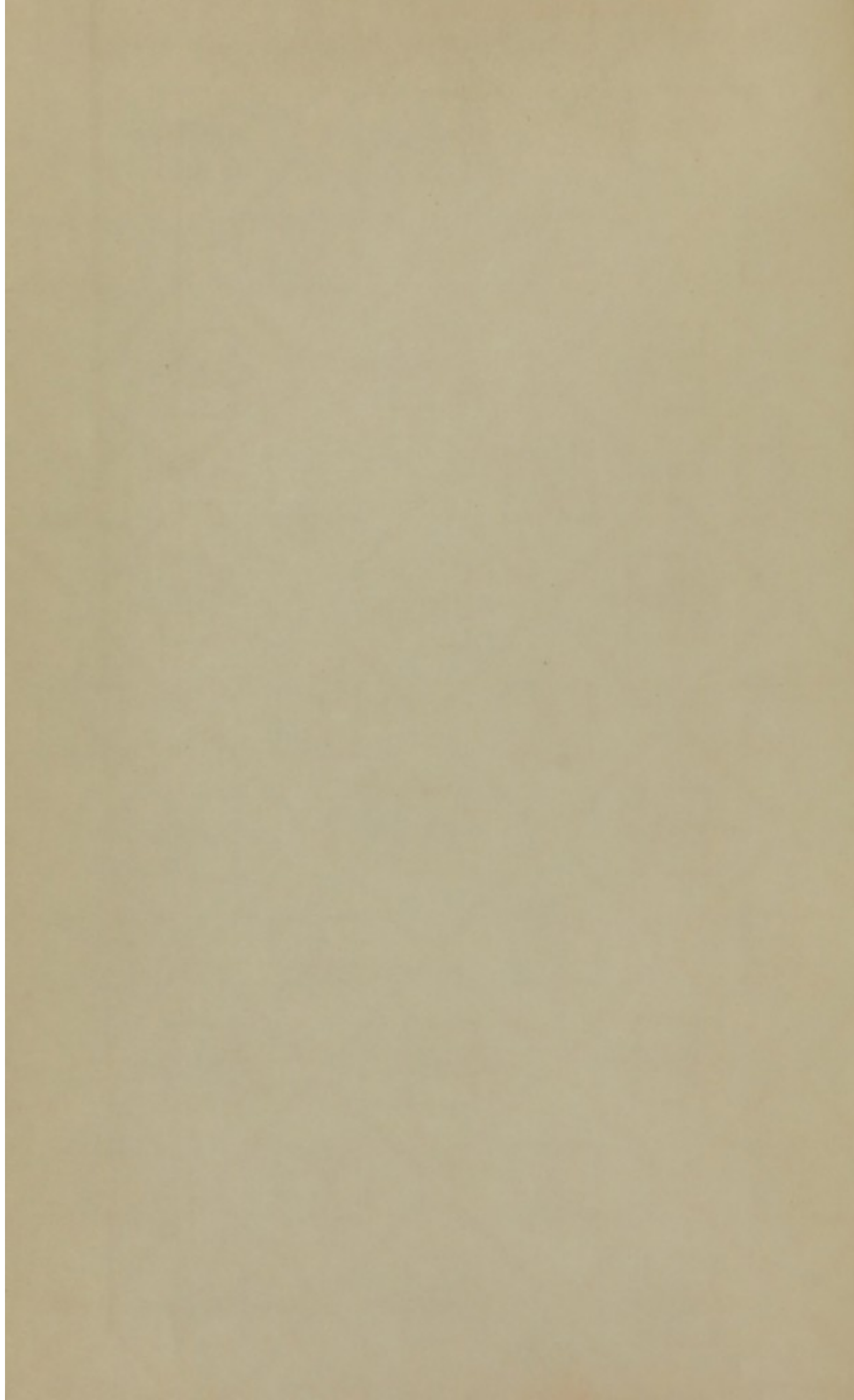


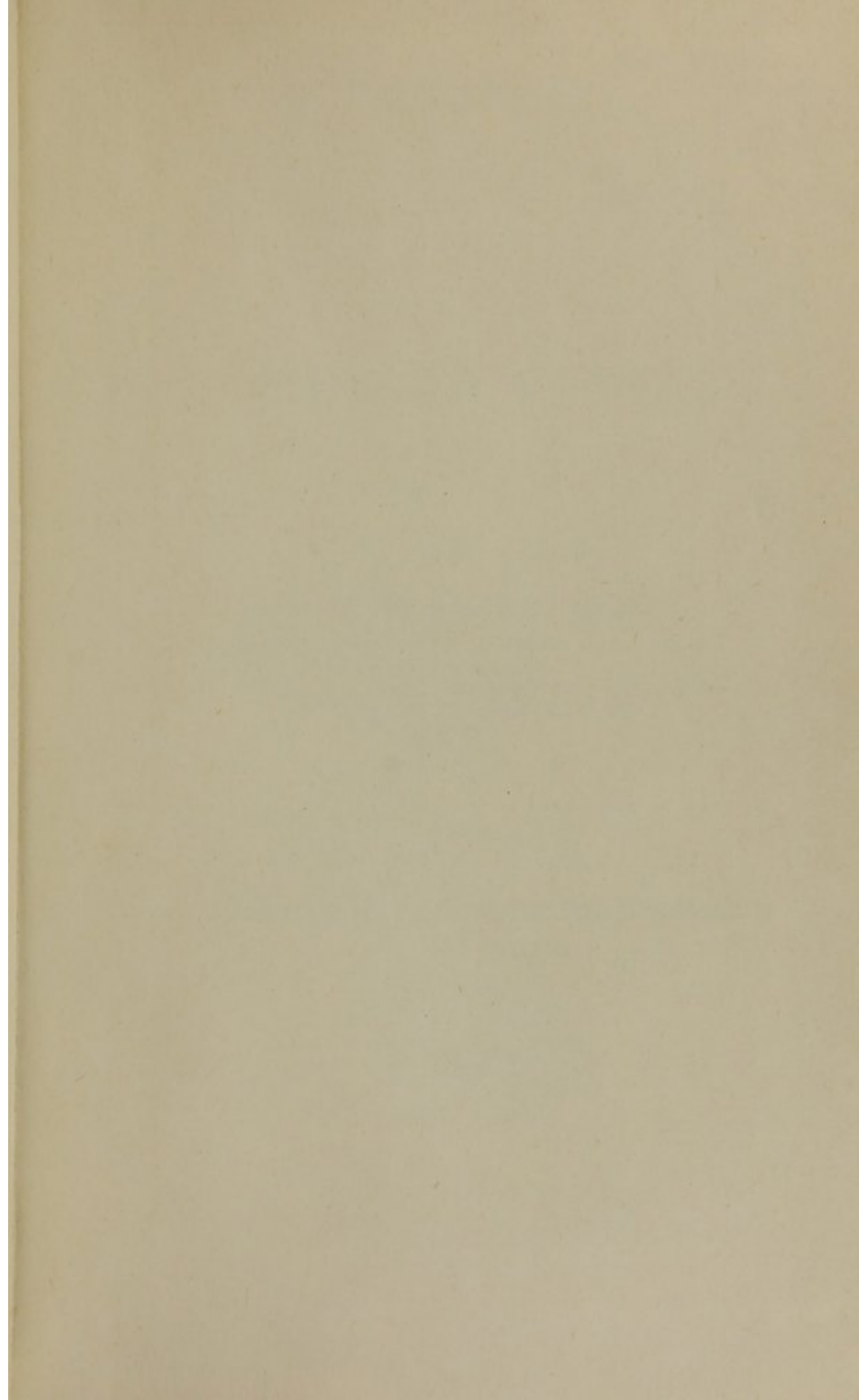
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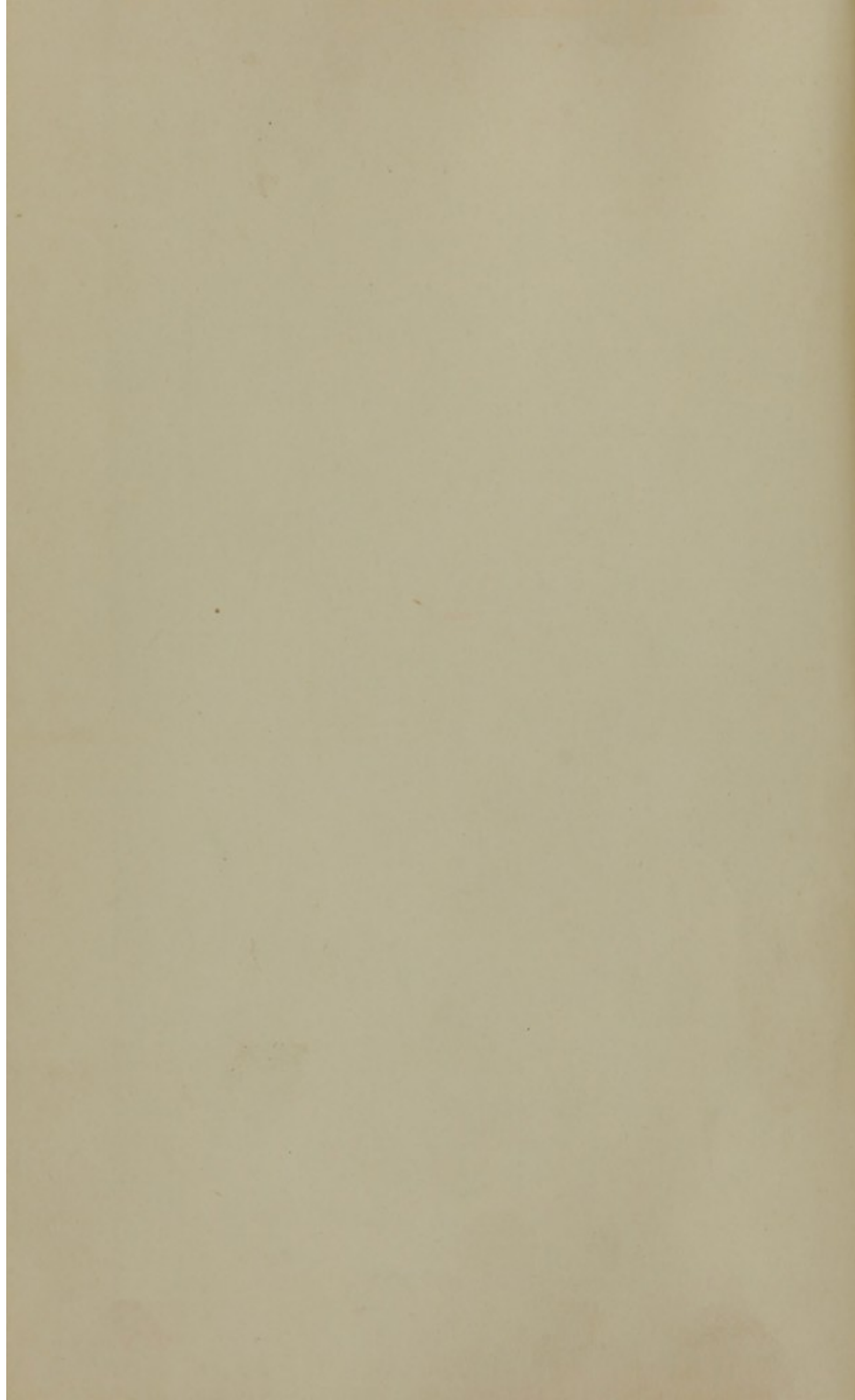












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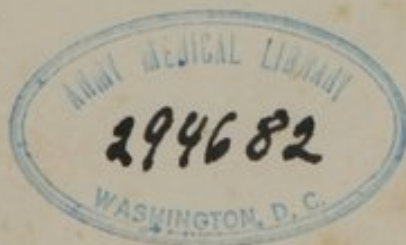
PRACTICE OF SURGERY.

BY

HENRY H. SMITH, M. D.,

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ETC., ETC.

Illustrated by Two Hundred and Seventy-four Engravings on Wood.



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J. P. Middleton

TO

JAMES L. CABELL, M. D.,

PROFESSOR OF SURGERY, PHYSIOLOGY, AND COMPARATIVE ANATOMY

IN THE

UNIVERSITY OF VIRGINIA;

THE ABLE TEACHER, THE ACCOMPLISHED SURGEON,

AND THE

EARNEST ADVOCATE OF A HIGH GRADE OF MEDICAL EDUCATION
IN THE UNITED STATES;

NO LESS DISTINGUISHED FOR THE CULTIVATION OF HIS MIND,

THAN FOR

THE GENEROUS QUALITIES OF HIS HEART;

The following Pages are Inscribed,

BY HIS FRIEND,

THE AUTHOR.

TO

JAMES J. GARFIELD, M. D.

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BY HIS FRIEND

THE ALMA MATER

PREFACE.

MEDICAL instruction, to be thoroughly conducted, requires not only a full series of lectures with appropriate illustrations by the teacher, but also that an opportunity be afforded the student of revising in books and examining in the quiet of his own study, the views that he has heard expressed elsewhere.

In preparing a Text-book as an adjuvant to his lectures on the Principles and Practice of Surgery, the Author has endeavored so to arrange it, that whilst it will recall many of the opinions taught in his course, it will also facilitate the progress of the young surgeon and prove useful to him as a work of reference in the responsibilities of early professional life.

Although the title of Practice of Surgery has been taken, the work will be found to contain as full an exposition of the Principles of the science as was consistent with its character as a text-book.

As Operative Surgery requires for its performance a constant reference to the details of regional anatomy, it has been made the subject of a previous treatise, the second edition of which, in two volumes, has now been some time before the profession. To these volumes frequent references are made in the following pages, the two works being intended to form one series on the Science and Art of Surgery.

In the composition of the present Treatise, it has been the Author's wish to present each subject as fully as was essential to its comprehension by the youngest of his pupils without entering

into such details of the history, pathology, &c., of each as properly belong to monographs. Such an extended treatise on each of the various affections that are daily presented to the attention of the surgeon, would have enlarged this work beyond reasonable limits and destroyed the object of its formation. Such reading should also be made to occupy the years which ensue upon graduation, and is amply provided for in the works of those who have devoted themselves to special subjects, as in the *Treatises on Fractures, Luxations, Diseases of the Breast, Testicle, Hernia, &c.*, by Sir Astley Cooper; the *Affections of the Bones*, by Stanley; of the *Eye*, by Lawrence; of the *Ear*, by Wilde, &c. But, to all these subjects, sufficient insight is now offered to tempt the student to further investigations when he has mastered the elements of his profession, if the love of knowledge in him, as in others, grows with its cultivation.

Whilst admitting his own indebtedness to these high authorities for many opinions hereafter quoted, the author desires especially to express his obligations to Mr. James Paget, of London, for his admirable exposition—in his “*Lectures on Surgical Pathology*”—of the present condition of surgical knowledge respecting inflammation, nutrition, &c.; a treatise which, for clear analytical observation, is fully equal to any other ever published on these subjects.

As the present volume is intended to aid the inexperienced surgeon, the author has added, in various places throughout it, a few formulæ of such combinations of medicinal articles as have proved useful; but he desires to express the wish that the reader will regard them only as applicable to certain conditions of diseased action, or to certain stages of the affections under which they are stated, and to remember that when any of them are employed without a careful analysis of their adaptation to special cases, their use becomes empirical, and such as no intelligent surgeon would be willing to sanction.

The illustrations of the volume have been carefully selected with a view to their utility, and especially as explanatory of the micro-

scopic appearances of structure, or of forms of surgical appliances, subjects which the best description, without a drawing, does not always render easy of comprehension. Through the liberality of his Publishers, Messrs. J. B. Lippincott & Co., he has also been enabled to furnish the reader with one hundred and seven new cuts, most of which are from nature, for the drawing and engraving of which he is indebted to the artistic skill of Mr. Baxter, a gentleman whose experience in this line enables him to delineate anatomical and surgical details with great accuracy. All the cuts have been credited, as far as possible, to their original sources; but where this has not been known, the work in which a cut was employed has generally been supposed to be entitled to the credit of its formation.

In the arrangement of the manuscript, he is under many obligations to his friend and prosector, Dr. J. J. Woodward, by whom much valuable aid has been rendered, whilst to his assiduous pupil, Mr. Edward Shippen, he is indebted for the Index to the volume.

Written, as the work has been, during hours taken from repose, and with the frequent interruptions of active professional life, some imperfections, both typographical and otherwise, may doubtless be noticed by a critical reader; but if this volume should receive the professional favor that has been accorded the author on other occasions, he trusts at a future day to be able to strengthen these weak points—some of which are almost inseparable from the mechanical labor of a first edition.

No. 311 Walnut Street,
PHILADELPHIA, Sept. 1856.

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PRACTICE OF SURGERY.

PART I.

SURGICAL PATHOLOGY AND THERAPEUTICS.

INTRODUCTION.

SURGERY (*χειρ*, the hand, and *εργον*, work; *Chirurgia*, Latin—*Chirurgie*, French) may be defined as that part of the "healing art" which relates to the characters and treatment of such disorders as are tangible, whether arising from impaired vital action or excited by external causes.

In explanation of the extended meaning of this term, Mr. Lawrence includes under it: "1. Injuries of all kinds. 2. The greater part of external and local complaints. 3. Such internal affections as produce changes recognizable externally. 4. All disorders requiring external topical treatment, operation, or manual proceedings of any kind."¹

In order to promote the more thorough examination of this wide field, surgical writers have subdivided it into two grand portions; one being known under the general head of "External or Surgical Pathology;" the other under that of "Surgical Therapeutics." Such a methodical division, though highly conducive to study, must not be regarded as being based on any natural arrangement of the disorders to be investigated, few external affections existing independently of the sympathetic action of the internal organs.

¹ Cooper's Surg. Dict.

Under the head of External or Surgical Pathology, are usually placed all those laws which are generally recognized as the Principles of Surgery or its Science; whilst the term External, Surgical or Mechanical Therapeutics, properly expresses the whole Art or Practice of Surgery.

Surgical therapeutics, as well as surgical pathology, includes, however, many principles which are common to the practice of medicine as well as to that of surgery, whilst the former (surgical therapeutics) embraces not only the internal means of treatment, but also, under a special head (Operative Surgery), such remedial measures as are carried into effect by means of cutting instruments.

In the arrangement of a work which is intended to be adapted to the wants of the youngest, as well as to those of the more advanced student, I shall, in view of the definition just given, confine myself to such portions of the Science and Art of Surgery as are not included under the last head (operative surgery), this having been the special subject of a previous treatise.¹

In the methodical division of the present treatise, I will consider, 1st, such portions of surgical pathology and therapeutics as are more or less applicable to surgical disorders in all parts of the body (Parts I., II., III.), then treat of those which affect the different tissues (Parts IV., V.), and subsequently take up the consideration of such as are specially related to certain regions of the body (Parts VI. to XVIII.).

¹ A System of Operative Surgery, based upon the practice of surgeons in the United States, with a Bibliographical Index and Historical Record of many of their operations, during a period of 234 years. Second edition, by the Author. Philadelphia, 1855.

CHAPTER I.

SURGICAL SEMEIOLOGY.

THE correct investigation of the elements of a disorder being essential to a recognition of its presence, the first subject to which the attention should be directed is Surgical Semeiology, or that portion of pathology which teaches the signs or symptoms of surgical disorders.

Of these signs some are equally applicable to many complaints, and may be studied together, being rather generic in their character; whilst others, which are more specific, can be best alluded to under the particular head to which they belong. Presuming that the student is acquainted with the different points in the anatomy and physiology of the human frame, I shall at once proceed to examine, 1st, such signs of surgical disorders as in most instances are exhibited on the exterior of the body; and 2d, study such as are to be noticed in connection with the action of the internal organs.

SECTION I.

OF THE SIGNS FURNISHED BY THE EXTERIOR OF THE BODY AS A MEANS OF DIAGNOSIS.

Health being the result of the perfect action of normal organs, any departure from their original condition will develop changes that constitute disease. In that class of disorders assigned to the surgeon, the outward man or his more external organs, are those most directly affected, either in consequence of the disordered action of internal parts, or from external violence, and their general condition should therefore first attract our attention. Thus the carriage,

posture, shape, color, temperature, and sensibility of the exterior of the body are often directly affected by injuries, and should be carefully noted in forming a diagnosis.

§ 1.—OF THE POSTURE OF A PATIENT AS A MEANS OF DIAGNOSIS.

The carriage of man when in the full possession of all his powers is naturally erect and heavenward, but no sooner is he struck by the blight of injury than he droops and sinks to earth.

The variations from the erect posture will therefore not unfrequently indicate the extent of his injury.

The *recumbent position*, or that in which all the limbs are relaxed and the body is alone supported by artificial means, if the result of violence, will generally indicate serious depression of the nervous system, all parts of the body being dependent on this great centre for their life-like force. The doubling of the body forwards, or that position in which the limbs are drawn up towards the chest, usually indicates abdominal trouble; whilst its rigidity or extreme extension, or tendency to approximation of the heels and head, shows a derangement in the contents of the spinal canal.

The *sitting posture* may be the result either of partial external injury, by which the patient is prevented from standing, or it may follow an effort to leave the recumbent one when the strength is not yet sufficient to enable him to rise entirely.

The *relaxed condition of the extremities*, or their fixedness in unnatural positions, are also often important signs as indicating injuries by which muscular action is more or less impaired. The power of moving a limb or any portion of the body without its quivering or being unsteady in its movements, shows perfect health; but a trembling motion, imperfect elevation, or unnatural flexion or extension, tell most truly of disorder either in the parts devoted to locomotion or in the nerve centres which regulate them. In health, the mechanical movements of the body and limbs are all perfect and easy, whilst in the injured or diseased condition, the derangement may be readily recognized by their labored and imperfect action.

In order thoroughly to understand the mechanical actions of a patient, it sometimes happens that the surgeon will be compelled to carry him through a regular set of motions, in order to decide which portion of his body is disordered. In the stiffness of joints, power

of muscles, action of limbs, and correctness of the spinal curvature, such a direct observation can alone show the seat of the disorder. When an examination of the patient is required under such circumstances, he should be entirely deprived of covering on the part to be inspected; if in the spine, by the removal of all clothes, except drawers, &c.; and if in the lower extremities, by the retention only of the upper part of the clothing. But when a partial exposure circumscribes the view, and the nature of the injury demands it, entire nudity, as practised by army and navy surgeons in the inspection of recruits, affords decidedly the best opportunity of arriving at a correct conclusion. Under these circumstances the examiner should stand about six feet from the patient, and direct him to stand erect and face him. When thus placed, let the surgeon proceed to inspect, first, his general carriage, as the position of his head, the level of his shoulders, the fulness of the chest and abdomen, and the position of his legs and feet. After which he may proceed to a more special observation of particular parts, examining the motion of his arms, by making him raise them over his head, move them in a horizontal position; and then make the back of the hands touch behind his back. Then, in examining his other movements, direct him to bend his body until the points of his fingers touch the ground; to straighten himself again; to open and close his hand; flex and extend each finger; pronate and supinate his hand, &c.

Next, let the patient be made to walk towards and from his examiner; to bend and straighten each limb, extend and flex each foot, stand on one leg, and, in fact, pass through these and such other movements as will show clearly his power to perform all the natural motions of each portion of his trunk. This kind of examination, though not often required, will be found especially useful in detecting injuries about the hip-joint or spine, cases having been frequently thus recognized at a glance, which had escaped the most careful measurement and merely local observation.

§ 2.—OF PHYSIOGNOMY AS A MEANS OF DIAGNOSIS.

Physiognomy, so often trusted to in the judgment of moral character, is not less useful in the formation of an opinion of physical disorder. A lively countenance indicates not only mental but

corporeal health and comfort, whilst a distressed or distorted expression shows as truly the reverse.

The sharp nose, knitted eyebrows, hollow sunken eyes, tenseness of skin, and leaden or livid hue of the "*Facies Hippocraticæ*," indicate the approach of death or of extreme exhaustion. The pinched character of the features often accompanies peritonitis; the "*Risus Sardonicus*," or spasms of the lips and cheeks, often precede or accompany tetanus; whilst the involuntary contraction of the mouth, tongue, &c., shows an injury near the nerves which supply these parts.

Another expression, said by the late Dr. Geo. McClellan, of Philadelphia,¹ to be an alarming symptom after the reception of an injury, "is an inquiring anxious look about the forehead, eyes, and upper portions of the face, while all about the mouth and lips is smiling and composed. It resembles the mixed sad and cheerful expression which our great novelist, Dr. Bird, has attributed to Montezuma in his captivity, and by which some authors have attempted to characterize our whole aboriginal race—a melancholy smile about the lips indicative of their fatal proclivity to destruction. Another expression of the countenance which will strike an intelligent observer is seen when one first approaches the bedside; the patient will look at you with a stare of alarm and suspicion, and will constantly repeat the same look as often as you approach him, to make an inquiry. No matter how long you remain in the room, whenever you attract his attention, his forehead will be drawn up and his brows contracted into a scowl of suspicion, mingled with anxiety. If these patients do not always die, every practitioner should certainly be cautious in giving a favorable prognosis, for the probability is that not more than one in one hundred can possibly recover."²

But, in addition to its expression, the *color* of the face will often indicate the danger from disease or injury. A purple or livid color may show an injury to the chest involving the organs of respiration; a leaden or sallow hue is characteristic of the constitutional disturbance of cancer; pallor of countenance nearly always supervenes on excessive loss of blood; and a yellow jaundiced tint has been known to follow serious gunshot wounds, as well as fractures involving large joints. Concussion of the brain, depressed fracture

¹ Principles of Surgery, p. 19.

² Op. citat.

of the skull, hanging, drowning, &c., all produce changes which, once seen, will readily be recognized as pathognomonic of these conditions.

§ 3.—OF VARIATIONS IN THE SIZE OF A PART.

Differences in the size and volume of a part under consideration, and especially of the extremities, are the grand rallying points of the surgeon in cases of injury. These signs necessarily require a comparison of the different sides of the body, allowance being made for the increased development of the whole right side, from its being usually the most exercised. The enlargement of any region may show the formation of unnatural growths in the deep-seated tissues; or the development of air, as in the emphysema of gangrene or of fractures about the chest; or the existence of matter, or of unnatural secretions, as seen in elephantiasis, in tumors, suppurations, synovial degenerations, &c.; whilst the diminished size of a region often indicates atrophy, loss of muscular power, or an unnatural relation of parts, as seen in injuries of the deltoid muscle, dislocations of the shoulder or hip, depressed fracture of the skull, ribs, &c.

Variation in length is usually limited to the extremities, and indicates changes in the natural relations of the articulating surfaces of the bones. It is mainly valuable in diagnosing fractures and dislocations. Whenever measurement is resorted to for a knowledge of the length of the upper extremities, it should be made between two well-known and fixed points, as from the acromion process of the scapula to the condyles of the humerus, or from the condyles, or olecranon process to the styloids of the radius, or ulna. But in the lower extremities, in addition to the selection of two fixed points (as the anterior superior spinous process of the ilium, and the internal malleoli of the tibiæ), the surgeon must also see that the pelvis is straight and at its proper level with the spine, otherwise he will be misled. If a line carried from one spinous process to the other cuts the median line of the abdomen at a right angle, there can be no error of measurement from this cause; but if it does not, and the pelvis is inclined either to the right or left side, there will be a corresponding increase in the length of that side to which the pelvis leans.

The shape of parts is frequently a diagnostic sign of change of

structure or of function. The pyriform shape of hydrocele, the oval, globular, or ovoidal form of hernial tumors; the change produced in joints by effusions, the knotted, lobulated tumors of cancers, the protuberant abdomen of ascites, all are points which may be referred to as furnishing valuable aid from their shape in deciding on the existence of these affections.

§ 4.—CHANGES OF COLOR AS A MEANS OF DIAGNOSIS.

The color of the skin on different parts of the body is a change which is often so marked as to indicate not only to the surgeon, but even to the patient, the progress of disease. This variation of color is most valuable, as a diagnostic sign, and should be always noted, as in the lividity of bruises, the redness of superficial burns, or in the purple tint which is apparent in partial or diffused sphacelus.

When attendant on progressing mortification, the color of the integuments generally changes from the acute redness of healthy inflammation to the livid blue or purple of passive congestion; and then, again, when the reparative process is established, and nature begins to separate the dead from the living portions, we can trace the "red line of demarcation" and see the black of actual death, separated by various shades of blue, black, purple, and red, from the bright scarlet of healthy active inflammatory congestion. Extreme caution is, however, necessary in forming a diagnosis of sphacelus from color alone, as a bruise, an effusion of blood beneath the skin, the occurrence of purpura hemorrhagica, the discoloration following the use of leeches, of adhesive plaster near suppurating surfaces, and of washes of iodine, or of the nitrate of silver, all produce such variations in shades as will readily mislead an inexperienced observer. The color of the skin is also serviceable in diagnosing tumors, though the lividity and blueness of many, is simply due to the temporary venous enlargement caused by a congestion of the superficial veins. The change of color here alluded to is one solely dependent on the compression of the vessels by the tumor as it distends the skin, and is not connected with the structure of the tumor itself, simple fibrous and non-malignant growths occasionally producing lividity in as marked a degree as that seen in those which are more malignant. The *nævi materni*, or mother's mark, aneurisms by

anastomosis, varicose veins, aneurismal tumors, in fact, everything that impedes the free circulation of the blood through the capillary vessels, may be the cause of changes of color in the skin over them.

§ 5.—OF THE CHANGES IN TEMPERATURE.

The temperature of a part or of the entire body, as indicating a change in the local or general circulation, is always deserving of the surgeon's attention, though it is not generally as valuable an indication as might be supposed, both patient and surgeon being occasionally deceived by their own sensations. Thus the burning heat of inflammation is often alluded to by patients as being many degrees above the natural warmth of the body; yet it is now well known, from the oft reported experiments of Hunter, that the heat is only a degree, if at all, above that of the blood, at the centre of the patient's circulation. The stinging heat of frost-bite, the agonizing pain of burns, scalds, &c., would all lead us to suppose that nature had in these instances departed widely from her usual course, yet the thermometer proves but little variation from the natural temperature of the blood, whilst cold and chilliness are not unfrequently complained of when the heat is really above the natural standard of the limbs.

Cold, or the absence of heat, is often a symptom of much value, because it is generally indicative of disordered circulation or low powers of life, and thus shows the presence of danger from the want of vitality. The temperature of a part should therefore be always carefully attended to after the ligature of a great vessel, whilst the coldness of surface, consequent on severe injuries and operations, demands our greatest care, in order to ward off evil.

§ 6.—OF MODIFIED SENSATION AS A MEANS OF DIAGNOSIS.

As the indications resulting from an apparent change of temperature in a part as described by the patient require a cautious estimate of their value, in order to prevent our being misled, so should his description of the seat of the sensation invite the surgeon's incredulity. Thus, in the cases just referred to, a sensation of chilliness

is often complained of by the patient when in reality the feeling is due to extreme heat, or to the action of the atmosphere on a part deprived of its cuticle. The pain from stone in the bladder is another instance of erroneous sensation, being most generally referred by the patient to the end of the penis, though the irritation is at the neck of the bladder, whilst one of the earliest indications of disease in the hip-joint is most frequently the pain complained of at the inside of the knee. A tingling in the ends of the fingers or toes may be consequent on the formation of tumors, and their pressure on the origin of nerves far removed from the seat of sensation; whilst the cessation of pain, and the relief which follows the development of sphacelus in a strangulated hernia, is one of the most serious symptoms brought to the surgeon's notice. The intensity of pain, as described by the patient, is, however, sometimes an important aid to diagnosis, if correctly understood. As a general rule, its existence should be looked on rather favorably than otherwise as regards the final result, the severest pain not unfrequently accompanying the simplest affections; thus a boil, or a suppurating scrofulous gland, is often more painful in proportion to its extent than a cancerous or other malignant tumor of double its size. But, though generally distrustful of the symptoms thus furnished in some cases, the sensations of the patient are in other instances the only means of diagnosing the injury, as in rupture of the gastrocnemius muscle, where no outward signs or symptoms are noticeable; in the nervous deafness of affections of the ear without apparent change of structure; the mistiness of sight in amaurosis, &c. Especially is this true in very severe cases, where little reliance can be placed on the character of the pain as described by patients. This insensibility has been well painted by the late Dr. McClellan, of Phila., who, in describing the patient's condition, says: "He may be somewhat agitated and composed at first, but complains presently of little or nothing. He suffers no pain or inconvenience of any kind, and is hardly willing to have the attention of the surgeon directed to his wound. The pulse and respiration remain undisturbed, and the bystander apprehends no danger from appearances. Inexperienced medical attendants take no alarm, and perhaps every one prognosticates favorably. But the case looks altogether too well for one of such magnitude. A great joint has been torn open; a terrible compound fracture is present, or several large muscles and nerves have been lacerated, and yet no corresponding disturb-

ance is manifested. As Hunter has observed, "Nature requires to feel the injury."¹

As the sufferer from surgical disorders is so apt to receive incorrect impressions from his own sensations, so is the surgeon liable to deception if trusting too readily to the evidences furnished by his own senses. Thus a relaxed muscle, if improperly touched, may create the impression of the presence of fluctuation; the crepitus of a tendon in an inflamed bursa may simulate the same sensation as that resulting from fracture, whilst the apparent pulsation of an enlarged gland over one of the great bloodvessels may create the same impressions to the touch as those which are produced by an aneurism.

The great number of errors in diagnosis, resulting mainly from incorrect sensations on the part of the surgeon, are so well known that the power of eliciting a true impression is not unfrequently designated as the result of the "tactus eruditus," or master touch.

§ 7.—EXCRETIONS OF THE PATIENT AS A MEANS OF DIAGNOSIS.

The last of the external signs likely to assist the surgeon in the formation of a diagnosis will be found in the knowledge gained from the excretions of the body and the accidental local discharges. The character of the pus discharged from wounds, ulcers, fistulæ, &c., always demands attention, as indicating important points in the pathological condition of the part, and often requiring a peculiar plan of treatment; thus healthy pus, florid granulations, and the clean moist edges of a sore, generally show a healthy wound or ulcer, or one which is disposed to heal; whilst unhealthy, sanious, offensive matter, with dry edges and the formation of crusts and scabs, not unfrequently declares the existence of less favorable circumstances.

The characters of Pus are especially valuable as a diagnostic sign, indicative of the true condition of many parts; thus, that which is an opaque, tolerably consistent, yellowish-white fluid, with a peculiar smell when fresh, which it loses on cooling, is of a sweetish taste, specifically heavier than water (spec. grav. 1.030), not readily subject to putrefaction, and which reacts in its fresh state as an alkali, but after a time is neutral or acid, and which is seen under the micro-

¹ Principles of Surgery, by Geo. McClellan, M. D. Edited by J. H. B. McClellan, M. D., p. 17. Phila., 1848.

scope to consist of fluid parts and globules, is known as good or "laudable pus," and indicates healthy action; whilst that which is thin, mucus-like, serous, grayish, greenish, brownish, and more or less fetid, shows the progress of disease, and is termed "Sanies or Ichor." Small lumps of cheese-like matter, mixed with pus, usually indicate the existence of the tuberculous or scrofulous diathesis; whilst fecal matter, blood, and undigested particles of food mixed with pus, often prove clearly a direct communication with the bowels in rectal fistulæ.

Blood which escapes from a part is also an indication of the existence of peculiar circumstances, and often shows the character of the portion injured and the depth of the injury. If it is bright red or scarlet, and flowing in jets synchronously with the pulsation at the wrist, it may pretty generally be regarded as showing the injury of an artery; but if, on the other hand, it is blue, black, or purple, and flows continuously, a vein will doubtless be found to be its origin.

The character of the Urine, whether clear, turbid, high-colored, or mixed with blood or matter, is most generally indicative of renal or vesical disturbance, whilst the Feces present points not only from which to gain knowledge of general constitutional disturbance, but also of local change of structure. Blood mixed with the discharge of fecal matter may be the result of hemorrhoids; pus mixed with it may show the existence of ulceration; and a contracted, narrow-shaped piece of feces, or one looking as if compressed, or shaved on the sides, may prove the existence of an enlarged prostate gland, the development of scirrhus growth, or the existence of rectal stricture, which would otherwise be overlooked.

The Sputa and matter vomited, according to their color, consistence, and substance, are occasionally among the most important of our diagnostic points in injuries of the throat, lungs, stomach, &c. If a wound of the chest is followed by a free expectoration of bloody and frothy mucus, the lung will probably be found to have been touched by the cause of the wound; whilst the hawking of blood or of pus, and the vomiting of the contents of the stomach would very truly indicate the state of the throat or stomach in many surgical affections, and in wounds of these parts would prove extremely valuable diagnostic signs.

The continuance of the normal secretions is in some cases the sole

indication of the soundness of parts which could not otherwise be proved. Thus a pure mucous expectoration, or the regurgitation of food or drink after an injury of the chest or abdomen, or the natural discharge of bile or of urine after an injury of the liver or bladder, would alone establish the fact that their normal functions were not impaired by the accident.

CHAPTER II.

DIAGNOSIS FROM AN EXAMINATION OF THE INTERNAL ORGANS.

AFTER studying the external signs of surgical disorders, the inspection of the internal organs, as shown by an examination of their functions, will also afford an amount of knowledge which is in many cases absolutely essential to the formation of a correct diagnosis. In the investigation of this portion of the subject, I would invite the student's attention to four different functions of the economy: 1. The Circulation. 2. Respiration. 3. Digestion; and 4. Nervous power.

§ 1.—OF THE SIGNS FURNISHED BY THE GENERAL STATE OF THE CIRCULATION.

The diagnostic signs furnished by an examination of the general state of the circulation, and indicated by the action of the heart and of the pulse as seen in fevers, are well known even to non-medical men. I shall, therefore, pass at once to such points as mainly demand the attention of him who is engaged in the practice of surgery.

The information furnished by the circulation, independent of its value in connection with the pulse, is mainly useful in showing the existence of injured or diseased vessels, and is best seen in the different kinds of hemorrhages and in arterial tumors. In hemorrhages, the signs from the state of the general and local circulation are all important. The sudden sinking of the pulse, feeble action of the heart, loss of color in the capillaries, all indicate the loss of

blood, whilst its color and mode of flowing have already been alluded to as pointing out wounds of arteries and veins. It should, however, be remembered that it has occasionally happened, that an opening in a vein which lies directly over a large artery, has caused a pulsating stream, similar to that from a wounded artery, in consequence of the action of the vessel beneath it; and that a serious loss of blood has not unfrequently given a red color to the stream flowing from a vein. It is also useful to note the source of hemorrhages; thus the escape of blood from the ears may show either a rupture of the membrana tympani, especially in very young subjects; or, what is more common, a fracture at the base of the skull, and especially of the petrous portion of the temporal bone. The color of the fluid in the latter case is more frequently that of venous than arterial blood, and its escape through the ear has been explained on the supposition of a rupture of the petrous or other sinuses, which, by detaching the dura mater from that part of the base of the skull, allows the blood to enter the internal meatus auditorius, or to pass through the seat of fracture into the internal ear, whence it flows outwardly through the ruptured membrana tympani. But in all hemorrhages, the state of the circulation is more important as a prognostic than as a diagnostic sign. In some cases of severe injury, especially contusions and other affections of the abdomen, the escape of blood outwardly need not be looked for, the internal flow being the most frequent, and from being unseen, the most deceptive. Here the loss of color in the capillary circulation, the pallor of the face, the feeble pulse, and other general symptoms of prostration, are alone capable of indicating the internal injury.

In tumors, especially if dependent on aneurismal enlargements of vessels, the activity of the local circulation is strongly indicative of the affection. Still, an enlarged gland, fibrous, fatty, or other tumor, especially if bound down by fascia upon the course of a main vessel, will prove a source of error, unless close attention is paid to the collateral circumstances. When it is desirable to ascertain whether a pulsating tumor is aneurismal, or merely an enlarged gland affected by its position in regard to the artery, we should always endeavor to elevate the tumor from the subjacent parts, and then notice whether the pulsation continues. Pulsating tumors in the ordinary position of lymphatic glands, as in the groin, axilla, or neck, should always be thus carefully removed from subjacent parts

by the fingers, if possible, before deciding on their true character. The absence of the peculiar aneurismal thrill, the solidity of the swelling, its gradual development, with the enlargement of neighboring glands, the peculiar constitution of the patient, the exciting cause, &c., will all aid us in determining this important question.

The state of the circulation, especially in the capillary vessels, is especially important in diagnosing erectile tumors, fungi, &c.; the natural condition of the local circulation before the development of the swelling, being always borne in mind. The character or appearance of the surface itself in connection with the flow of blood is also important in the diagnosis of certain disorders; thus the rupture of skin and the repeated hemorrhages from a swelling may enable us to distinguish fungus hæmatodes from cancer, whilst frequent bleedings from mucous cavities, accompanied with swellings or tumors, would lead to the suspicion of polypi or of ulceration. A suddenly formed tumor in the neighborhood of a joint producing discoloration of the skin, and faintness supervening on violent muscular exertion, especially if the tumor is seated in the axilla, might lead a surgeon to regard it as the result of a partial rupture of the artery; whilst the same swelling, unattended by a depressed state of the circulation, and not gradually increasing, would probably be only indicative of a dislocation. The feeble pulsation of the arteries in the extremities not unfrequently indicates an obstruction in the course of a vessel or its ossification, but, if it is at the same time accompanied by a change of temperature and color, it would naturally lead to the suspicion of senile gangrene. In examining for the pulsation of an artery at its usual seat, allowance must be made, under these circumstances, for a natural malposition of parts, in order to avoid error; thus the brachial artery occasionally divides high up in the axilla; and the femoral sometimes gives off the profunda very low down, and either might prevent the sensation of pulsation in the usual points of examination without producing any inconvenience to the patient. The radial artery also occasionally winds round the wrist so high up as to leave no pulse in the ordinary position. To decide then that there was an interrupted circulation in these cases without an investigation being made as to the course of the vessel in the individual under examination, would only prove the want of caution in the observer.

§ 2.—OF THE RESPIRATION.

As the rapid or labored state of the respiration is often the result of increased muscular or vascular action, the notice of its condition is occasionally a most useful adjuvant to the formation of a surgical diagnosis. In congestive affections of the brain, whether resulting from blows or from the action of poisons, a slow, snoring, or stertorous respiration should instantly call attention to this important organ, as such a respiration indicates not only injury, but the importance of relieving the brain from it, before the respiratory action is entirely interrupted. Stertorous respiration must not, however, be confounded with the ordinary snoring of some patients when asleep, nor yet with the peculiar respiration of those laboring under enlarged tonsils or nasal polypi.

In wounds of the larynx and trachea a marked change will be found in the natural sounds of respiration, and in ulceration of the glottis, nasal polypi, elongated uvula, fissure of the palate, dislocations of the laryngeal cartilages, as well as in foreign bodies in the trachea or oesophagus, the change in the tone of the voice, or the peculiar cough will very often at once enable us to form an opinion as to the existence of either of these affections. Especially is this true in the affections of the nose and mouth, a very slight departure from the normal condition of either, producing a change of function that leads the practised ear at once to recognize the seat of the disease. If practical opportunities have not led to a knowledge of the change of voice here referred to, it is only necessary for the observer to close his nostrils more or less with the fingers and then speak, in order to furnish a tolerably correct illustration. In such cases the patient speaks, it is said, through the nose, though perhaps it would be more correct to say he speaks without the nose; the change of voice being evidently due to the interruption of the passage of the sound through the nasal cavity, in consequence of which we have the resonance of a partially closed chamber. The hacking cough, efforts to clear the throat, and constant sensation of tickling, are also sufficiently frequent, as evidences of disease in these parts to demand an examination of the state of the uvula and fauces, in all cases of affections of the throat, so that we may prove the presence or absence of elongation of the uvula, a cause which, though

apparently trifling, is yet sometimes productive of most serious consequences by the extension of the irritation to a pulmonary structure which may be predisposed to tubercular infiltration.

§ 3.—OF DIGESTION.

The changes produced by surgical affections in the ordinary functions of the digestive organs, whether arising from a local or general injury, should always lead to a careful investigation of their separate actions; the acts of mastication, deglutition and defecation occasionally proving most conclusively the condition of parts of which it would otherwise be difficult to judge.

1. MASTICATION.—Mastication, when imperfectly performed, may indicate an injured or diseased state of the teeth, or of the muscles, of the lower or upper jaw, though most frequently the former. The existence of caries in the teeth is not unfrequently first shown by the pain consequent on the act of chewing, and the difficulty of properly approximating the lower to the upper jaw is highly characteristic of certain dislocations and fractures. A crackling noise in the neighborhood of the ear—often only heard by the patient, but occasionally also evident to the bystander—indicates disorder in the maxillary articulation, whilst the escape of saliva, enlarged glands, distortion of tongue, &c., very often results from cancer, ranula, and other lingual and buccal tumors.

2. DEGLUTITION.—Deglutition, as usually performed, is an act that, after mastication, it is almost impossible to prevent under a healthy condition of parts; but let the tonsils be swelled, the uvula enlarged, the tongue affected, or the pharyngeal or œsophageal passage at all inflamed or constricted, and swallowing becomes difficult or even impossible. When the roof of the mouth, or the hard and soft palate are sound, or when the lips present their natural structure, food once introduced into the mouth passes on without trouble; but in hare-lip, or fissure of either the hard or soft palate, it is found either difficult to get it into the mouth, as in suckling, or, when there, the food is seen to escape more or less through the cavity of the nostril. In the healthy condition, food, both solid and liquid, is readily transmitted to the stomach; but in œsophageal stricture, or in the formation of tumors or abscesses in or near the œsophagus,

swallowing becomes difficult, whilst from the accidental course of a particle of food into the larynx, spasms frequently ensue that are occasionally most serious.

3. HUNGER AND THIRST.—Hunger and thirst, in the healthy state, are removed by the introduction of food and drink into the system; but let the natural course of the articles be impaired by an injury to the digestive apparatus, and these desires immediately become more persistent. A recurrence of either hunger or thirst, a short period after food and drink of an ordinary amount have been taken, may, therefore, naturally lead to a suspicion of the escape of the food at some point of the digestive tube before entering fully into the system; hence wounds of the throat or stomach, artificial anus, &c., are not unfrequently followed by constant hunger.

4. VOMITING.—Vomiting, as a symptom of surgical disorders, is often an important aid in the diagnosis and prognosis of the affection. In concussion of the brain and in blows upon the head—especially in the young—vomiting may generally be regarded as indicative of serious cerebral disturbance; and when followed by a tendency to sleep, or by stertorous respiration, should always render the prognosis of cerebral injuries most guarded. Occasionally it happens that a slight blow upon the head soon after a meal is followed by copious vomiting; but, under these circumstances, this act should not be regarded in as serious a light as when following an injury at a considerable interval after eating. If the vomiting is laborious, and there is reason to suspect effusion, or even a tendency to the rupture of a vessel in the brain, the act of vomiting should be facilitated by the free use of warm diluent drinks, until the stomach is emptied, when, if possible, it should be arrested by the administration of aromatics or mild tonics.

The matter vomited is also not unfrequently highly characteristic of the injury or disorder. Vomiting of blood may arise from a wound of the stomach or throat, or it may simply follow a severe epistaxis in which the blood has been swallowed. Strangulated hernia, especially after a few hours' duration, very frequently causes the vomiting of stercoraceous matter, and in intussusception, stricture of the bowels, &c., the same kind of matter is often more or less mixed with the ordinary contents of the stomach.

5. HICCUP.—Hiccup may be the consequence of a wound of the diaphragm, or of irritation of the phrenic nerve, though more fre-

quently it is seen as the result of long continued vomiting, or as the consequence of extreme nervous or vascular prostration.

6. OF DEFECACTION.—Defecation is indicative, in many instances, of the actual condition of the lower bowels. Hardened lumps, or "scybalæ," indicate constipation, no matter what it may be dependent on; whilst the mixture of pus or blood will not unfrequently lead to the suspicion of an abscess opening into the bowels, to the existence of fistula or hemorrhoids, or to the development of cancer. In the natural condition of the rectum, the feces are usually round and of moderate size; but in stricture of this gut, or in enlarged prostate, the stool is most generally flattened on one side, very much reduced in size, and not unfrequently appears as if shaved by a cutting instrument.

§ 4.—OF THE FUNCTIONS OF THE NERVOUS SYSTEM.

When we recall the importance of the brain and spinal marrow, in the ordinary functions of man in a state of health, we must at once admit the value of the signs furnished by the nervous system in cases of injury; and were we fully acquainted with the connection of parts, and that mutual relation to each other usually designated by the vague term "sympathy," we doubtless should find most valuable indications from the study of its derangements. But, as a general rule, the changes of function in the nervous apparatus furnish but a negative sort of evidence to the surgeon.

The sensations of the patient, the existence or absence of pain, his descriptions of the accident, or the loss or exaltation of muscular power, may all be dependent on serious injury of the nervous centres, or simply the result of a certain activity of imagination. In some patients the normal sensibility will be highly augmented or diminished, nausea and faintness be present or absent, and the whole system either depressed or highly excited, without any serious lesion existing to explain this departure from the natural condition. The value of the signs furnished by the nervous system depends, then, in a great degree, upon the skill of the examiner in developing their existence, and upon his caution in guarding against deception on the part of the patient. To some persons—owing to peculiar mental action—a trifling injury is shocking in the extreme,

and accompanied by great prostration, whilst others who labor under very serious lesions will yet retain their composure, sensation, power of movement, and mental and bodily strength. We have seen more than one strong adult rendered faint, with a feeble pulse, cold skin, pallid face, and showing every sign of great apparent prostration when simply *ordered* to be bled; whilst others have undergone horrible lacerations in machinery, &c., and yet retained much of their usual mental and sensorial powers.

But, as a general rule, loss of muscular power, loss of sensibility, or the extreme development of either, should be regarded as indicative of cerebral or spinal disturbance.

CHAPTER III.

OF THE USE OF THE SENSES IN FORMING A DIAGNOSIS.

PRESUMING that the surgical observer, being aware of the dangers in his path, is mentally prepared for a close observance of facts, we may now study the impressions produced on the mind by the use of the senses; arranging them according to their actual value in the investigation of disease, thus: 1. Sight. 2. Touch. 3. Hearing. 4. Taste; and 5. Smell; the facts thus learned being afterwards mentally digested before a conclusion is formed.

SECTION I.

OF THE SIGHT AS A MEANS OF DIAGNOSIS.

So generally useful is the sight as a means of diagnosis, and so constant is its use, that without a careful analysis of the facts furnished by it, many observers would probably overlook the sources through which they gain their information and credit other senses. With the exception of touch, the sight is the most accurate of a surgeon's senses, especially if properly cultivated; but, before relying on its impression in disease, he must be familiar with the ap-

pearance of healthy structure, as well as with the general natural contour of the body.

In examining the *form* of a part by the sense of sight, a comparison of the unnatural appearance with that presented in health, must necessarily be made, before any value can be assigned to the point of deviation that is noted. In the shortening of the limbs in fractures; in the deformities from dislocations; in the swellings caused by tumors and suppurations, and even in the contraction of natural orifices little can be learned, unless the surgeon is capable of recognizing the degree of departure from a state of health.

After judging of change of form, he should next decide on the variations in the *color* of the parts. Increased redness may show the commencement of inflammation; the red line which tends towards the chest may indicate its progress in the course of a lymphatic; linear or circular redness the efforts of nature to separate mortified parts from those which are sound; a copper-colored spot, the probability of syphilitic taint; and a bluish-red color will often indicate venous rather than arterial vascularity, chronic inflammation, erysipelatous disorder, or the formation of abscesses; whilst a more livid tint is as often characteristic of ecchymosis from contusions, or, when vesicated, indicative of commencing gangrene. A yellow modification of these two tints may generally be correctly associated with hepatic disorder. But, though the change of color often shows the existence of disorder, it does not invariably do so. Many tumors, in their earlier stages, simply elevate the integuments without producing a change of color, as is seen in fatty as well as in aneurismal tumors; cold abscesses; hernia, &c., although subsequently, the approach of these tumors to the surface of the part modifies more or less its previous condition both in shape and color.

By the sight we also judge of *change of structure*; thus in wounds, we can tell their character by their edges, and their depth by the color of the blood escaping from them, or the presence of muscular tendinous fibre, or by the display of nerves. In ulcers, we judge of their acuteness and duration by the aspect of the granulations, and the character of the discharges; whilst from the vascularity and adherence of cicatrices we may form an opinion of the nature of the deep-seated parts, as in the peculiar color and attachment of cicatrices over bones. In all these instances, the sight, or a mere inspection, will enable an educated observer to detect at a

glance the character of the complaint, and to decide by so rapid a comparison of parts, that the latter process is almost lost sight of, his opinion seeming to be formed intuitively.

By the sight we also judge of the character and contents of tumors; thus, some are smooth and even on the surface, others are nodulated or lobulated. Some are pendulous, some pulsate, some are evidently turgid with blood, some pale and shrivelled; all which differences indicate variations in condition, the details of which are to be subsequently learned by the employment of other means and senses.

SECTION II.

OF THE TOUCH AS A MEANS OF DIAGNOSIS.

Surgical disorders being defined as "such as are more or less tangible," the sense of touch is evidently one of the most important as well as the most generally applicable of all the means adapted to their diagnosis. Many conditions of disordered action are appreciable mainly through the use of this sense, such as the mobility of tumors; the movement of liquids, as in fluctuation; the pulsations of aneurisms; the crepitation of emphysema, of tendons, and of fractured bones. The sensitiveness of the patient, as developed by the pressure of the surgeon's fingers, is also an example of the aid given by the touch, in the formation of a diagnosis, as when it shows the position of the testicle in hydrocele. In fact, without the sense of touch, it would often be impossible to make a diagnosis of surgical complaints.

In exercising this sense, the fingers may require the intervention of instruments, in order to reach the object to be touched, as in sounding for stone in the bladder, where the presence of the stone is made sensible to the finger only through the medium of the steel instrument.

The "Touch" may be practised in surgery either through the direct contact of the fingers or of the palms of the hand. In using the fingers, without the intervention of a foreign substance, it will be found that the forefinger is that which is most sensitive as well as convenient, though the apposition of the second to the first finger, by augmenting the tactile surface, often adds to the

accuracy of the impression. With the two fingers thus placed, or with the index finger of each hand alternately pressed perpendicularly on the surface of a swelling, the superficial parts may be made gently to approach the deeper structures; and if any of their contents are fluid, the movement of a liquid or "fluctuation" may be certainly recognized. Or in the case of larger collections of fluid, as in abdominal dropsies, the apposition of the entire palm of one hand on one side of the belly, whilst the opposite side is lightly tapped with the pulps of all the fingers of the other, will often indicate the presence of liquid by the sensation caused by the succussion or concussion of the wave thus created, against the palm as at first placed. In practising "the touch," in order to prove the presence of liquid, caution is, however, necessary, lest the sensation caused by the movement of a flaccid tissue, as a relaxed muscle, be mistaken for the motion of liquid.

Few points of diagnosis present greater chances of error on the part of a young surgeon than this false sense of fluctuation. In order to avoid it, he should therefore proceed as follows: Retain the fingers of one hand with sufficient firmness on one side of the part to be examined, whilst, with the other, he presses quickly and with moderate force on the opposite side of the swelling; or if the part to be examined is of considerable extent—as the abdomen—let him direct an assistant, as advised by Recamier, to press gently with one hand in the median line of the body, whilst he manipulates with his own hands, as just stated. The motion of the intestines, as well as of the liquid wave, being thus partially checked, the sense of fluctuation, if yet apparent, will be almost certain evidence of the presence of liquid.

By the rapid pressure of the finger upon an inflamed part, and its equally prompt removal, the surgeon is also often enabled to judge of the existence of congestion in the superficial vessels or of the activity of the capillary circulation. If the skin becomes momentarily pale under pressure, and then quickly resumes its livid or florid color, there can be no doubt of the rapid flow of blood through these small vessels, which, being emptied by pressure, and thus rendered pale, become so turgid in a moment as to restore the original color of the part.

Soft and elastic tumors, containing a thick or jelly-like structure, often present an indistinct sense of fluctuation (as in cases of fungoid disease), in consequence of the yielding of the structure under

pressure, and its rapid enlargement by the afflux of blood, which instantly supervenes on the removal of the pressure. Under these circumstances, the liability to error from the use of the sense of touch is very great, so much so as occasionally to require the addition of a minute puncture with an "exploring-needle," in order to correct the impression, by disproving the presence of a liquid. The best method of avoiding error under such circumstances, without resorting to the use of the needle—which may become a focus of irritation—is to retain the finger in position, as just stated in the case of a relaxed tissue; that is, to press firmly with the fingers on one side of the tumor, and then tap quickly and with some little force on its opposite side. Unless liquid is present, the succussion will not be felt, the thick character of the contents preventing the transmission of the blow of the finger to those first placed on the tumor.

The peculiar sensation of rubbing or "crepitation," caused by the friction of the surfaces of two fragments of bone, or by the play of two articulating surfaces of a joint upon each other, or by that of a tendon in a thickened bursa, or in effused lymph, is also recognized mainly by the sense of touch, though that of hearing may be made to aid it under certain circumstances, as will be again mentioned in connection with the subject of fractures.

The degree of motion in a part, whether due to the existence of fracture, or dislocation, the development and attachments of tumors, or their connection with the bloodvessels, is also recognizable chiefly by the sense of touch. In investigating the presence of pulsation in tumors, the fact previously alluded to must be remembered, to wit, that vascular pulsation is sometimes caused, not by disease of the artery, as in cases of aneurism, but simply by the proximity of a tumor to the vessel, the pulsation of which is felt in the tumor, in consequence of the latter being either directly in contact with it, or bound down upon it by adjacent fascia. To avoid this error, the surgeon should endeavor to remove the tumor as much as possible from the vicinity of the artery, by lifting it up from the deeper seated parts, or give the parts such a position as will relax the fascia and muscles. Under such manipulation the sense of pulsation will often be entirely destroyed, and the diagnosis rendered more certain.

The various errors of diagnosis made by able surgeons under these circumstances, sufficiently prove the great necessity of caution

in similar cases. Thus M. Bérard, in an excellent Thesis "on Diagnosis," cites many instances; in one a large abscess above the clavicle pulsated so strongly, and otherwise so closely simulated an aneurism, that the operation for ligating the artery was proposed by the surgeon, and only avoided by the determination of the patient to commit suicide. To accomplish this he punctured the tumor, when the exit of pus established the character of the complaint. The same author also cites a case of fungus of the dura mater, which was mistaken for aneurism of the temporal artery; and one of goitre, which was mistaken for aneurism of the carotid. The recorded errors of diagnosis arising from the false impressions produced by the sense of touch, are so numerous as to prevent anything like a full enumeration of them at present, and the caution in regard to them must therefore be thus briefly alluded to, and again given in connection with special cases.

SECTION III.

OF THE SENSE OF HEARING AS A MEANS OF DIAGNOSIS.

By the sense of hearing, the surgeon often acquires such a knowledge of the disordered action or condition of a part of his patient's organism as is specially useful to him in the formation of an opinion respecting the nature of the complaint.

By the variations in the *tone* of a patient's voice he is enabled to judge of changes in the condition of his nasal passages, as may be noticed in cases of polypi narium, of fissure of the hard and soft palate; disorders of the larynx and trachea, &c.; the details of which will be given hereafter in their appropriate place.

By the sound of "*gurgling*," he recognizes the presence of gas or liquid, and thus obtains one proof of the existence of a hernia, or of a collection of liquid in a circumscribed cavity; whilst in operations near large veins, he also by this sound is apprised of the entrance of air into the vein and of the liability of the patient to sudden death. By the crackling sound designated as "*Crepitus*," he learns the condition of certain structures as modified by disease or accident; thus, when gas collects in the subcutaneous cellular tissue as the result of mortification, its passage through the cells may be heard to crackle, as well as be felt; when two fragments of

a broken bone are rubbed together, the crepitus may be heard, whilst the crepitation is felt; in the infiltration of the skin from wounds near the organs of respiration, the crackling of the emphysematous condition may also sometimes be heard as well as felt; and in wounds of the lung, the escape of the air into or from the cavity of the chest may also be distinctly heard, thus constituting evidence of the character of an injury which could not otherwise be positively recognized.

The true state of many structures involved in tumors is also often learned chiefly through the employment of the sense of hearing, as in varicose aneurisms, where the peculiar "*whirr*," caused by the current of the circulation, proves the connection of a vein with an artery. The crackling of the osseous shells of certain bony tumors, and the elastic "*ripe watermelon-like sound*" produced by percussing encephaloid growths when connected with bone, is often a valuable aid to the knowledge of their true character.

Percussion and auscultation, which, by the genius of Laennec, have been made so useful to the physician, are also not less valuable to the surgeon. The viability of the foetus in utero, prior to the performance of the Cæsarean section; the extent and condition of abdominal tumors; the extent of effusions into the chest, and the propriety of the operation of paracentesis thoracis, are but a few of the instances in which the surgeon is aided by the employment of these adjuvants to diagnosis.

SECTION IV.

OF THE SENSE OF TASTE AS A MEANS OF DIAGNOSIS.

It is not often that the surgeon of the present day feels the necessity of calling the sense of taste to his aid in forming a diagnosis; but the older surgeons tell us that laudable pus has a sweetish, mawkish taste, that a gangrenous part gives a very sharp taste, as Valsalva is said to have proved; or that the fluid which escaped from an abdominal fistula was bile or urine, as is reported to have been proved by Petit's tasting the discharge. Though, under such circumstances, professional zeal may carry a strong stomach safely through such an experiment, few would at the present day, with the aids now obtainable from the microscope and chemical tests, be disposed to repeat it.

SECTION V.

OF THE SENSE OF SMELL AS A MEANS OF DIAGNOSIS.

From the superficial character of many surgical disorders, the odor created under various changes of structures by disease often brings this sense into play, to the very great inconvenience of the young surgeon. The peculiar and often disagreeable odors created by certain conditions have, however, a value in diagnosis. Thus it is easy to tell a vesico-vaginal or a perineal fistula by the ammoniacal odor of urine; and to recognize the fact that an anal fistula communicates or is in close contact with the rectum by the fecal odor of its pus; that a hernia is strangulated by the fecal odor of the matter vomited, as well as by the presence of stercoraceous matter; whilst the odor of gangrene, or of the pus connected with a necrosed or carious bone, or that from the sloughing of cancerous structures, is so peculiar that when once perceived it is seldom forgotten.

The odor of ozæna and of salivation from mercury is also so marked as to be highly characteristic of the state of the parts which generally produce it.

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PART II.

SURGICAL PATHOLOGY OF THE SOFT TISSUES.

SURGICAL pathology, as a branch of general pathology, embraces the consideration of the characters and means of relieving external disorders. It presents, therefore, a subject of such extent as to require various subdivisions, in order to permit its thorough investigation.

In its consideration the present part of this work will be devoted to the study of all such external disorders as arise or are connected with a marked modification in the nutritive powers of the *Soft Tissues*.

This generic division of diseases into classes instead of their investigation in special cases may be the more advantageously made, because there is often found in nature such a similitude in the condition of parts variously injured, as is only to be accounted for by a reference to the general laws which regulate the vital powers; thus the phenomena of inflammation in all the soft structures of the body are frequently precisely the same, though the causes which led to their production are widely different; whilst the development of tumors, whether benignant or malignant, often exhibits the same general course of action as is seen in the formation and growth of normal structure. As the most important of the general disorders of the soft parts, attention is now asked to the subject of inflammation.

CHAPTER I.

GENERAL CHARACTERS OF INFLAMMATION.

THAT change in the natural preservative action of a part which is characterized by increased redness and heat, as well as by pain, swell-

ing, and perverted secretions, is generally designated by the term *Inflammation*.

This term, though purely metaphorical in its character, has been so long applied to the disordered condition just defined, that it is useless to modify it, even though it is certainly inexpressive of the true state of the parts which it is intended to designate. By the Romans it was adopted as characterizing the heat—*in* within, and *flamma* a flame—which was a marked symptom of the disorder; whilst the Greeks designated the same state by the word *Phlogosis* or *Phlegmon*, in consequence of the burning character of the pain which attended it.

Whenever developed, Inflammation should be regarded by the surgeon as presenting a condition of a part which requires watching, lest it result in serious evil; not that it is always to be checked or interfered with, for it will be subsequently seen that a certain amount of inflammatory action is often essential to the success of certain surgical means of relieving diseases.

In the study of the phenomena of Inflammation, surgical writers have exhibited considerable minuteness of detail; and, in order to indicate the tendency of certain of its forms to present certain characteristics, have created what they term the "Varieties of Inflammation."

Varieties of Inflammation.—Under the head of varieties of inflammation, are usually placed such forms as are designated as Healthy and Unhealthy, Circumscribed and Diffused, and Acute and Chronic. It must, however, be apparent that the terms Healthy and Unhealthy, owe their origin rather to convenience than to correctness of nomenclature, as the very definition of inflammation shows that the term is employed to designate a departure from healthy action.

By *Healthy* inflammation surgeons, however, understand that in which the tendency of the inflammatory action is to a reparative result or to healthy action. By the term *Unhealthy* inflammation, they indicate one whose tendency is destructive, or which results in an unnatural or unhealthy condition of the part which has been inflamed.

The words *Circumscribed* and *Diffused* are expressive only of the extent of the disorder, whilst *Acute* and *Chronic* have reference solely to its duration; *Acute* meaning one that is recent and active, and *Chronic* one of longer continuance.

An *Acute Inflammation* is characterized by active vascular excitement, by a bright red color of the part, by heat and by pain of a troublesome character. It is sudden in its attack, violent in its

character, and rapid in its progress. Acute inflammation is sometimes also designated as *Active* inflammation.

Chronic Inflammation is one of less violent and tardy action, and hence is sometimes spoken of as *Passive* inflammation. All its symptoms are less prominent than those seen in the acute variety; thus the color is less bright, the heat and pain less marked, and nature is longer in restoring the inflamed parts to their former condition.

The *Symptoms of Inflammation*, or the signs by which its presence is indicated, are noted both in the action of the part as well as in that of the system at large; hence surgeons speak of the local and constitutional symptoms of inflammation.

SECTION I.

OF THE LOCAL SYMPTOMS OF INFLAMMATION.

The local symptoms of inflammation may be classified under: 1. Changes of color. 2. Changes of temperature. 3. Changes of sensation. 4. Modification of the size and consistence of the inflamed part; and are usually described under the heads of Redness, Heat, Pain, and Swelling, or the "rubor, calor, dolor, and tumor" of Celsus.

§ 1.—OF THE REDNESS.

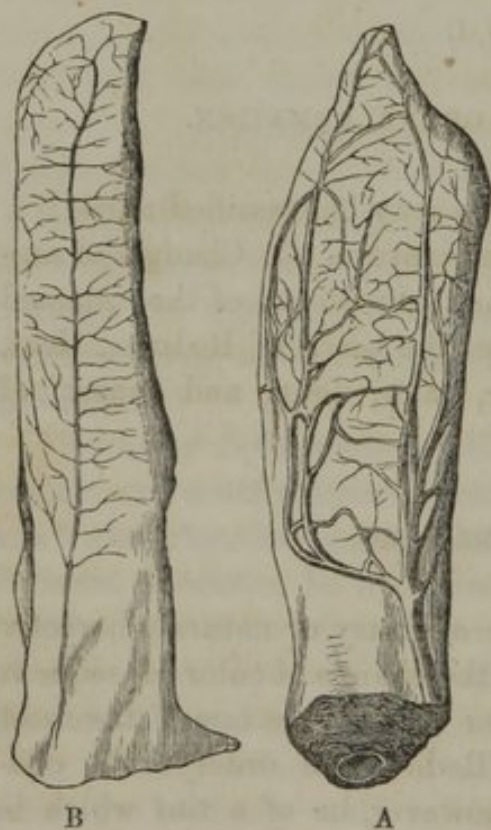
As every one is familiar with the ordinary or natural character of the external portions of the body, the change of color consequent on inflammatory action has long been regarded as one of the most prominent signs of its presence. Redness, in order to be characteristic of inflammation, must, however, be of a tint which is *above* the natural standard of color. In Acute inflammation it is of a bright scarlet, but in Chronic it is of a more purplish hue. It is generally most marked at one spot—the focus—and decreases or shades off to the healthy tint as it departs from this centre. Sometimes it ends abruptly and by a well-defined margin; but in other instances, as in erysipelatous inflammation, it is irregular, or even fringed and indented on its margin. The pressure of the point of the finger often destroys the red color, and renders the point pressed on momentarily paler than is natural; but the instant the pressure

is removed, the redness is rapidly restored, thus furnishing a good test of the activity of the circulation in the inflamed part.

The redness of inflammation is usually due either to the flow of an unusual quantity of blood into the part, or to the admission of the red corpuscles of the blood into vessels which usually do not carry them, or in which they will not circulate without becoming obstructed; thus if the conjunctiva, or any other tissue which is usually colorless, becomes inflamed, its vessels soon become apparent, though previously unseen.

But, though the redness of an inflamed part had been so often noticed, its cause was long one of the disputed points of pathology;

Fig. 1.



A VIEW OF THE RABBIT'S EARS, AS SEEN IN HUNTER'S EXPERIMENT.—The right or inflamed ear, A, shows the character of the enlarged vessels; many being apparent in it which are not visible in the left ear, B, or that which was uninfamed.

The vessels in the inflamed ear are nearly four times as large as those in the healthy ear. (After Paget.)

some observers insisting that it was due to the formation of new bloodvessels, whilst others argued that there was only a dilatation of such as previously existed. To settle this question, Mr. John Hunter experimented as follows: By freezing the ear of a rabbit, and then thawing it, he developed considerable inflammation in one ear; then killing the animal, and injecting both the inflamed and healthy ear, he noted precisely the same vessels ramifying through both; but, in the inflamed ear, the arteries were much more distinct and enlarged than they were in the healthy ear.¹ A repetition of his experiment by myself has furnished a similar condition of parts to those illustrated by Fig. 1.

The enlargement of the vessels of an inflamed part affects equally its arteries, veins, and capillaries, and usually extends to some distance beyond the focus of the inflammation. The amount of the enlargement of the vessels in an inflamed part is not, how-

¹ Hunter on Inflammation, by Palmer, p. 309, Philad. edit., 1841.

ever, always the same, as it extends sometimes to two or three times their ordinary diameter. From the observations of modern observers, as Bennett and Paget, it also seems that, in addition to the enlargement of the bloodvessels under these circumstances, there is a change in their shape, and that they are thrown into curves which are more or less wavy and tortuous; whilst Kölliker and Hasse state that the vessels sometimes present gradual fusiform dilatations of their whole circumference similar to those seen in aneurisms.¹

The microscopic examinations of Wharton Jones, Allison, Williams, and others, have also shown that the red color of an inflamed part is due not only to a change in the calibre and arrangement of the vessels, but also to a modification of the position of the elements of the blood, and especially the condition of its red and white corpuscles. In health, the red corpuscles of a transparent structure, as the web of a frog's foot, can be seen circulating with rapidity in the centre of the vessel, whilst on each side is contained the white corpuscles and liquor sanguinis (Fig. 2), which circulate more slowly. But as soon as inflammation is developed, a change, it is said, can be noted; the red corpuscles begin to retrograde, then to oscil-

late, and at last cease to move; the blood becoming stagnant, as it were, in the vessel, and the corpuscles by their permanency adding to the color of the tissue which is inflamed. Another, but minor cause, of the increased redness of the inflamed part is sometimes seen—as stated by Mr. Paget²—in the oozing of the coloring matter (hematin) of the blood-corpuscles, both into the interspaces which exist between the corpuscles in the vessel, or into the liquor sanguinis, as

Fig. 2.



DIAGRAM SHOWING THE STATE OF THE CORPUSCLES IN THE VESSELS BOTH WHILST CIRCULATING, AND ALSO AS ARRESTED DURING THE CONGESTION OF INFLAMMATION.—*a, a.* Colorless or lymph-corpuscles on the sides of the vessel. *b, b.* Blood-corpuscles circulating in the centre of the vessel. *c, c.* The stagnant blood, or arrested red corpuscles, which is one cause of the redness of inflammation. *d, d.* Corpuscles oscillating and detached from the stagnant mass before ceasing to move. *e, e.* Intervascular spaces into which serum, colored by hematin, sometimes escapes, and is another cause of redness. (After Williams.)

¹ Paget's Lectures, Philad. edit., p. 196.

² Ibid., p. 195.

well as into the areolar structure when it escapes from the vessel into the adjacent tissues.

From these sources it is, therefore, shown that the red globules of the blood are the chief agents in producing the color of inflammation.

The red color of a part, when above the natural tint, may generally be regarded as evidence of inflammation, especially if it is accompanied by any other symptoms, as heat and swelling; but redness alone, is not a positive sign of inflammatory action. Blushing creates it, and muscular effort, as in violent exercise, produces congestion; yet neither would justify the surgeon in thinking that the part was inflamed, simply because the redness was above the natural standard.

§ 2.—OF THE HEAT.

The increased temperature of an inflamed part is another prominent symptom, so much so as to have given its name to the entire disorder—as before stated—as, *inflammo*, I burn; or *in*, within, and *flamma*, a flame, as it was described by the Romans. Though marked, the heat of an inflamed structure is not so much above the natural standard as the sensations of either the patient or the surgeon might tempt them to suppose, it being seldom above that of the centre of the circulation at the heart of the one who suffers from it. To prove this, Mr. Hunter performed various experiments; thus he made an incision two inches deep into the gluteal muscle of an ass, so as to inflame it, and also developed inflammation in the rectum and vagina of this animal and in the thorax of the dog. On testing these inflamed parts with a thermometer, he, however, found that the instrument indicated only a rise of temperature of about one degree as compared with the natural heat of deep-seated parts, and that then it did not exceed that of the blood in the heart of these animals. By blistering the chest of a patient he also found that the difference between the heat of the inflamed and of the surrounding parts was not more than one or two degrees; but, on applying a blister to the extremities, which, in consequence of their distance from the heart, are naturally colder, he found that the variation of the temperature between the healthy and inflamed parts was between 5 and 7 degrees. He also noticed the same fact in operating for the

radical cure of hydrocele upon a patient in St. George's Hospital. On opening the tunica vaginalis the thermometer rose only to 92° ; but the next day, when inflammation was developed, he found it to be exactly $98\frac{3}{4}^{\circ}$. But though this showed an increase of $6\frac{3}{4}^{\circ}$, he did not find the heat to be greater than that at the source of the circulation in the same man.¹

These experiments are, therefore, universally regarded as proving that the actual rise of temperature in the inflammation of *deep-seated* parts, or those near the heart, is slight (1°); although in *distant* or *superficial* parts, or in the extremities, it is $6\frac{3}{4}^{\circ}$, and that in all instances it is not above the heat of the blood in the heart; thus showing the deceptive character of evidence furnished by the sensations of a patient when the action of his nerves is modified by disease.

The cause of the heat in an inflamed part has been variously explained. Mr. Hunter attributed it to the increased flow of arterial blood, raising the heat towards that of the blood at the heart. Mr. Travers ascribed much to the action of the nerves upon the circulation, whilst Liebig regards it as resulting from the greater number of the red corpuscles introduced into the vessels; these corpuscles being, as he supposes, oxygen carriers, and hence affecting the production of heat by a chemical action in the tissues.

As the explanation of Liebig on this increased local heat by chemical action, corresponds with the opinions of the best physiologists on the source of the vital heat, there is good reason in the present state of our knowledge to regard it as being correct.

Unusual heat, like redness, may and does exist without being indicative of the presence of inflammation. Unless, then, it is preternatural, of some duration, and conjoined with some of the other symptoms, it cannot be regarded as positive evidence of the presence of inflammation.

§ 3.—OF THE PAIN.

The pain of inflammation is a prominent symptom, though it is not always present in a marked degree. It varies in its character in the inflammations of different tissues, and sometimes also in different attacks of inflammations in the same tissue, being

¹ Hunter on Inflammation, by Palmer, p. 324, Philad. edit., 1841.

described as burning, tingling, itching, throbbing, lancinating or shooting, sharp, dull and obtuse, terms which require no explanation. Inflammation of the *skin* is generally accompanied by a burning or tingling pain; in the *cellular tissue* it is throbbing or pulsatile; in the *serous membranes*, sharp and lancinating; whilst in *glands*, as the parotid, kidney or testicle, and in the mammary gland of the female, it is dull and heavy. The sensibility of all parts is not, however, invariably augmented when they become inflamed, but is, on the contrary, diminished; as in the inflammations of the mucous membranes of the mouth, nostril, and ear, where sensibility, as respects the function of smelling, taste, and hearing, is diminished, though the part may be painful when touched.

The development of pain by inflammatory action is apparently due to the functional disorder of the nerves of the part, or sometimes to the distension of tissues produced by the congestion in its bloodvessels, or to the presence and confinement of the liquid products of inflammation.

As indicative of the presence of inflammation, the existence of pain should always be cautiously examined by the surgeon, as neuralgia, or simple functional disorder of a nerve, often causes intense pain without there being any inflammatory action in the part, and its diagnosis becomes, therefore, a matter of importance.

Generally, *neuralgic* may be distinguished from *inflammatory* pain by the fact that pressure relieves the former, but augments the latter, whilst the gravitation of the blood to an inflamed part augments its sensibility, and yet has little effect on the neuralgic condition. Lastly, neuralgic pain may last for many days without developing any of the results of inflammatory action, especially suppuration, which sooner or later becomes apparent when inflammatory action has continued for a few days.

Though so frequently present, pain is not essential to inflammation; numerous instances being recorded where even severe inflammation has existed without its presence having been shown by pain.

The location of the pain is also no evidence of the locality of the inflammation; thus inflammation in the hip-joint is often first shown by pain, which is referred to the inner side of the knee; and irritation of the neck of the bladder causes pain at the point of the

penis, whilst in inflammation of the liver the pain is often referred to the left shoulder-blade.

§ 4.—OF THE SWELLING.

The swelling of inflammation is generally the result of a mechanical distension of the tissues near the focus of the inflammatory action, and may be due either to the various effusions consequent on the disorder, or sometimes to the congestion of the blood-vessels of the part.

The effusions consequent on inflammatory action may consist of serum, lymph, or pus, and be found in any of the tissues, but especially in the areolar, reticulated, or cellular tissue of the inflamed part. These effusions also produce varied forms of swelling and changes of structure; thus serum creates puffiness or œdema—lymph a more firm swelling, with induration or hardening; whilst pus, as well as serum, if of any amount and in a loose structure, creates a soft swelling, with evidences of fluctuation.

§ 5.—SUMMARY OF THE LOCAL SIGNS OF INFLAMMATION.

In reviewing the changes in the condition of tissues as connected with the development of inflammation, it will now be seen that the symptoms of inflammation are the presence of unnatural redness, heat, pain, and swelling; that the redness is due to the greater number of red corpuscles in vessels which usually are not so full or do not admit them, as well as to their stagnation in the vessels and the discoloration created by the escape of their hematin into the surrounding structures. That the heat is due to a more rapid circulation in the part, as well as to the more rapid oxygenation of structure caused by the presence of the red corpuscles; whilst the swelling is accounted for by the increased flow of blood to the part, as well as by the effusions consequent on this augmented vascular action, these effusions being due to certain changes in the blood which are yet to be described.

SECTION II.

OF THE CONSTITUTIONAL CHANGES PRODUCED BY INFLAMMATION.

INFLAMMATORY FEVER.—As all parts of the body are closely connected by means of the nerves—or, to use an old expression, “sympathize with one another”—the establishment and continuance of inflammation by the injury of one part, sooner or later develops disordered action in the general functions of the body, the effects of the primary irritation being transmitted from the part injured, to the brain. To this communication the brain replies through the spinal marrow and nerves, creating a state of general, though temporary, depression, which, by the inherent powers of life, is overcome, and results in over-excitement or fever.

Symptoms.—During the primary condition, or that of depression, the skin is apt to be, or feel cold, and is more or less disposed to shrink, thus rendering its papillæ more prominent, and creating “goose-flesh,” or the “cutis anserina.” Soon afterwards the muscles show the effects of imperfect nervous action; the heart contracts more feebly and the pulse flags somewhat, whilst the irregular muscular action causes shivering or trembling, which the patient cannot control, presenting symptoms which are technically denominated as a “Rigor” or Chill. Under these circumstances, the equal circulation of the blood becomes affected, less of it flows to the vessels of the surface of the body, whilst those of the internal organs become correspondingly engorged. After an interval, which varies under different circumstances, a reaction ensues, and is indicated by an increased force of the circulation. Hence the heart beats more rapidly and forcibly; the pulse becomes fuller and quicker, beating from 80 to 130 in the minute, and feeling more or less cord-like; the respiration becomes more active; and the blood, which during the chill had appeared almost to stagnate, now flows with increased rapidity. The skin therefore becomes florid—especially on the face—and is hot and dry; the breath is much warmer; the secretions of all the glands become more or less vitiated or checked; there is a marked change in the nutritive action of the body, and the condition designated as “Fever,” is fully established. After a period which varies from a few hours to a day or two, the secretions

again appear; the skin becomes more moist, and cooler; the tongue, which had shown fur, is now less dry, and cleaner, owing to the restored action of the salivary glands throwing the saliva upon it; the urine again flows freely and clearer, and the attack of Irritative, Inflammatory, Symptomatic or Sympathetic Fever, is over for the time, or presents a more or less marked recurrence of all the symptoms. The violence of the symptoms of inflammatory fever in surgical cases is generally indicative of the importance of the local inflammatory action, as well as of the tissue that is inflamed; being more violent from inflammation developed by wounds of internal organs, as the lungs, &c., than it is when the irritation is seated in the skin. Wherever or however this fever be excited, it is usually most quickly relieved by such means as will remove the primary local excitement.

In idiopathic inflammations, or those which are usually assigned to the practice of medicine, there are some modifications of symptoms, &c., which it is not necessary to describe in a surgical treatise, and the details of its treatment will therefore be given in connection with the means of relief adapted to the local condition which generally precedes it in surgical cases, the peculiar form of fever spoken of as hectic being the subject of a special section hereafter.

Diagnosis.—Inflammatory fever, as presented in surgical cases, is not liable to be confounded with other affections; the history of the injury, and the development of local irritation prior to or consecutive with the constitutional disturbance, generally sufficing to establish a correct diagnosis. In complicated cases, as in the supervention of injury on other causes, as exposure to miasm, cold, &c., there may be difficulty in establishing the precedence of the local or constitutional disorder; but in the majority of instances of inflammatory fever from surgical causes the local irritation will precede, by some hours, the development of the febrile reaction.

CHAPTER II.

ETIOLOGY AND TREATMENT OF INFLAMMATION.

THE etiology (*aitia*—cause) of inflammation, as regulating every rational plan of treatment, has always received a large share of the attention of those who have carefully studied the important modification of nutritive action, the symptoms of which have just been detailed. Few subjects have given rise to longer discussions or eliminated more diversified theories of its production than this of inflammation. It would, however, be impossible, in a general treatise, to allude to these theories in detail, and I shall, therefore, only offer a comparatively brief outline of them in the first section of this chapter, and give in the second a fuller consideration to the more practical subject of the best means of relieving inflammation when it is established by injuries.

SECTION I.

OF THE ETIOLOGY OF INFLAMMATION.

The causes of inflammation may be classified as exciting, predisposing, and proximate.

The *exciting causes* of inflammation are very varied, embracing the entire class of surgical disorders, as frictions, pressure, irritants, wounds, &c. Thus, in fat men, the friction of the scrotum against the thigh, or of a tumor against adjacent parts, will suffice to develop inflammation of the skin, whilst the pressure of the sacrum against a bed; of the heel against a pillow, or of various bands, splints, &c., against the surface of the body, will also create it. Unhealthy pus, wounds, and foreign bodies—as calculi—acting on normal tissues, will likewise rapidly develop the same condition.

The *predisposing causes* of inflammation are certain states of the atmosphere, as shown in the development of erysipelas the

habits of the patients, as intemperance; their age, or sex; and specific conditions of the blood, as syphilis or cancer, all of which present us with various causes which will predispose the patient to inflammation, and very seriously complicate otherwise simple injuries.

The *proximate or essential causes* of inflammation are, however, those which present a much wider field for study; and it is in connection with them that physiologists have exercised their utmost powers of observation, and exhibited their greatest ingenuity in the formation of theories for the explanation of a condition which the use of their senses, even when aided by the microscope, did not suffice accurately to establish.

Among the earliest opinions advanced in regard to the proximate causes of inflammation that attracted much attention was that of a "lentor" or viscosity of the blood, as suggested by Vacca in 1765; of an "error loci," or misplaced position of the blood; of "a spasm of the extreme vessels or capillaries," as suggested by Cullen; of increased action in the vessels themselves, as suggested by Hippocrates, but subsequently warmly urged by Hunter; or the debility of the vessels, as suggested by Allen, of Edinburgh, and re-advanced by Wilson Philip. The opinions of debility and stagnation, or increased circulation, have each been advocated by subsequent writers; Van Helmont, Stahl, Haller, and Thompson, regarding inflammation as due to excessive vascular action, whilst Hastings, Henlé, and others, sided with the opinions of those who saw in it debility of the vessels, and consequent congestion.

It is, however, to modern observers—as Travers, Bennett, Wharton Jones, Williams, Carpenter, Lebert, Simon, and Weber—that we are mainly indebted for most of the positive information that we possess of the actual condition of an inflamed part.

These gentlemen have, from the examination of inflamed parts under the microscope, been enabled to satisfy themselves that under the effects of irritation the flow of blood in the capillaries is first accelerated, but that very soon the red corpuscles oscillate backwards and forwards, the blood stagnates and the vessels become distended. That sometimes a vessel ruptures and its blood escapes into the surrounding tissues, whilst the liquor sanguinis, often colored with hematin, is exuded by exosmosis or, perhaps, by the function of the organic cells near it, the redness of inflammation being due to all of these causes.

Among the best accounts given of the proximate effects of such

causes as will develop inflammation is that furnished by Mr. Paget,¹ to which the reader is referred for a full statement of this and many other points illustrative of the action of the vessels as shown not only in inflammation but also in the repair of tissues, inflammatory action being frequently associated with the reparative process. As objection had been raised to such observations as had been made upon the web of a frog's foot (on the ground of its being a cold-blooded creature, and therefore possessed of a circulation unlike that seen in man), Mr. Paget experimented on the wing of a bat, which more closely resembles warm-blooded vertebrata. In this creature, he noticed that if whilst "the blood was circulating in the vessels—as in a companion artery and vein—a fine needle was drawn across them three or four times without apparently injuring them or the membrane over them, they both soon contracted and closed; that, after thus remaining for a few minutes, they began to open, and, gradually dilating, acquired a larger size than they had before the stimulus was applied. He also noticed that as the vessels were contracting, the blood moved more slowly and began to oscillate, until at last it ceased to move, the state thus induced in the vessels being similar to what is commonly understood by the expression 'active congestion' or 'determination of blood' to a part, and being due to a general enlargement of the vessels themselves as well as to the increased velocity of the blood in them."

Thus far, facts have been presented which are now well known, in explanation of the immediate cause of inflammation; but when we come to the rationale of this action, and endeavor to explain how the inflammation is produced, we reach the unsatisfactory ground of pure theory. Of these theories, there have been all the varieties before alluded to as the opinions of those whose names have been quoted. As a fuller description of them would not furnish any facts of value in the treatment of inflammation, I will only state that the following seems to offer the most satisfactory explanation of the action of these causes that can be given in connection with the development of this disordered action from surgical causes:—

1. That the starting-point of inflammation is the sense of injury felt by the organic nerves, as stated by Dr. McCartney. This involves the important practical point that inflammation, after an injury, may be checked or regulated by such means as will tend to soothe or allay the nervous irritation.

¹ Lect. on Surgical Pathology. Phila. edit., p. 198.

2. That the original irritation of these nerves produces disordered action not only in the capillaries, bloodvessels, and blood, but also in the living properties of the adjacent tissues as an organic entity—that is to say, in the component cells of the tissue affected—as has been stated by Mr. Travers.¹

3. That the first contraction of the capillaries, as described by Mr. Paget as seen in the bat's wing, is due to the action of such portions of the coats of the capillaries as correspond with the circular fibres of the larger bloodvessels; whilst their subsequent *dilatation is due to the action of that portion of the vessels which corresponds to the longitudinal fibres of a muscle, or the elastic coat of the larger arteries*, which, by shortening their length, causes the oscillatory movements of the blood-corpuscles; the relaxation of the walls in the approximation of the two extremities of a vessel permitting the lateral expansion of its coats and the subsequent stagnation or congestion of the blood.

Such an explanation, it is admitted, is purely theoretical, but yet there are some facts which tend to support it. Thus, when an artery is entirely divided, it not only becomes contracted in its calibre, but also retracted in its sheath, and when it is obliquely opened, the wound is augmented to a much greater degree by the longitudinal or oblique contraction of an elastic tissue; whereas when cut transversely, it is the circular fibres which lose it. Anatomists have also demonstrated that in the coats of the arteries there are both circular fibres and also a longitudinal elastic coat, the circular fibres, though not individually performing the entire circuit of the vessel, being yet sufficiently perfect to diminish its calibre very materially. Although histology has not yet shown the presence of longitudinal muscular fibres in the coats of the arteries, yet it has shown that the elastic tissue which forms the outer portion of their muscular coat—and which was described by Hunter—serves the same purpose.

“This elastic coat, according to Horner,² gives a middle state to an artery, or has a continued tendency to it. If, therefore, an artery be too much dilated it contracts it, or if too much contracted dilates it—all of which is readily exemplified by a cylinder of gum-elastic which, whether compressed or dilated, has only one state of repose, to which it immediately returns on being left to itself. Mr. Hunter³ also supposed that a certain degree of this elasticity

¹ Travers on Inflammation. 1844.

² Special Anatomy and Histology, by Wm. E. Horner, M. D. Philad., vol. ii. p. 178, *ut supra*.

³ Opus citat.

was continued to the very end of every artery (capillaries), and that it was this elasticity which caused the blood at a little distance from the heart to flow through them in a *continued* jetting stream when they were opened, although it was supplied to the aorta, from whence they received it by the *interrupted* strokes of the heart. The observations made with the microscope, have also shown that the fibres of the middle—or so called muscular coat of the arteries—are identical with those of the ligamenta flava of the vertebral column,¹ and that it has, therefore, considerable retractile power.

For these reasons it may, I think, be reasonably supposed that the dilatation of the capillaries is not the result, as has often been suggested, of the mechanical distension of the coats by the *vis à tergo* of the circulation upon vessels temporarily paralyzed by injury, nor indeed due entirely to the action of the elastic tissue just referred to as relaxing their sides by approximating their extremities, or diminishing their length. Yet this latter suggestion has its value as affording an explanation of the phenomena of the corpuscular oscillation and stagnation, and when combined with the views of Mr. Paget² ("that the velocity of the stream in any vessel of an inflamed part cannot be wholly determined either by the diminution or enlargement of its channel, or by the stagnation or congestion of the blood in the vessels beyond, though much doubtless depends on these conditions, but rather depends on that mutual relation (vital affinity) which exists between the blood and the vessels, or the parts around them, which being natural permits the easy transit of the blood, but being disturbed increases the hindrance to its passage"), seems to me the most reasonable explanation of the proximate causes of inflammation that can, in the present state of our knowledge, be presented. I therefore sum up these causes as follows: Every surgical inflammation is due to some irritant, say the prick of a needle as applied to the part inflamed; the nerves perceiving it the vessel shrinks from the contraction of its circular fibres, and this is followed by the dilatation of its coats as produced by the action of the elastic tissue—hence the oscillatory movement and subsequent retardation of the current or congestion; these changes being aided by the mutual relations which exist between the blood-corpuscles and the vessels themselves, whence we have the redness, pain, and other local symptoms of inflammation.

¹ Special Anatomy and Histology, by Wm. E. Horner, M. D. Philad., vol. ii. p. 178, *ut supra*.

² Paget's Lectures. Phila. edit., p. 204.

RESULTS OF INFLAMMATION.—The inflammatory action being once established, may be either arrested without leaving any signs of its presence, as in "Resolution," or disappear rapidly in consequence of the disgorgement of the capillaries, "Delitescence," or suddenly leave one point and show itself elsewhere as in "Metastasis." But when inflammation continues for a moderate period it may result in changes in which the action of the organic cells of the tissues become apparent, as seen in the "Effusion of Serum," of "Lymph," or of "Pus," as will be described hereafter.

SECTION II.

OF THE TREATMENT OF INFLAMMATION.

Having thus studied the general progress of inflammatory action, it will now be useful to examine the means that may be employed by the surgeon to keep it within proper bounds, it having been admitted that its development is sometimes essential to the successful treatment of many surgical disorders, though sometimes also likely to prove injurious, and therefore to be prevented.

§ 1.—OF THE PROPHYLACTIC TREATMENT.

The prophylactic treatment of inflammation consists in the employment of both local and constitutional measures.

The indications for the *local* prophylactic treatment are to be found in the avoidance of any unnecessary irritation, from the exposure of parts to the action of the atmosphere, and from all such causes as would excite the local circulation; as when acrid discharges are permitted to pass over unprotected parts; or inattention to cleanliness allows chemical changes to render any discharge irritating; or when a continuance of such a position as creates undue pressure is allowed.

These indications may be accomplished by protecting the surfaces in various ways, as by covering the tissues with cloths or with wheat bran, starch, or other dry powder; or by sheathing them with mucilages, mild plasters, &c.; as well as by relieving the parts pressed on, by shifting the patient's position, or by

the use of soft pillows, or by modifying the arrangement of the splints and bands.

The *constitutional* prophylactic measures are very much the same as those required in the constitutional curative treatment of inflammation, that is, the employment of such means as will allay nervous excitement, as anodynes; or diminish the force of the general circulation, as the abstraction of blood, abstinence from food or purging, all of which are especially useful as prophylactic measures, especially in plethoric patients.

§ 2.—OF THE CURATIVE OR REGULATING TREATMENT OF INFLAMMATION.

The curative treatment of inflammation, or that which keeps it within proper bounds, is to be found in the reduction of both the local and general circulation.

I. LOCAL ANTIPHLOGISTICS.—The activity of the local circulation may be modified by the use of evaporants, astringents, and all the remedies designated as the "Antiphlogistic" class, which may now be considered in detail.

a. EVAPORANTS.—The cooling influence of evaporation requires no explanation as to its action. It may be accomplished by the "water-dressing," or by "irrigation."

Irrigation, or the "water-dressing," consists in the application of liquid to the part either by means of cloths wrung out of either simple or medicated water, and frequently changed upon the part, or by means of the constant passage of a stream of water upon the inflamed surface—especially if in an extremity—by means of capillary action, or by the use of an appropriate apparatus.

The neatest and most thorough mode of irrigating a limb is by means of an apparatus which consists in a tin vessel, from the bottom of which passes a perpendicular pipe, from which runs a transverse one which contains a number of points, from which jets of water are thrown on the limb. In the main pipe is a stop-cock, by means of which the quantity of water thrown upon the limb can be accurately regulated. Such an apparatus may be made by the tin-plate workman, but may also be prepared extemporaneously by employing a cane-angle or reed with quills, and attaching it to the perforation in the bottom of a wooden pail.

Irrigation may also be practised by moistening thoroughly a piece of patent lint, and applying it to the inflamed part. Then soaking a piece of lamp-wick so as to wet it, lay one end on the lint, and place the other in an adjacent vessel of water, when the capillary action of the wick will carry the water from the vessel to the limb, and thus keep it constantly moist. (Fig. 3.) In em-

Fig. 3.



ploying either the lamp-wick or the other apparatus, the bed must, of course, be protected by placing oil-cloth or something similar beneath the limb, and arranging it so that the surplus liquid may readily pass from the limb into a proper receptacle near the bedside. In order that irrigation may prove useful in the reduction of inflammatory action, it is necessary that the liquid should flow so steadily upon the part as to keep it constantly cool; if it does not, the alternation of heat and cold, or the reaction which follows the application of cold, will prove injurious.

Irrigation, or the water-dressing, may also be applied by surrounding the part with wet cloths—as a soft towel, and then wetting it constantly by means of a sponge; but the utility of this method depends in a great measure upon the watchfulness of the attendant in keeping the cloth constantly wet.

Sometimes, instead of cold irrigation, the warm water-dressing

may prove most useful in the treatment of inflammation by furnishing such an amount of heat and moisture as facilitates the expansion of the structures in an inflamed part. To apply the warm water dressing, it is merely requisite to change the temperature of the water in the vessel, as formerly arranged, or, if wet cloths are employed, to cover them with oiled silk so as to prevent evaporation. As the latter dressing does not require a renewal oftener than once in six hours, it does not demand so much attention as the other. It will, in all cases, be found preferable to the poultices formerly employed, not only on account of its neatness and freedom from all sources of irritation, but also from its economy. When it is desirable to apply astringents, the water-dressing will also answer a better purpose than poultices, simply by adding to it acetate of lead, &c., whilst the addition of opium will, at any time, give it a sedative character.

Spongio-pileine, or a combination of the particles of sponge and lint felted together and coated on the outside with caoutchouc, is an admirable substitute for the poultice, and is now kept by many druggists. Its use will be again alluded to in connection with the application of poultices in the treatment of abscesses.

Another series of antiphlogistic measures is to be found in the local abstraction of blood. This may be effected either by leeches or by cups.

b. LEECHES.—The utility of leeching is at present too generally understood to require any comment, whilst the frequency with which leeches are found in many of our creeks, renders it unnecessary to describe the character or action of this creature. As most practitioners can now readily obtain them, even in country districts, I shall therefore only allude to a simple mode of preserving them for constant use.

PRESERVATION OF LEECHES.—Place in the bottom of a wooden vessel a few large rough stones and a little moss, or a few sticks; fill it half full of water, and cover it with a coarse cloth; place it in a cellar or room of a moderate temperature, and the leeches will be readily preserved in a healthy condition. The chief difficulty usually experienced in their preservation arises from the creature's often having no means to cleanse the skin from its natural secretion, which, by accumulating, becomes a source of disease. When the leech can draw itself against a stone, or other moderately rough surface, this is avoided. The water need not be changed oftener than once

in two or three weeks, in order to free it from their excrement. In cold weather it should be slightly warmed, and should never be placed on the leech at a temperature below that of 58° Fahrenheit.

When leeches have been once applied for the abstraction of blood, they should be kept in a jar of water by themselves for three or four weeks, until they have digested that which they drew, after which they may be placed in their tub, or again employed upon patients. They should never be "stripped," or drawn through the fingers, in order to cause them promptly to disgorge the blood which they have drawn.

APPLICATION OF LEECHES.—The application of leeches may be accomplished by placing a few in a small empty cup (Fig. 4, A), smearing a little blood from the finger, or a little sugar and water upon the skin, and then, holding the cup near the part—as the temple—permit the leeches to crawl out of it on to the skin (Fig. 4), when they will readily attach themselves, provided the part has been thoroughly cleansed, or shaved, if necessary, prior to their application. When full, leeches drop off without difficulty, and should then be immediately placed in another cup (Fig. 4, B) until they can be permanently deposited in the jar of water. If sufficient blood has not been drawn, the bleeding may be

subsequently encouraged by fomenting the part with warm cloths; but, when the leeches have drawn as much as is desired, a greased rag applied to their bites is all that will be requisite. If any bite bleeds too freely after the leech has been removed, the hemorrhage may be checked by touching it lightly with a sharp-pointed pencil of the nitrate of silver, or by pressing on it a little dry lint. When it is desired to circumscribe the application of leeches, they may be placed on the part, as moistened with a little blood or sugar and water, and then covered for a few minutes with a tumbler; or a single leech may be applied to any special point, as the canthus of

Fig. 4.



A VIEW OF THE APPLICATION OF LEECHES.—A. A tin-cup with perforated top for the carriage and application of leeches. B. A cup for their reception after they have been applied. (After Nature.)

the eye (Fig. 5), the nostril, &c., by placing it in a glass tube open at both ends, and then applying the tube to the part from which the blood is to be abstracted. Six American leeches will draw about

Fig. 5.



A view of the Application of a single Leech by means of the glass tube. (After Nature

one ounce of blood, though one European or Swedish leech will often draw fully this amount by itself.

c. CUPS.—The abstraction of blood by Cups may be accomplished by exhausting the cup, by means of an air-syringe, as furnished by

Fig. 6.



A view of the Cup when exhausted by the combustion of Alcohol applied in it by means of the paper cone, showing the position of the latter. The upper end is the part which burns, after being moistened in the alcohol. (After Nature.)

the cutler, or by forming a little cone or thimble of letter-paper, by twisting a strip of it around the end of the finger. Then dipping the base of the cone in a little spirits of wine, touch it to the flame of a candle, toss it into the cup, and apply the latter directly on the skin. As the twisted end of the cone is the heaviest, it will generally be found to rest upon the skin, and thus keep the ignited portion from burning the patient, the combustion being promptly checked by the want of air within the cup. After

the vessels of the skin have been rendered turgid beneath the exhausted cup, remove it by gently inclining it to one side, so that

the air may enter it from beneath, and then divide the congested vessels by the application of the "scarificator," or scarify the skin with the point of a lancet—though the first is preferable—when the cups should be reapplied until they draw sufficient blood. After cleansing the part, a greased rag is the only dressing that is necessary.

d. COUNTER-IRRITANTS.—When the direct abstraction of blood is not admissible, owing to the debility of the patient, or in cases of long-continued inflammatory action, the vessels may be emptied, or the activity of the circulation in the inflamed part diminished, by the employment of "Counter-irritants," or by the establishment of "Exutories," "Issues," or drains in the neighborhood of the inflamed part. Counter-irritants relieve local inflammation by drawing the blood to the seat of the new irritation, whilst issues relieve the congestion of an inflamed or congested part by establishing the process of suppuration, and thus creating a drain upon them.

Counter-irritation may be made by applying on the sound skin, near the inflamed part, some irritating substance, as croton oil, or cantharides, or tartar-emetic ointment. Croton oil and tartar-emetic ointment may either be rubbed on, or applied to the part by cloths or plasters, the latter being renewed every twenty-four hours till it pustulates; whilst the cantharides may be applied in the form of "Blistering Ointment," or of "Blistering Collodion." The latter is a very neat mode of producing vesication, and is accomplished by painting the surface to be vesicated with the collodion, which comes off with the cuticle after the latter is elevated by the vesication.

ISSUES are formed by creating a slough, favoring its separation by the repeated applications of the warm-water cloths, and then preventing the ulcer left by the separation of the slough from healing, by introducing and keeping in it some foreign substance, as peas formed of orris or gentian root (Fig. 7). The peas may be kept in place and the ulcer protected from accidental injury by means of the "Issue shield," which is formed of a little plate of caoutchouc covered by a tin strip, the latter being fastened on the arm by an elastic band. The slough may be produced by rubbing a little caustic potash on the skin until the integu-

Fig. 7.

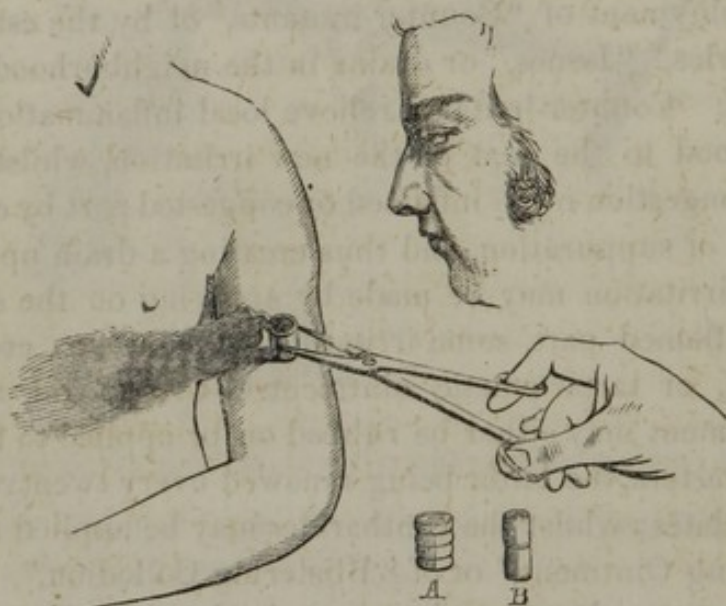


Issue Peas and the Issue Shield, as applied to the arm. (After Nature.)

ments become brown, or by creating an eschar by the application of fire by means of "moxæ."

MOXÆ may be made by soaking strips of linen in a saturated solution of the nitrate of potash, drying them, forming the strips into rolls, tying them with a silk thread, and then cutting them into pieces one inch long and about one-fourth of an inch thick (Fig. 8, A, B); or by rolling up "agaric," or the sheet punk of the tobacco-

Fig. 8.



A VIEW OF THE APPLICATION OF MOXÆ.—A. Moxa ready for use. B. A roll from which the moxa is to be cut. (After Nature.)

nist, into pieces of a similar size. Either of these moxæ, when ignited and applied to the part, as represented in Fig. 8—the combustion being aided by blowing the breath on the burning mass—first creates a sense of heat, which soon becomes more painful, until sensation is in a great measure deadened by the carbonization of the tissue. The separation of this eschar should be subsequently favored by the repeated applications of heat and moisture, as alluded to in the formation of issues by the caustic potash.

e. SETON.—The Seton (*seta*, a bristle) is formed by introducing beneath the skin a narrow strip of silk or cotton, or of caoutchouc, as seen in Fig. 9, A, B, and retaining it there until it develops sufficient inflammation to create suppuration. The introduction of the seton may be best accomplished by attaching it with a thread to the eye of a probe; then picking up a fold of the skin—as

on the back of the neck—transfix it with a sharp-pointed bistoury, and introduce the probe and seton before the bistoury is withdrawn (Fig. 9). After placing the seton in position, cover the part with the warm water cloths, renewing them every six hours until free suppuration is induced. After the seton has been worn about ten days, some simple ointment, as that of Cerate, may be applied over the part to prevent the chafing of the dress. But when it ceases to discharge freely something more stimulating may be required—as Basilicon, or Red Precipitate Ointment, &c., which should also

Fig. 9.



A VIEW OF THE INTRODUCTION OF A SETON BY MEANS OF THE BISTOURY AND PROBE OF THE POCKET CASE, which is preferable to the thick seton needle of the cutter.—A, B. Setons of caoutchouc. (After Nature.)

be drawn into the wound by anointing the seton with it. The seton should be moved through the wound at least once in every twenty-four hours, the part that is wet with pus being thoroughly cleansed. When fungous granulations or "proud flesh" form in the ulcer, the application of the nitrate of silver may be demanded. On removing the seton, the ulcer generally heals rapidly under the use of a mild dressing.

Of the various modes of practising counter-irritation, the issue, as made by the use of the seton, is the most permanent, though it is specially adapted to the neighborhood of the spine. Over joints and on the extremities, issues, as made with caustic potash or moxa,

are generally preferable, though the use of moxa is now becoming rare, owing to the apprehensions of patients of the suffering which it induces, though it in reality creates severe pain only for the moment, or until an eschar is formed.

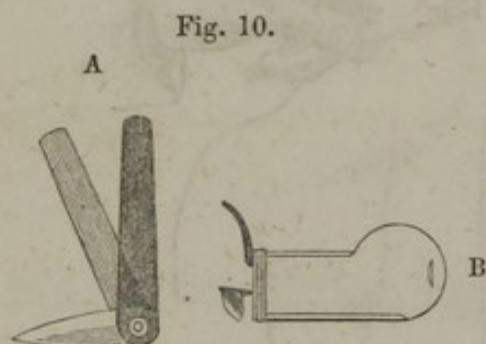
The local circulation of an inflamed part may also be diminished by the judicious application of the bandage, or by elevating the part so as to retard the flow of blood into it. The application of bandages will be shown hereafter.

§ 3.—OF THE CONSTITUTIONAL TREATMENT OF INFLAMMATION.

Among the most important of the constitutional or general means of regulating inflammatory action are Venesection or General Blood-letting, Anodynes, Antimonials, Purgatives, and Mercurials.

a. **VENESECTION.**—Venesection, or the abstraction of blood by puncturing a vein, may be practised either upon the veins at the

bend of the arm, in the external jugular vein, or in the saphena major above the ankle.



A. A thumb lancet. B. A spring lancet.
(After the Instruments.)

Venesection in the superficial veins of the arm may be practised either with the thumb (Fig. 10, A), or with the spring lancet (Fig. 10, B).

In order to render the veins of the bend of the arm apparent before employing either of these instruments, apply a narrow band as a ligature a few inches above the elbow, as in Fig. 11. The five veins which usually become apparent after the application of this ligature are the Cephalic on the outer side of the arm, the Basilic on its inner margin, the Median vein in the front, and its two branches, the Median Cephalic and Median Basilic, which run from the median vein to the other two veins. The relative position of the cutaneous nerves and of the brachial artery to these veins will, it is presumed, be first learned by the student before he attempts the operation. After selecting the fullest vein, and feeling for the position of the artery, as may be told by its pulsation, let the patient grasp a stick, in order to steady his arm, whilst the operator seizes it with one hand, so that his left forefinger or thumb may press slightly

upon the vein a little below the point at which it is to be opened. This pressure not only steadies the vein, and prevents it from rolling under the lancet, but also prevents the sudden exit of the blood, after the vein is punctured, or until the basin is so placed as to receive it, thus insuring cleanliness. Then if it is desired to employ the "Thumb lancet," bend its blade to a right angle with the handle, and hold the latter between the teeth, with the point of the blade turned from the right hand until prepared to use it, or until the vein has been steadied, as just directed. Then, seizing the blade of the lancet between the thumb and forefinger (Fig. 11), rest the

Fig. 11.



A view of the Operation of Venesection by means of the Thumb Lancet in the Median Cephalic Vein, showing the position of the operating hand, as well as that which steadies the vein. (After Nature.)

third finger on the arm near the vein, and, placing the point of the blade on the vein, push it quickly inwards until it punctures the front coat of the vessel, and then cut upwards and outwards by depressing the hand so as to make a small incision a little obliquely to the course of the vein. Then lay down the lancet, and, holding the basin so as to receive the blood, remove the pressure of the left finger or thumb from the vein, and let the blood run until sufficient is taken. If the blood does not flow with sufficient freedom, its escape may be facilitated by friction of the forearm in the course of the vein, or by directing the patient to move his fingers upon the stick, so as to obtain the flexion and contraction of the muscles of his forearm. When sufficient blood is drawn, loosen the band or ligature above the elbow, pick up the orifice in the skin with the left forefinger and thumb, wipe the part clean, apply over the wound a little compress, and bind it there with a few turns of a ribbon or narrow bandage applied around the part in the form of the figure 8.

In operating with the "Spring lancet," set the spring, apply the circular ligature, wait for the veins to become turgid, or favor their filling by friction, and holding the blade of the lancet close to the vein, and a little obliquely to its surface as well as to its course, touch the spring with one finger of the hand holding the instrument, so that the blade may be made to puncture the front of the vein by the force of the spring. (Fig. 12.) The subsequent

Fig. 12.



A view of the Operation of Venesection as performed with the Spring Lancet. (After Nature.)

steps are then the same as those just stated in connection with the operation as practised by means of the thumb lancet.

If in either operation the opening of the vein and that in the skin do not correspond, owing to the relations of the parts being changed by the movements of the patient, or in consequence of the coat of the vein not having been freely opened, the blood may escape into the cellular tissue beneath the skin, and, distending the latter, form a little swelling or "Thrombus." This may require an increase of the opening in the skin, if sufficient blood has not been obtained. If enough has been taken, it is only necessary to apply firmer pressure upon the compress which is employed to close the wound, and the tumor will subsequently disappear by absorption. If the patient faints, place him in the horizontal position, so as to favor the flow of blood to his brain, sprinkle a little water in his face, or let him snuff up the vapor of aqua ammonia or cologne, and he will usually soon recover.

Bleeding in the veins of the leg is now seldom practised; but, when it is desired, it may be performed as follows: Render the vein turgid by the application of a ligature around the calf, and open it with a thumb lancet, taking care not to puncture it so as to break

the lancet in the tibia, the integuments being here the only soft tissues over the bone.

Bleeding in the jugular vein, if desired, is to be accomplished by placing a compress over the course of the vein just above the clavicle, and fastening it in position by a bandage around this side of the neck and the opposite axilla. Then, puncturing the vein with a thumb lancet, place the edge of the bowl close against the neck, or press a bent card against the part just below the wound, so as to form a trough and carry the blood into the bowl without permitting it to trickle over the patient's clothes. After obtaining a sufficient amount, dry the wound, close it with a little piece of adhesive plaster, and then, untying the bandage, remove the compress from above the clavicle. By allowing this bandage and compress to remain in position until the wound is closed, the accidental entrance of air into the vein is prevented.

The amount of blood to be taken by any venesection for the relief of inflammation must be regulated by the circumstances of the case, and especially by the impression made on the patient's pulse. As soon as this flags, the flow of blood should be arrested.

It having been seen that the irritation of the nerves had a marked influence in the production and continuance of inflammatory action, the next of the constitutional means of treatment is to be found in the employment of anodynes.

b. ANODYNES.—Anodynes prove useful in the treatment of inflammation by diminishing the reaction which often ensues upon venesection, as well as by allaying the local sensibility consequent upon the original cause which developed the inflammatory action.

Among the most active of the anodynes is Opium, but as it primarily creates vascular excitement, it is better to defer its use in the treatment of inflammation, and especially in cases unaccompanied by intense pain, until some means have been employed to diminish the heart's action. Hence opium will seldom prove as useful before as it will be after bleeding. From its tendency to check the secretions it is also better to combine some mercurial, antimonial, or diaphoretic article with it. In the form of Dover's powder opium is highly serviceable in the treatment of many forms of inflammation. One grain of Calomel and ten of Dover's powder, given at night, are an excellent combination. In cases of acute inflammation of serous tissues, as in peritonitis, and, indeed, in those

of most of the other tissues, especially when unaccompanied by cerebral congestion, opium is highly useful, when given in one grain doses, and repeated every four hours, until somnolency is induced. In many injuries involving important parts—as the joints—and in bad fractures, a full dose of opium (that is, sufficient to insure sound sleep) will often prevent, or, at any rate, materially check the development of the subsequent inflammation.

c. SEDATIVES.—The class of sedatives embrace very many remedies, as antimonials, ipecac., &c., though as they also produce other results, they may be separately referred to. But the most important sedative, and hence valuable antiphlogistic remedy, is to be found in the Root of the *Aconitum Napellum*. Aconite root, administered in the form of the saturated tincture, not only reduces promptly and certainly the heart's action, but, unlike opium, increases several of the secretions, especially those of the kidney and skin. It is also a powerful anodyne in large doses, though its activity as a poison renders very great caution necessary when it is employed. The strong tincture of the root, usually known as "Fleming's tincture," is a remedy which, since the year 1845, has rapidly risen in professional favor. So powerful are its effects upon the heart and pulse that some practitioners regard it as a valuable substitute for the lancet. In cases of injury or inflammatory action likely to be followed by free suppuration, and especially in those of feeble constitutions, it may be thus employed; but in acute frank inflammations in plethoric habits, it is decidedly better to abstract blood, either locally or by venesection, before resorting to its use. In small doses, often repeated, the use of the tincture will frequently reduce the pulse, and of course the other symptoms of febrile vascular action in the course of a few hours from 110 or 120 to 80. Fleming's tincture of the root may be readily and safely administered—provided the patient is frequently seen—by combining it with a little syrup and water, so as to give a half or one minim, or one or two drops as a dose every hour, *for four or six hours*; the remedy being omitted, or its effects carefully noted, as soon as the pulse diminishes in frequency.¹

Antimony in small nauseating doses, $\frac{1}{8}$ to $\frac{1}{16}$ of a grain, is a power-

¹ A good formula, which I have often employed, is the following:—

R.—Tinct. rad. aconit. napel. (saturand.) ℥viii.

Syr. aurantii cortex f 3ss.

Aquæ font. f 3iss.—Misce.

S.—A teaspoonful every hour, with caution, as directed.

ful sedative, and its action is nearly always accompanied by a free secretory action of the skin, which tends to reduce vascular excitement. It and Ipecacuanha when combined with small doses of opium, so as to prevent vomiting, will often be followed by the happiest effects.

Calomel (Hydrargyrum Chloridum Mite, *U. S. P.*) is also a sedative to the heart's action, destroys the plasticity of the effused lymph, restores the secretions, and is hence much employed in the treatment of many of the surgical examples of inflammation, as in indurations of glands, iritis, &c.

Purgatives, Diuretics, and the whole antiphlogistic class, as recommended in the treatment of medical or internal inflammatory affections, are equally useful in the treatment of those presented to the surgeon; but, as there is nothing to be said of them that is specially applicable to surgical inflammations, their further consideration may be deferred to such cases as demand their use. The importance of attention to diet, &c., is another of those points of sound practice equally employed both by the physician and surgeon, and not requiring to be further alluded to at present.

CHAPTER III.

THE EFFECTS OR PRODUCTS OF INFLAMMATION.

As it has been shown in the preceding chapters, that inflammation modifies the natural preservative action of the affected part, and that it is characterized by an abnormal condition of the local vessels and nerves, it may now be readily understood that this modification of function will generally be followed by a corresponding change in the structures supplied by these vessels and nerves. Such changes do occur, and have been so frequently noted after the development of even a moderate degree of inflammatory action, that they are regarded as more or less constant, and are technically designated as the "Results," "Effects," or "Products" of Inflammation. These products are usually spoken of as the "Effusion of Serum," "Effusion of Lymph," and "Effusion of Pus."

In analyzing the peculiar characters of these different products

two varieties have been described by Mr. Paget,¹ and classified in accordance with their tendency; the first resulting in the formation and organization of tissue in a manner similar to that seen in the process of normal development and nutrition, whilst the second creates a disintegration and destruction of the structure in which it is formed. In the first class Mr. Paget places the effusions of serum and lymph, whilst that of pus constitutes the latter variety. As they present different characters, they require a separate examination.

SECTION I.

OF THE EFFUSION OF SERUM.

Serum, or the element of the blood and product of inflammatory action now alluded to, is generally spoken of as the watery portion of the liquor sanguinis. But, though it is the most liquid portion of the blood, it cannot be regarded as analogous to pure water, as it contains, even in its most normal condition, a considerable amount of albumen, together with some salts, and when exposed to a heat of 165° coagulates firmly. As it is in contact with the fibrin of the blood in the vessels, there is reason to think that in its escape through the vessel into the adjacent areolar tissue, it carries with it some portion of this fibrin, in consequence of which the so-called effusion of serum sometimes creates a thickening and induration of tissue analogous to that which ensues upon the effusion of pure lymph or fibrin.

Whether the effusion of serum into the tissues which are inflamed is due to a simple exhalation of the liquid through the coats of the vessel, in consequence of the congestion of the capillaries and the stagnation of the blood, or whether it is not also aided by the attractive or imbibing power in the cells of the tissue affected, is not as yet perfectly settled, though there are many reasons for supposing that the effusion is due rather to a vital action in the tissue than to the mere mechanical leakage consequent on the obstruction of the circulation in the vessels. Be this as it may, the effusion of serum during the inflammatory process not unfrequently proves beneficial to the patient, as it seems to diminish the amount of fluid in the dis-

¹ Paget's Lectures, Philad. edit., p. 26.

tended vessels, and thus apparently facilitates the onward flow of the blood which had been arrested. It must, however, be admitted that the temporary relief of throbbing, pain, &c., which patients experience on the occurrence of swelling from this effusion, cannot be entirely explained on the simple principle of relief to the mechanical distension, something being also doubtless due to the coincidence of the effusion of serum with such a change in the local inflammatory action as permits the restoration of secretion in the tissues, or the natural action of the adjacent cells.

Sometimes, however, the effusion of serum increases the sense of local fulness, and distends the structure involved, until it becomes a source of danger, as when it occurs into the areolar tissue beneath the skin in cases of anasarca. In this instance, the effusion sometimes creates such a distension as impairs the vitality of the tissue, most of the nutritive bloodvessels of the skin as well as of several other structures passing through the areolar tissue. In treating cases of inflammation of the integuments, accompanied by such an effusion of serum as strongly distends the skin, it will, therefore, sometimes be necessary to make numerous punctures in the latter in order to favor the external flow of the serum and prevent an undue accumulation. When such punctures are deemed requisite, they may be made by rapidly penetrating the skin with the point of a thumb lancet at short distances, and then by the gentle pressure of a bandage forcing the serum from the areolar tissue through the little opening thus made in the integuments.

SECTION II.

OF THE EFFUSION OF LYMPH.

Under the terms, "nutritious juice," "natural balsam," "coagulable lymph," "plastic lymph," &c., surgical writers have from an early period desired to designate a liquid product of inflammation, which was colorless, coagulable, disposed to form flakes, and apparently similar in its appearance to the fluid found in the absorbent or lymphatic vessels of the body. As the term "coagulable lymph" is universally understood, and there is no other suggested of a more explicit character, its use is continued by writers, though the words

fibrin, plasma, or liquor sanguinis, as indicating the same substance, are gradually gaining favor.

Lymph or plasma, when first exuded as a product of inflammation, is generally a pellucid liquid, though sometimes it is of a pink hue, from being tinged with the coloring matter from the red corpuscles, as was stated in connection with the redness of inflammation. The characteristic quality of this lymph is its capability of organization under favorable circumstances, and, when organized, its tendency to form tissues which resemble in structure the tissue in or on which it may have been effused.

In studying the modifications of effused lymph, as a product of inflammation, Mr. Paget¹ classifies them under two general heads: 1. "Fibrinous lymph," or that in which the fibrinous element or fibrin predominates, and 2. "Corpuscular lymph," or that in which the true lymph cell or exudation corpuscle is the chief constituent.

The process by which the lymph-corpuscles are changed into fibrous, fibro-cellular or connected tissue, is said by Schwann, as quoted by Paget, to be as follows:—

First, there is a change by which the nucleus becomes more distinct, then it becomes oval, and one or two nucleoli appear distinctly in it. Soon it attenuates itself until it resembles elongated cells which are bellied out in the middle, then the cell-wall becomes thinner, it elongates at one or both ends, produces caudate or spindle-shaped cells which gradually elongate and attenuate themselves towards the filamentous form (Fig. 13), and these filaments being clustered or fasciculated, the fibro-cellular tissue is formed.

When fibrinous lymph is effused, its tendency towards organization may be promptly noted; a very good example of which is to be found in inflammations of the serous membranes, where, as in pleurisy, the lymph soon takes on the character of a tissue, or assumes a certain tenacity and expansiveness of surface. As thus formed, it is spoken of as "false membrane," and on examination will be found to consist of a tough, elastic, grayish, and semi-transparent substance, of sufficient character to justify its being called a membrane.

In the second or corpuscular form of exuded lymph, no coagulation occurs. It is called corpuscular lymph, from the cells which float through it in greater or less numbers. These cells are the

¹ Paget's Lectures, p. 216, Philad. edit.

Fig. 13.



A view of the Formation of Fibro-Cellular Tissue by changes from the Lymph-Corpuscles.
(After Paget.)

lymph or "exudation corpuscles." They are transparent, hold various contents (Fig. 14), and are not unlike the white corpuscles of the blood.

Fig. 14.



A view of the Corpuscular Lymph Cell is given in the first figure of the row—the progress of this cell in fatty degeneration, and in the distension and absorption of its investing membrane, is shown in the remaining portion of the cut. (After Paget.)

Now, whenever these cells, or lymph corpuscles, have a tendency to organization, plastic, or caudate cells as they are sometimes called being developed from them, the lymph is designated as *Euplastic* lymph, that is, lymph the tendency of which is beneficial. On the contrary, when they tend to degeneration, or when, for example, pus corpuscles are developed from them, the lymph is called *Cacoplastic* lymph; that is, lymph the tendency of which is bad.

The effusion of lymph or plasma plays an important part in the development of normal structure; and as may, therefore, be expected, is all important in the repair of injuries. As a general rule, the larger the proportion of the fibrinous element in lymph, the greater is the probability that it will become organized into healthy structure; and, in the case of a wound, that the latter will present a greater disposition to union by "adhesion." On the other hand, the greater the proportion of corpuscles in the lymph, the greater will be the chances of suppuration, the wound being rather dis-

posed to heal by "granulation," so that if the surgeon takes his microscope, and examines the effusion in any case, he may obtain from the structural characteristics thus revealed, a good idea of the general tendencies of the inflammation, and be able to judge whether there is a probability of adhesion, of suppuration, or of the formation of some unhealthy structure. Wounds uniting by means of fibrinous lymph, or by adhesion, heal much more rapidly than those uniting by means of corpuscular lymph or by granulation.

Passing by the more minute consideration of the characters and properties of lymph, as belonging more properly to a treatise on animal chemistry or physiology, we may now proceed to the consideration of a point which is much more intimately connected with surgical doctrine; to wit, the organization of lymph.

The precise manner in which the organization of lymph takes place has long been a mooted point, and various theoretical explanations have been given from time to time. Of these, it is generally considered that the most correct are those offered by Mr. Paget, who, in his excellent lectures upon nutrition, to which allusion has already been so frequently made, expresses the opinion "that *all* the vessels of the lymph thrown out in inflammation are formed by an outgrowth from adjacent vessels, and that none of them are primarily developed in the lymph itself," as was formerly taught. The manner in which vessels are formed, according to Mr. Paget, is twofold.

First, we have the fusiform enlargement of capillaries, or the "outgrowth" from an old vessel. Second, the "channelling process."

In the fusiform enlargement of the capillaries the process is as follows: In a capillary vessel running in an arched shape in contact with an effusion of lymph, two points become expanded (Fig. 15), which gradually extend until they meet. Then the septum being absorbed, a perfect arched tube is formed, and the blood passes off from the main channel through the new vessel thus formed. Now, if this process is continued a little further, we will have two new projections from another point of a vessel, which also inclose a certain space; and if this goes a little further the two projections will meet, as before, under a vital action; various capillaries will be formed, and a full circulation established in parts where but a short time previously there was only a shapeless unor-

ganized blastema. In this blastema bloodvessels were formerly supposed to be formed by the projection of blood-disks into it from the open ends of the vessels, the course of each disk forming the cavity of a new vessel.

Fig. 15.



A diagram of the "Fusiform Enlargement." (After Paget.)

The channelling process, as recently explained by Mr. Paget, differs somewhat from this. The vessel, according to him, first forms a teat or fusiform enlargement upon its side, instead of continuing to elongate itself as in the case just described, when by bursting its coats the blood-disks are thrown out into the surrounding blastema, as in the drawing (Fig. 16). They then progress in divers direc-

Fig. 16.



A diagram illustrative of the "Channelling Process." (After Paget.)

tions; the channels become coated at the sides, and the formation of bloodvessels takes place around them, as in the development of normal structure.

Of these two explanations of the formation of new bloodvessels and the organization of lymph, the first, or that of fusiform enlargement, appears to be the most natural, and most in accordance with the usual observations of vital action, whilst that of the channelling

of vessels, even as explained by Mr. Paget, is too mechanical. The latter has, however, had its supporters, and various ingenious experiments have been tried to show how vessels could thus be formed in an organizing effusion of lymph. Thus, Sir Anthony Carlisle endeavored to prove that the latter mode of formation of bloodvessels could be effected by a method analogous to that of chemical action, by taking a mass of moistened pulverized chalk, and dropping upon it a drop of an essential oil, when he found that the latter worked about in various directions, so as to form little furrows or gutters in the chalk. From this experiment he deduced the doctrine, that in like manner the extravasated blood-disks found their way among the formative cells of the blastema into which they escaped, the bloodvessels being thus channelled out by the course of the corpuscles. But a moment's reflection will enable any one to perceive that this experiment proved nothing in respect to a vital action. Blood-disks are in no manner represented by a drop of essential oil, nor does an organizing blastema present any points in common with powdered chalk, and it will doubtless be admitted that there is no reason to suppose that a blood-disk is endued with any such vital property as enables it to know where it ought to go, and where it ought not.

Whatever theoretical explanation may however be adopted as to the manner in which the vessels grow, the new ones as first formed are certainly extremely delicate, and therefore, very easily ruptured, either by congestion during life or by injection after death.

§ 1.—OF ADHESION AND THE ORGANIZATION OF LYMPH.

When lymph is effused for the purpose of closing a solution of continuity, such as wounds, &c., one of the processes under which it becomes organized, and the first to which attention is asked is that designated as Adhesion.

The lymph which is effused by inflammatory action for the purpose of producing adhesion, may be studied as existing successively under three different conditions. The first is that of unorganized plasma; the second, that in which it has become organized and vascular; whilst, in the third, the new structure is seen taking on more or less of the specific characters of the tissue it has united or reproduced. In the first stage, or that of unorganized plasma, all

the appearances and microscopic characters are to be noted, which have been already explained in connection with the characters of fibrinous lymph. In the second stage bloodvessels gradually form after the method which has also been described; and, in the third, we find the plasma taking on the specific characters of the tissue or structure which it has replaced, apparently in consequence of the formative power of the cells of each tissue. These general observations apply to all lymph thrown out for the repair of solutions of continuity, whether external or internal, but it should be especially remembered in regard to the third stage, that though the organized lymph takes on *more or less* of the characters of the tissues united or reproduced, it seldom or never becomes exactly similar to them, it being generally easy to perceive a difference even with the naked eye; thus, when the skin has been divided, and again united by a cicatrix, the new structure, though answering the purposes of normal skin, and even mistaken for it at a little distance, will yet show, on a closer examination, that it is different from the original tissue in its intimate structure. The same is equally true, both in muscle and in bone, the new structure, although possessing sufficiently the characteristic properties of either to answer the purposes for which it is intended, will yet be found, upon a close examination, to differ more or less from the healthy structure. And the same thing will be seen in the tendons, or any other tissue which may be examined after its union by adhesion.

It is difficult, in view of the constant necessity for the establishment of the adhesive process, to over-estimate its importance in the practice of surgery, the whole class of Plastic or Taliacotian operations—as they have been called, from the name of the surgeon who first brought them into repute—depending for their success entirely upon this process, whilst its importance in the healing of wounds will be apparent when the latter subject comes under consideration. It may, however, be useful to state in this place, that when lymph is effused for the repair of wounds, it closes them in three different modes.

1. By means of what has been termed “Union by the first intention,” or the simple agglutination of the edges of the wound by the effused lymph, little or no inflammatory action being developed; an instance of which is seen in the healing of the little puncture made in venesection, and which, if accurately closed with a small piece of adhesive plaster, unites so promptly that examination the next

day will show the edges united without any redness having been produced; the lips of the wound having been simply but thoroughly agglutinated.

But when a moderate inflammatory action is developed, and plastic lymph is thrown out, then we have, 2. "Union by adhesive inflammation."

If, however, the inflammation goes a step further, we have, 3. Union by granulation, or the "Union by the second intention" of the old authors; certain characteristic bodies, called granulations, being formed, to facilitate the process of repair.

As these points will be again referred to more particularly under the head of wounds; we may now pass to the consideration of the subject of granulation, as created during the organization of lymph.

§ 2.—OF THE FORMATION OF GRANULATIONS FROM LYMPH.

By the term *Granulations* is designated small organized, very vascular, conical masses of lymph, arranged side by side, of an arterial red color, sensitive, and bleeding when rudely handled. In their

Fig. 17.



SKETCH OF THE ARRANGEMENT OF BLOODVESSELS IN GRANULATIONS.—Near the surface the vessels communicate much more frequently, and form terminal loops. (After Paget.)

production we have three stages: First, plastic lymph is effused. Secondly, cells are developed in it, which cover over the surface,

and are heaped up from half a line to a line or more in thickness. Thirdly, bloodvessels enter, and around these are found deep-seated cells, which are gradually organized into the tissue to be replaced.

The vascular organization of granulations is described by Mr. Paget, to take place as follows: A loop-like capillary vessel entering into the lymph of which the granulation is formed—and the shape of which is, perhaps, due to the elevation caused by the fusiform enlargement of this vessel—creates immediately around it other vessels and granulation cells by which the granulation itself is formed, these cells being much better developed towards the bottom than towards the surface, as a general rule. On the surface of a granulating sore there may be nothing but simple lymph or exudation corpuscles; while at the bottom a tissue, similar to that to be reproduced, is often fully formed already.

Characters of Granulations.—A healthy granulation presents the following marked characters. It is florid, smooth, moist, shining, and does not bleed readily; although of course rough handling may cause an effusion of blood. Healthy granulations seldom rise above the level of the skin, but having reached that point they coalesce laterally, and form a cicatrix, in the manner that will be presently described.

Unhealthy granulations, on the other hand, are pale, flabby, and devoid of the bright florid color of healthy granulations, showing a deficiency in the activity of the circulation. They are of a deep-red color, and may be at once distinguished from the other class, by their bleeding upon the slightest touch, and having a tendency to become luxuriant in their growth.

When granulations thus become exuberant in their development, they constitute what is vulgarly known under the designation of "proud flesh"—a condition of things which is much feared by patients—who frequently apply to the surgeon with a great deal of anxiety, to know whether the little wound upon their finger or elsewhere has about it any proud flesh. Experience, however, shows that these exuberant granulations are generally harmless in their characters, and only tend to retard the process of cicatrization, being easily removed by means of a little nitrate of silver, burnt alum, or similar mild escharotics.

Treatment of Effusion of Lymph.—The local and constitutional

treatment of the effusions of lymph, resolves itself into the employment of such means as are likely to prove effective in preserving the proper degree of vascularity in the part. If the lymph is not sufficiently vascular, if the action of the part is sluggish, and the circulation languid, as is shown by the granulations being pale and flabby, resort must be had to stimulation; but if the grade of the inflammation is too high, the circulation too rapid, the pulse bounding, and the vascular action of the part exaggerated, there is danger that the lymph, which has been effused, instead of becoming organized, may degenerate and result in the formation of pus. In this case antiphlogistic means, to reduce the general and local circulation to the proper standard, will be demanded.

§ 3.—CICATRIZATION AS THE RESULT OF THE EFFUSION OF LYMPH.

When granulations reach the surface of the skin, a process takes place by which we have the formation of a "Cicatrix," or the "Scar" of common language. This process of cicatrization follows when the granulations which have reached the surface of the sore tend to the formation of epidermic cells. The entire cicatrix, or new tissue, which is thus formed, is also known under the name of "Inodular Tissue." In studying its characters, the following peculiarity should be noticed: when first formed, a cicatrix, exhibits an unnatural degree of vascularity, and is redder than the surrounding skin; but in time it gradually contracts, its vessels are emptied and shrivelled, and it finally becomes paler than the original tissue of the skin. Any one who has cut his fingers must have noticed this fact; at first, the scar was redder than the rest of the hand, and a little more elevated; but, as it gradually contracted, it grew narrower, more depressed than the neighboring parts, and at last became so much paler than the normal skin as to attract notice by its whiteness.

The further consideration of cicatrization, like that of union by granulation, will be again alluded to under the head of wounds.

When corpuscular lymph has a tendency to degenerate, and pus cells are formed, we have that process which is known under the name of suppuration or effusion of pus, which is the third product resulting from inflammatory action.

SECTION III.

OF THE EFFUSION OF PUS.

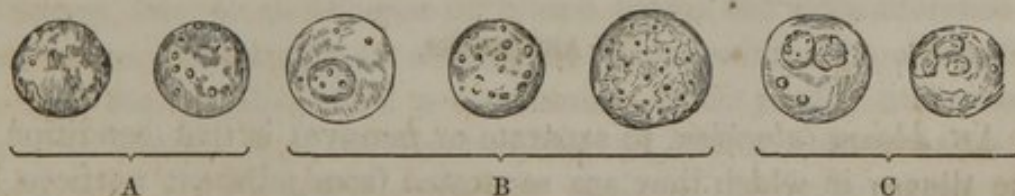
Pus is a yellowish, cream-like fluid, neither acid, alkaline, nor corrosive; ordinarily without taste or smell, and mild and unirritating when it comes in contact with healthy structures. It consists of serum, which has floating in it the pus corpuscles, presently to be described.

Pus, as it has just been represented, is highly useful to a sore, and acts by protecting the new-formed granulations from the influence of the atmospheric air. An ignorant or inexperienced dresser is sometimes seen to wash it entirely away from the surface of the sore, so as to leave the new granulations naked and bleeding; but this is altogether wrong. In a sinus where the pus lays from day to day, in danger of putrefying and becoming offensive, it may be well enough to wash it out; and it is also well enough to remove pus from sound flesh and from around the edges of a sore; but the young dresser should always remember that healthy pus is the mildest application a sore can possibly have.

When pus becomes thin and greenish in its appearance, it takes the name of "Ichor." When thin and bloody it is known as "Sanies," and then is often found to contain little shreds of the disintegrated tissues. When the pus becomes dried and dust collects in it, it is spoken of as "Sordes."

When healthy pus is examined under the microscope it presents

Fig. 18.

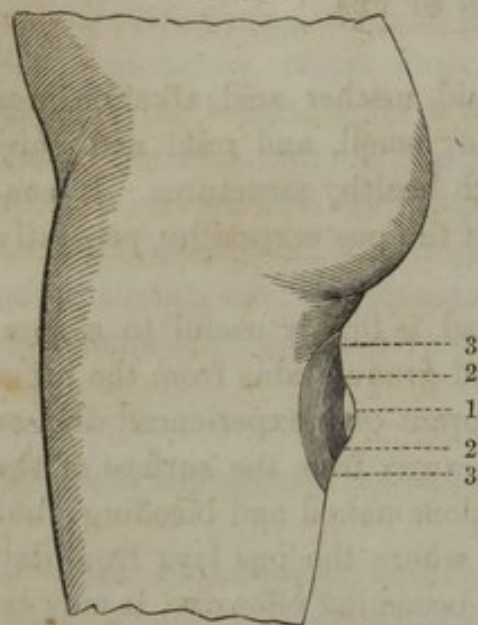


A VIEW OF PUS CELLS IN THEIR ORDINARY STATE.—Those at A are spherical. Those at B are swollen, and their contents diffused by the addition of water. Those at C present two, three, or four small bodies like nuclei, after the addition of dilute acetic acid. (After Paget.)

us with the pus cells or corpuscles, which have been already mentioned. They are represented in the drawing (Fig. 18), and are opaque, yellowish cells, consisting of a cell-membrane containing

nuclei, oil globules, and granules of a smaller size. The size of the pus globules is so great that it is impossible for them to pass

Fig. 19.



A DIAGRAM SHOWING THE DIMINUTION OF INFLAMMATION AFTER THE ESTABLISHMENT OF SUPPURATION.—
1. Pus. 2, 2. The darker red color of acute inflammation. 3, 3. The tint intermediate to this, and the healthy color.

through the coats of the blood-vessels—an important fact, as will be perceived hereafter, in connection with the subject of cold abscesses.

The pus corpuscle, when moistened, swells up; and when acted upon by acetic acid becomes transparent, and exhibits several nuclei (see Fig. 18).

With regard to the local symptoms of suppuration, they are at first those simply of inflammation, as redness, heat, swelling, and pain; but when the pus is formed these symptoms generally moderate, the acute red immediately around the central spot or that of suppuration shading off into the pink color of healthy structure, as in Fig. 19.

When pus is formed and cannot escape, we have what is called an abscess, fluctuation being added to the other symptoms.

CHAPTER IV.

ABSCESSSES.

AN *Abscess* (*abscidere*, to separate or remove) is that condition of the tissues in which they are separated from adjacent portions by pus, which either forms within or flows into them from some other source. A more limited description defines an abscess simply “as a circumscribed effusion of pus;” whilst the more ancient writers describe it as “a tumor containing pus.” The fact of pus being collected in a circumscribed space may, it is apparent under all these definitions, create that condition which is properly designated as an abscess.

Though abscesses are produced under various circumstances, only two varieties are generally noted; the one which is the product of an active inflammation being called an *acute* or *warm abscess*; the other, which is the result of chronic inflammation, and unaccompanied by heat, throbbing, &c., being designated as a *cold* or *chronic abscess*.

Whether acute or chronic, all abscesses have one common characteristic, to wit, the limitation of the space into which the pus is effused. In the acute variety, these limits, or "walls," are formed by an effusion of lymph which merely infiltrates the surrounding areolar tissue; but, in the chronic form, there is more or less organization of the lymph and a kind of false membrane created, which, from its being once supposed to be a pus producing structure, has been called the "pyogenic membrane."

In consequence of the limitation by this lymph of the cavity of an abscess, the contents extend themselves with some difficulty, as such an extension must first be preceded by the disintegration of its walls, and in consequence of this neighboring parts are protected, in many instances, from the injurious action of accumulations of pus.

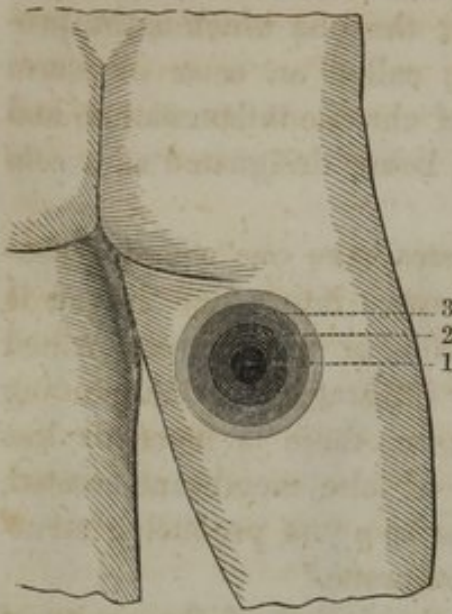
SECTION I.

OF THE ACUTE ABSCESS.

In studying the progress of an acute abscess, it is easy to recognize the fact that it is the result of active inflammatory action; and that the three products or effects of inflammation are present in it; thus the swelling of the tissues will at first be due to an effusion of serum, then to an effusion of lymph within the circumference of this serum; and lastly, to an effusion of pus within the circumference of the lymph. Such a condition may be readily understood from an inspection of the diagram, Fig. 20, which also serves to explain why an abscess "points" or becomes fullest at some one point, which point is usually the centre or focus of the inflammatory action.

According to the more recent views of physiologists, and especially in accordance with the opinions entertained by Mr. Paget, the formation of an abscess, like the formation of pus in superficial suppurations, may be thus explained. The first product of the

Fig. 20.



A DIAGRAM ILLUSTRATIVE OF THE CONDITION OF THE TISSUES IMMEDIATELY AROUND THE FOCUS OF INFLAMMATION WHEN ABOUT TO END IN AN ABSCESS.—1. The focus containing pus. 2. The effusion of lymph, which limits the extension of the pus. 3. The effusion of serum outside the lymph shading off into healthy structure, and indicating the lowest grade of active inflammation.

inflammatory action is serum, which is generally more or less blended with lymph; then we have pure lymph effused, which tends to organization on the side which is most remote from the focus of inflammation. In this organization there is a tendency to a free vascular supply of the lymph on its outer margin, and hence the disposition to thickening, hardening and adhesion of the tissues in which it is effused, as well as the creation of that structure which forms the walls of the abscess, and indicates the efforts of nature to circumscribe the purulent effusion. But, whilst this organizable material is being formed by the cells on the extreme margin of the lymph, those nearest the focus of the inflammation are degenerating or losing their organizable character, and hence are changed from lymph or exudation corpuscles into the lower grade of pus globules.

Fig. 21.



AN IMAGINARY SECTION OF A SUBCUTANEOUS ABSCESS, AS CREATED FROM THE HARD, CIRCUMSCRIBED MASS OF LYMPH EFFUSED AS THE PRODUCT OF INFLAMMATION.—The central portion represents the cavity of the abscess. The periphery shows the abundance of the bloodvessels around it, or the inflamed tissue, where may be noted the granulation cells, which form the proper walls of the abscess, the layer next to the cavity furnishing the pus corpuscle as it degenerates. (After Paget.)

As the accumulation of the pus globules thus formed creates a distension of the cavity in which they are collected, the super-imposed tissues are placed upon the stretch, and the point of greatest distension is that at which the pus tends to discharge itself. The result of the distension is a greater prominence on the exterior of the abscess (as seen in the top of Fig. 21), so that when this distension has reached its limit, such a change takes place in the integuments at the point most distended as results in ulceration. Through this ulcerated opening the contents of the abscess are discharged, when it is evacuated solely by the efforts of nature.

Symptoms.—The symptoms of an acute abscess may be readily understood from the preceding brief account of its progress. When inflammatory action is about to result in an abscess, the part becomes redder, hotter, and more painful and swollen than it was before; then, as the pus forms, the constitutional symptoms become more marked, the formation of the pus, or the establishment of suppuration, being often indicated by a chill or rigor, and by more or less marked development of the ordinary constitutional symptoms of inflammation. As the pus collects, the local signs of the presence of a liquid become apparent, and fluctuation may be recognized by the use of the means described under the sense of touch, page 39.

Diagnosis.—The presence of fluctuation being once established, and the evidences of inflammation noted, the diagnosis of an acute abscess is readily made.

Prognosis.—The natural tendency of every acute abscess is to evacuate itself on the side on which the tissues yield most readily, or, in other words, are most extensible and disposed to ulceration. Hence acute abscesses nearly always discharge themselves through the skin, nature subsequently accomplishing the cure by healing the cavity through the medium of granulation and cicatrization. The prognosis of an acute abscess is, therefore, chiefly dependent on two conditions; first, its position—that is, whether superficial or deep seated; and second, its extent. Abscesses of the superficial tissues, as of the integuments, are more favorable in their tendency—that is, will heal more rapidly—than those situated in glands, bones, and similar structures, whilst small abscesses are more likely to heal than large ones; the latter creating the necessity for a greater amount of reparative material. Abscesses in the neighborhood of

important parts, as the bloodvessels, trachea, pharynx, &c., are also more dangerous than those seated elsewhere.

Treatment of Acute Abscess.—The treatment of an acute abscess consists in the fulfilment of four indications.

The first is to remove the general and local cause of inflammation.

The second, to encourage the relaxation of the superimposed tissues, and favor the approach of the pus to the surface of the body.

The third, to evacuate the pus so promptly as to prevent its travelling or involving other parts than those at first affected.

The fourth is to promote the contraction of the sides of the cavity, and aid the efforts of nature to fill it up.

The first indication may be fulfilled by the removal of the cause of the local inflammation, and hence is somewhat varied in its character. If the inflammatory action has been created by the entrance of a foreign body, as a splinter, ball, &c., it may, if superficial, require a division by the knife of the structures in which it is buried; after which such means must be employed as have been already stated under the general and local treatment of inflammation. But if the mechanical removal of the cause cannot be accomplished, then the means now to be recommended for the fulfilment of the second indication must be resorted to.

As a general rule, relaxation of tissue, and the tendency of an abscess to point externally, may be aided by the continued application of heat and moisture. The neatest method of doing this is by the warm water dressing—that is, by placing a piece of spongio-

Fig. 22.



VIEW OF A PIECE OF SPONGIO-PILEINE.—The upper surface is formed by the sponge and lint felted together. The black under surface, the edge of which is turned up, is the outer layer of caoutchouc. (After Nature.)

pileine saturated with warm water, upon the part, and renewing the application every four or six hours; or if the spongio-pileine cannot be had, a piece of patent lint or flannel, wet with hot water, and then covered with a piece of oiled silk, may be substituted.

Formerly surgeons were accustomed to apply heat and moisture by means of the poultice, as made of flaxseed meal; cornmeal; boiled carrots; boiled and mashed potatoes; starch; bread and milk with a little lard; chamomile flowers soaked in hot water, &c. &c., some of which are especial favorites in domestic practice at the present

time; but all these articles possess little virtue, except as the receptacles of heat and moisture.

If circumstances render any of them specially desirable, either from the facility with which they can be obtained, or from their possessing a peculiar adaptation to the patient's feelings and thus creating a soothing mental condition, they should be prepared as follows: Mix the substance that is selected with hot water, and make it of the consistence of mush; then spread it upon a piece of muslin, of the proper size and shape to cover the part, spreading it thick enough, say from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch, to prevent its desiccation. Then placing over its surface a piece of bobbinet or thin gauze, also moistened in warm water, fold the edges of the cloth and gauze so as to form a border (Fig. 23), and thus prevent the escape of the poultice upon the part, as well as prevent the drying that would soon be established from the thinness of its edge. In order to insure the continued moisture of all poultices, it is also useful to cover them on the outer side, when applied to the part, with a piece of oiled silk.

In connection with these means of treating an acute abscess, it should be remembered that whilst heat and moisture favor the relaxation of tissue and the tendency of the pus towards the surface, *dry heat* stimulates the local circulation, augments inflammatory action, and tends to induce a contraction or thickening of tissue rather than its relaxation.

The third indication, or the speedy evacuation of an acute abscess, may be effected in one of three methods.

I. By a simple incision with the abscess lancet or bistoury. II. By caustic, whether nitrate of silver or caustic potash. III. By means of a seton or foreign substance introduced into the cavity of the abscess.

The choice of either of these means will depend very much upon

Fig. 23.



REPRESENTATION OF THE POULTICE AS SPREAD AND COVERED WITH THE GAUZE TO PREVENT ITS ADHERING TO THE SKIN. The upper and lower ends have been folded so as to prevent the escape of the substance of the poultice, but the sides have been left unfolded in order to show the relative size of the substance of the poultice to the sides of the cloth on which it is spread and the manner in which the gauze retains the substance of the poultice. If a poultice is to be used at all it should be carefully prepared and spread as represented in the cut. (After Nature.)

circumstances, though usually the last two are more applicable to the chronic than to the acute variety of abscesses.

As a general rule, the evacuation of the pus by a simple puncture is to be preferred in the treatment of an acute abscess, on account of the greater rapidity with which the wound heals; but there are cases in which its evacuation by this means would be improper, as in abscesses where the division of the parietes might involve important bloodvessels. Commonly, however, there is no danger of dividing vessels of importance in opening abscesses if proper caution is exercised. Few practical errors are more frequent than those due to the timidity of young practitioners in this method of treating abscesses. Take for instance the suppurations beneath the palmar fascia, where the young surgeon, recollecting the normal position of the palmar arch, is afraid to incise the parts, lest he should wound these vessels; or the case of bubo, where the position of the femoral vessels not unfrequently causes hesitation in the use of the knife. In these cases it should always be remembered that, as a general rule, there is but little danger of wounding vessels in evacuating the contents of an abscess, unless one proceeds with great recklessness and utter disregard of the anatomical relations of the part, plunging the knife completely *through* the abscess, and penetrating its interior wall, instead of simply puncturing its external surface; for, when an abscess forms directly over an artery or vein, the skin will generally be so elevated by the distension that ensues, that the distance between the surface and the vessel will be greatly increased.

In opening an abscess by puncture, or by a simple incision, a bistoury, abscess lancet, or any similar instrument may be used. In evacuating its contents with either of these instruments, hold it like a pen between the finger and thumb, while with the left hand the skin at the point of incision is made quite tense; then plunge the instrument only deep enough to pass through the skin into the cavity of the abscess by a forward and inward motion, and an opening sufficiently large to allow a free exit for the pus will be safely made. The subsequent flow of the contents of the abscess may be then left to nature, or its progress aided by gentle pressure and the subsequent application of heat and moisture.

The *constitutional treatment* of an acute abscess will, of course, vary with the stage. Before pus is fully formed, antiphlogistic measures may be necessary, in order to diminish the amount of the

inflammatory action; but where—after an abscess has been opened—there is a considerable flow of pus, or one which threatens to exhaust the patient's strength, the constitutional treatment resolves itself into such means as will support the general powers of the system, as full diet, chalybeates, tonics, &c., as will be explained more fully under the head of *Hectic Fever*.

SECTION II.

COLD ABSCESSSES.

The *Chronic* or *Cold Abscess* chiefly resembles the acute variety in the fact that it is a collection of pus in a circumscribed cavity, the grade of inflammation being here frequently so slight that the disorder may pass unrecognized for a long time. Abscesses of this class are generally due to low or chronic inflammations of the cellular tissues, or to some internal disorder, and especially to diseases of the bones, or the softening of tubercular deposits in the glands, &c. When, then, a cold abscess is seen, which the patient asserts is consequent upon a fall, blow, or other external violence, we should distrust the account, and regard the blow or fall merely as the event which first attracted the patient's attention to the complaint. When a cold abscess supervenes upon a blow its effects may be generally noted in the discoloration of the skin produced by the ecchymosis which followed it.

Cold abscesses may occur in any portion of the body, but are most frequently found in the neighborhood of the neck, axilla, buttocks, &c. Those due to diseases of the bones, and known as Lumbar or Psoas abscess, being generally caused by disease of the vertebral column, will be described hereafter, in connection with the latter subject.

SYMPTOMS.—The symptoms of a chronic or cold abscess are at first a moderate amount of vascular congestion, followed by a dull, heavy pain, in the parts affected; then, but often not before the lapse of many months, a tumor of varied size shows itself, which is hard and immovable, with a broad base, and without heat or redness. As it augments in size, the tissues covering it become thinner and softer, but do not become as red in color or as vascular as the skin over an acute abscess. As it gradually progresses

towards pointing the progress of the complaint is analogous to that described in the acute form, though generally very slow, the abscess remaining many weeks, or even months, unchanged. When a cold abscess is evacuated a marked difference will also be noticed between its pus and that which escaped from the acute variety. The pus of a cold abscess is usually imperfectly formed, is greenish, thin, and watery; ichorous in character, and frequently possessed of a strong, disagreeable odor. It also contains flocculi, which consist of portions of the disintegrated tissue, whilst that of the acute variety is usually thick "true laudable pus."

The walls of a cold abscess are also very different from those of the acute form, being indisposed to unite after the pus has been evacuated, in consequence of the absence of proper inflammatory action. These walls are also much thicker and lined by a false membrane, which, as has been before stated, is designated as a Pyogenic membrane; a name, however, not strictly applicable to it, because it is not capable of secreting pus, but is merely a kind of cyst, formed by the condensation of the surrounding cellular tissue, and covered over by a dead layer of granulation cells or corpuscles; the pus being formed by the degeneration of the effused lymph, which forms upon the surface of the cyst or of the so called membranes.

TREATMENT.—When, as is often the case, the amount of pus in a cold abscess is large, it may, if its contents are evacuated at once, give rise to a set of symptoms of a typhoid character. A cold abscess should not, therefore, be entirely emptied at any one period, but should be discharged carefully and by degrees, the possibility of the entrance of atmospheric air into its cavity being well guarded against. As the action of the atmosphere in the cavity of a cold abscess is often most dangerous to life, it requires special consideration.

OF THE ENTRANCE OF AIR INTO A COLD ABSCESS.—When air finds an entrance into the cavity of a cold abscess, a change is sometimes perceived in the odor given off by its pus; the latter becoming extremely offensive. It will also be noticed that it becomes acrid and irritating, whilst a train of constitutional symptoms may be observed similar to those produced by a poisoning of the blood in pyemia, dissecting wounds, &c. The peculiar action of the air upon the abscess is due to a chemical change, by which a hydro-sulphate of ammonia is formed. This substance being once ab-

sorbed into the general circulation, lowers the vital powers, prevents the coagulability of the blood, and produces a condition of things much resembling that seen in typhus fever. The hydrosulphate of ammonia here formed has been proved to be present in the circulation by various tests; thus it has been found in the blood itself, as well as in the various secretions of the body, and especially in that from the kidneys, salivary glands, &c.

The efforts of nature to overcome the depression consequent on this state of affairs produces a condition of the patient's system which is known under the name of *Hectic fever*, and will be the subject of a special chapter.

TREATMENT.—In considering the treatment of cold abscesses it must be noted that they require both local and constitutional measures.

THE LOCAL TREATMENT differs from that which would be proper in a case of acute abscess, and especially in the fact that their puncture and the evacuation of the pus should be delayed as long as possible, cold abscesses often continuing for months without making any progress; but when it becomes necessary to evacuate their contents—as when the extreme distension and tenuity of the skin shows that by longer delay the abscess will open itself by the natural process of ulceration through its parietes—it is generally better to anticipate the event by means of an operation. When the pus has been removed by any of the means hereafter detailed, the surgeon should at once press the sides of the cavity together, so as to bring its walls in contact, apply compresses and bandages to support them in this position, and then carry out a general invigorating plan of treatment.

When the evacuation of the contents of a cold abscess is decided on, various means may be employed in order to accomplish it. An excellent method consists in making a valvular opening through the skin with a bistoury, by pushing the instrument horizontally some little distance under the skin before entering the parietes of the abscess. By this plan its walls can be readily opened at a point remote from the orifice, in consequence of which the pus will escape through the skin, after being compelled to travel gradually along the canal thus formed without there being any probability of the admission of air. When as much of the pus is evacuated as is deemed desirable for the first period, pressure upon the course

of the canal will prevent the entrance of air until the opening in the integuments can be closed by adhesive plaster.

Another very good plan of evacuating the contents of a cold abscess is that of Bonet, of Lyons. It consists in placing the limb, or the patient, if necessary, in a bath of tepid water, making a valvular opening, as just stated, and then forcing out the pus so as to allow it to mingle with the water. Of course, under these circumstances, the entrance of air is impossible, the entrance of the water into the cavity of the abscess being prevented by the outward flow of the pus. In a very large abscess, one-third or one-half its contents may be evacuated at a time, and this is usually sufficient; the opening and the walls of the cyst being subsequently supported by a compress and bandage.

The modification of Schuh's instrument for Paracentesis Thoracis, suggested¹ by Dr. Metcalf, of New York, or the suction pump and exploring canula recommended² for the same operation by Dr. Wyman, of Cambridge, might also be advantageously employed for the evacuation of large cold abscesses without permitting the entrance of air.

Should the air enter the cavity of the abscess in spite of these precautions, and the consequent typhoid symptoms be developed, the abscess should at once be freely laid open, so as to permit the pus to have an easy exit; after which its cavity should be thoroughly washed out by injecting some solution calculated to neutralize the putrefactive process, which would otherwise ensue. A very good wash for this purpose may be made by adding one ounce of *Liq. Sodæ Chlorinat.* to six fluidounces of water. This may be used three times a day or oftener, a proper invigorating constitutional treatment being persevered in at the same time. Neither of these modes of evacuating cold abscesses should, however, be employed until it is evident that the abscess will rupture and evacuate itself if let alone, as it often happens that these cases do very well and disappear by the efforts of nature when unevacuated; provided the strength of the patient is properly supported, and no active local measures adopted.

Besides the methods just described, the contents of a cold abscess

¹ New York Medical Times, vol. ii. p. 377.

² Transact. Am. Med. Assoc., vol. iv. p. 245. Also, Smith's Operative Surgery, vol. ii. p. 58.

may be evacuated by means of *Caustic*—a plan of treatment which has been recommended for the evacuation of cavities containing serum, as hydrocele, &c., as well as for cavities containing pus. In employing caustic for the evacuation of cold abscesses, the nitrate of silver or caustic potash should be rubbed upon the spot where the opening is desired to be made. If nitrate of silver is used it must be moistened, but caustic potash being deliquescent, does not require any more moisture than it can obtain from the air, or from the tissues with which it is brought in contact. Caustic potash, when thus applied, forms a sort of soap with the disintegrated tissue, and creates a slough which soon separates by the powers of nature, and leaves an aperture in the integuments through which the pus is readily evacuated.

Nor are instances wanting in which the *Seton* also has advantages, as in those where the evacuation of the pus is intended to be slowly accomplished. In order to employ it in such cases a few strands of silk should be placed in a sail-maker's needle, and passed through the cavity of the abscess, or in a probe, after the abscess has been transfixed by a sharp-pointed bistoury; when the probe should be passed and the silk permitted to remain. The capillary action thus established through the strands of silk will gradually empty the abscess of its contents, while the presence of the foreign body in its cavity will excite a sufficient degree of inflammation to promote the union of the two surfaces when their contact is permitted by the evacuation of the pus. The needle or bistoury which punctures the walls of the abscess should always be passed from above downwards, and this precaution should be strictly observed, because if first introduced at the lowest point, the pus will escape before the entrance of the seton is completed, and the walls of the cavity be rendered flaccid.

It cannot, however, be too strongly impressed upon the mind of an inexperienced surgeon that hectic fever, or the typhoid condition just alluded to, does not often show itself until the pus of a cold abscess is discharged through the skin; and that the greater the delay in the evacuation of such abscesses, the better for the patient.

CHAPTER V.

HECTIC FEVER AND PYEMIA.

SECTION I.

OF HECTIC FEVER.

IN the remarks upon the constitutional symptoms of inflammation, it was stated that, after the development of a certain amount of local inflammatory action, with its accompanying functional disorder of the local nerves and bloodvessels, an impression was produced upon the brain, and thence transmitted to the circulation, which resulted in a rigor, fever, and sweat, with the other evidences of that condition of the system which was designated as inflammatory, symptomatic, or sympathetic fever (see page 54). This fever, as there stated, lasted for a period which varied from twenty-four hours to several days, and then passed off with certain changes in both the local and general symptoms.

In cases of inflammation, which result in a free secretion of pus, especially if this secretion is long continued, or in cases of injury in debilitated constitutions, where the powers of the system are not equal to the reparative effort demanded of them, a somewhat similar train of febrile symptoms is developed, differing, however, from that termed Inflammatory Fever, in the fact of its being more permanent; that it presents decided periods of remission; that the paroxysm returns at intervals of greater or less regularity, and that it is accompanied by great exhaustion and emaciation.

This febrile condition has been designated as "Hectic Fever," either from the exhaustion which it induces (*εστρηω*, to exhaust), or from its long duration (*εστεινος*, habitual), rendering it apparently habitual with the patient.

Hectic fever presents, in most instances, decided evidences of its

belonging to the remittent type of fevers, a distinct exacerbation being evident towards night, or immediately after meals.

The commencement of hectic fever is so insidious that it is liable to be overlooked, and hence it is that the experienced surgeon so constantly advises the younger members of the profession to "watch carefully the commencement of hectic," for, if it is not observed, it will take a firm hold upon the system, and, unless broken up, will terminate in death.

SYMPTOMS.—The symptoms of hectic are as follows: After the continuance of a free drain upon the system for a few days, or perhaps longer, the patient complains of a slight chilliness, which is often *so slight* as to pass unnoticed. This is followed generally, as in other cases of fever, by a reaction, which results in a greater or less degree of febrile excitement; the pulse becoming merely a little quickened; the next day it may be still more so, and then the day after be yet more accelerated, and count 130. The skin now becomes hot and dry, especially in the palms of the hands and the soles of the feet, whilst at the same time the whole face becomes flushed, or "the cheeks alone present a moderate circumscribed flush, pleasing to look at," but indicative of serious disorder in the system.

After this febrile state has lasted for one or more hours, the patient awakes from an uneasy sleep, in the middle of the night, or towards four o'clock in the morning, and finds himself bathed in a profuse perspiration, which, from its recurrence and the debility which it induces, is designated as "colliquative" (*colliquescere*, to liquefy). Under this perspiration the skin now becomes sodden, has a clammy, sticky feel, and is unpleasant to the touch; so much so that after touching it the surgeon feels immediately disposed to wipe his hands. As the disease progresses, the fever and sweat come on earlier in the day, the latter becomes more and more profuse, and diarrhoea also of a colliquative character often supervenes, the patient seeming to melt away in his own secretions.

In the early stages of Hectic fever, the remission is often tolerably distinct; but by and by it becomes less marked, and a certain degree of febrile action with an irritable, accelerated pulse and hot burning skin, is kept up throughout the whole day. Under these circumstances the *pulse* does not continue hard, tense, and full, as it is in inflammatory fever, but becomes quick and frequent, counting often from 110 to 150 beats per minute.

In connection with this condition, it may be well to mention to the young student the difference between the states indicated by these two terms, *frequent* and *quick*, as applied to the pulse, whether in surgical or medical disorders, as a pulse may be quick yet not frequent, or may even be both quick and slow, which is to be thus explained: In a quick pulse the impression made upon the finger is very sudden and of short duration; after which there may be quite a pause before the next beat is felt, whilst in the frequent pulse the artery makes many more beats in a minute, though its impression is less rapid, the interval between each beat being very slight. A pulse that is quick and slow is one beating 60 in a minute, but in which the *impression* is momentary, and the *interval* between the two beats quite marked.

The appetite in hectic is sometimes inordinate, sometimes unnatural, and sometimes after having been inordinate returns to a natural condition. The thirst is generally considerable, but usually not so great as it is in inflammatory fever. The tongue, which in the early stages is often natural or slightly furred, is sometimes disposed towards the last, to become dry and covered with an aphthous ulceration. The condition of the bowels may at first be natural; but generally, after the disease has continued for some time, a diarrhœa sets in, which adds to the debility already produced by the colliquative sweats. After hectic fever has existed for a short time, its presence is shown by the rapid *emaciation* which ensues, the fat almost entirely disappearing. Besides the emaciation there is a class of minor symptoms which now show themselves, and are the result of the want of a proper degree of nutrition. Thus the skin presents a certain loss of vitality, which is evinced by its throwing off its epithelial scales, these being shown in the dust seen in removing the patient's stockings; or sometimes noticed in quantities in the bed on turning down the bedclothes. The hairs, too, particularly the finer ones, are disposed to fall out, their connections being loosened by the loss of vitality in the skin. The same is the case with the other appendages of the skin, the vitality of the nails being lessened, and a disposition shown in them to curve in at their extremities. Hence this curving in of the nails is regarded by many as a positive sign of consumption, or rather of that condition of consumption in which hectic fever is present.

At the same time the pearly white color of the conjunctiva shows the impoverished state of the blood. The eyeball is generally

sunken, and the bones of the cheeks are prominent, from the removal of the accumulation of fat just below the malar bone, whilst all over the body, the bones stand prominently forth, and, by making undue pressure upon the skin, produce congestion, inflammation, and that peculiar variety of a slough called the "bed sore."

Throughout the entire course of hectic fever, the brain and nerves, and especially the mind, preserve their activity; the patient being generally cheerful, and "seeming to gather rays of hope from the very clouds of death which are settling round him."

ETIOLOGY.—Concerning the etiology of hectic fever there is a diversity of sentiment. At one time it was thought that the introduction of pus into the blood was the source of this fever, but now there are good reasons for doubting this, among which may be stated the fact, which has been already alluded to, that the pus corpuscle cannot by itself pass through the coats of the bloodvessels. The absorption of pus, or its passage from without into the bloodvessels, except where there is a breach in the continuity of the vessel, is therefore a fact which may very reasonably be doubted. When pus is found in the blood it should be looked upon as due either to the fact, just mentioned, that a vessel is open at some point in the neighborhood of the suppuration, or that the pus has been formed in consequence of some inflammation in the vessel itself. This doctrine of the production of hectic fever by the absorption of pus is, therefore, one which is not now generally regarded as tenable.

The most plausible theory is that which assigns the cause of hectic fever to the nervous irritation, consequent on the efforts of nature to furnish an amount of material equal to that which has been lost; and this theory is supported by the fact that if we can check the discharge, the symptoms of hectic disappear, as is frequently seen in a marked manner in the cases of amputations performed for the relief of the exhausting suppurations which ensue on diseases or injuries of the joints. The relief experienced in these cases is often so complete and immediate, that the night after the operation is frequently the first since the injury during which the patient enjoys a sound night's rest. If hectic fever were due to the introduction of pus into the blood this would not be seen, for, as the poisoning of the blood would then continue, no relief from it could be gained by the removal of a limb. On the other hand, if hectic fever is due to nervous irritation, it

may be readily understood how it would cease when the cause of the irritation was removed.

With regard to the impossibility of the absorption of pus, it has been objected that large abscesses frequently disappear, their purulent contents being certainly removed by absorption. But it must be remembered that in this case the pus is not absorbed as pus, but that it is only the liquid portions of the accumulation that are thus taken up; after which the pus-cell being broken down, either becomes disintegrated, and goes to the formation of a new structure which closes the cavity, or becomes incorporated in lymph, and forms an indefinite substance.

DIAGNOSIS.—With regard to the diagnosis of Hectic fever from Intermittent, the complaint with which it is most liable to be confounded, there can be no difficulty, the history of the case, in the majority of instances, being sufficient to point out the difference between the two. Intermittent fever is of miasmatic origin; hectic supervenes on exhaustion and irritation; whilst the cases will be very limited in which a patient who has an extensive suppuration or injury will also have been exposed to such a source of miasm as could create intermittent. Intermittent fever, moreover, offers a regular paroxysm; there is a distinct chill, followed by fever and perspiration, and then there is an interval in which the patient is very nearly or quite well; but in Hectic, after it has continued for any length of time, there is seldom a full remission, more or less febrile action being generally found throughout the day. But that which will guide with most certainty in the diagnosis is the fact that hectic fever, considered surgically, is generally conjoined with some external source of irritation, or some drain calculated to exhaust the patient's strength; and this fact, by pointing out the cause of the disease, will prove of the greatest value in deciding on the proper treatment.

PROGNOSIS.—With regard to the prognosis of hectic, much will depend upon the cause and upon the extent to which it has drawn upon the patient's strength. If he is advanced in years he will be more apt to succumb, other circumstances being equal, than when in the full vigor of life. His social position should also have its effect upon the surgeon's prognosis, patients in hospitals, who are cut off from fresh air, and surrounded by the foetor of disease, having less prospect of recovery than those more favorably located.

TREATMENT.—The indications to be followed in the treatment of

hectic fever, are: First. To remove the cause of the irritation. Second. To support the patient's strength.

To carry out the first of these indications it is necessary that the means should be varied to suit the case. It is therefore impossible to lay down any particular rules, the course pursued in any case being chiefly directed by the nature of the cause and the possibility of its removal.

In fulfilling the second indication, those means should be employed which have been already pointed out as calculated to restore the patient's strength, and to support a system which has been exhausted by the causes which have produced the fever. With this object a full, free, generous diet, chalybeates, &c., should be directed. Beefsteak and porter will be found to answer an excellent purpose, and with them may be combined doses of quinine carried to the extent of producing sedation, whilst opiates should be so administered as to aid the quinine in checking that nervous irritation which often keeps up the disease.

The success of this plan of treatment is another argument in favor of the doctrine that hectic fever is due to nervous derangement. If hectic were due, as some of the other fevers are, to an altered condition of the blood, we might anticipate some benefit from antiphlogistic measures; but experience has shown that the more the patient is depressed by depletion, the more aggravated will be the symptoms of the fever.

SECTION II.

OF PYEMIA.

A few paragraphs back it was stated that there was no reason to suppose that the absorption of pus and its admixture with the blood could be the cause of hectic fever. There is, however, a disease called *Pyemia*, which presents febrile symptoms, together with a formidable series of constitutional disturbances which are generally ascribed to such an admixture.

Repeating the assertion then made concerning the impossibility of the absorption of pus into the blood through the coats of the vessels, there is yet no reason to deny its effects when there placed, even though rarely noticed, and it may therefore now be said that

the presence of pus in the blood undoubtedly occurs in Pyemia, and that it is due either to some one of the modes then pointed out, such as a rupture of the coats of a vessel whilst it is in contact with a suppurating surface, or to a collection of pus, from an inflammation within the vessel itself, and more particularly to that form of disease known as *suppurative phlebitis*.

SYMPTOMS.—The symptoms of Pyemia, or the blood poisoning resulting from the presence of pus in the circulation, are as follows: After the existence for a short period of a suppuration, in which, from encroachment upon some vessel, pus has entered the blood; or when an inflammation of the lining membrane of a vein has led to its production within the vessel, a well-marked, heavy chill is felt, differing greatly from that of hectic, if in nothing else, at least in its greater violence. During this chill there are frequently well-marked signs of cerebral disturbance, as, for instance, incoherent mutterings, or low delirium, and the pulse becomes small and thready; while the face assumes a peculiar leaden hue, the extremities become blue and cold, and the skin contracted. After some twenty minutes or more, this chill passes off, the warmth returns, and a degree of febrile action is set up which is proportioned to the extent of the previous depression. In the course of an hour, however, there is usually an imperfect recurrence of the chill, followed by fever, and so on throughout the day, slight erratic chills recur, while at the same time the surface appears to all but the patient to be quite as warm or warmer than it is during health.

If there is a wound, and it be examined under these circumstances, its appearance will be found to be much changed as the granulations become pale or livid, and lose the florid color which was due to a proper circulation of blood. The pus also changes in character, and instead of presenting the cream-like appearance of ordinary healthy pus, becomes dry and unhealthy, much resembling that which has been pointed out as *sordes*. The patient soon becomes exhausted, and from want of nerve force sinks into a sort of stupor, which is not unlike that of typhus fever. The respiration shares in the general disorder of the system, becomes rapid and labored, counting sometimes as many as fifty inspirations in a minute, whereas, during health, it is not more than 15 or 18. If the chest is examined by auscultation, subcrepitant rales will also be noted, and if we examine the skin, it will be found more sodden, earthy, and lead colored than it was in hectic; whilst the joints swell and be-

come painful, more especially those of the lower extremities; and there is frequent pain in the calves of the legs. The tongue is dry, and frequently fissured; sordes collect on the teeth, the pulse becomes faint and tremulous, the belly swells, the cornea becomes dim and hazy, and death soon closes the scene.

Other symptoms frequently precede a fatal result in this, as in other complaints; thus, the sphincters become relaxed, the urine and feces are passed involuntarily, and the patient is unable to maintain his position in bed, tending constantly to slip down towards the foot of the bedstead, &c.

If a post-mortem examination be made, metastatic abscesses will often be found in all parts of the body, but especially in the lungs, liver, spleen, kidneys, muscular fibres, or in the cellular tissue, the whole system seeming to be infiltrated with pus.

This disease, though of frequent occurrence in the hospitals of Europe, is not common in the United States, and therefore merely requires this brief allusion.

Treatment.—In the treatment of Pyemia, no fixed plan can be laid down as calculated to benefit the patient, the blood being frequently so thoroughly poisoned as to render his recovery under any circumstances, extremely doubtful. Cauterization of an open suppurating surface, with the internal use of alcoholic stimulants, and of such means as will preserve the action of the heart until the poison can be eliminated, are all that has been suggested as likely to prove useful.

CHAPTER VI.

OF ULCERATION AND ULCERS.

It has been shown in connection with the effusion of pus, and the production of abscesses, that a degeneration of the products of inflammation, and of the tissues affected by it, rapidly follows when inflammatory action attains a certain degree of intensity. This degeneration or loss of vitality being most apt to result in a sore or ulcer, the process which creates it is designated as "ulceration," and as this process creates an "ulcer," ulceration and ulcers are

not only naturally associated with each other, but are sometimes loosely described as identical. There is, however, this difference, that an ulcer cannot be created until the process of ulceration has previously existed; the one (ulceration) being the cause—the other (the ulcer) the effect. They may, therefore, be advantageously studied under different heads.

SECTION I.

OF ULCERATION.

The term *ulceration* is employed to express that vital action by which a solution of continuity is created in any of the structures of the body, but especially in those known as the soft tissues.

The opinions advanced by physiologists at various periods respecting the process of ulceration, and the removal by it of certain portions of the body, have been very varied, being generally based on the prevailing doctrines of the day respecting the vascular system, and the natural growth and decay of all tissues. Galen appears to have regarded ulceration as a process of *erosion*, or as a solution of continuity created by the solvent power of the liquids of the body. Cuvier and those of his period supposed that the elementary particles of the body were in a state of perpetual change, and that absorbent vessels were unceasingly employed in removing the old, while the arteries as unceasingly deposited new material, a want of action in the arteries permitting the absorbents to take up more than their due share, thus creating a deficiency or chasm in the structures involved in the action. From the latter opinion came the doctrine of the existence of two sets of vessels, those depositing material being regarded as “exhalants,” whilst those removing it were called the “absorbents.”

As late as the time of Hunter, ulceration was regarded as indicative of the over-action of these “absorbent vessels,” and it was not until the development of the powers of the microscope that more recent writers, as Paget¹ and Miller,² brought forward the cell doctrine of the present day. These writers, in common with the best pathologists of our period, look upon ulceration as evidence

¹ Lect. on Surg. Pathol. by Paget, p. 270, Phil. edit., 1854.

² Miller's Principles, by Sargent, Philad. edit., 1853.

of the "molecular death of a part," the latter being expressive of the opinions created by the observations of microscopists in regard to the minute structure of the tissues, as well as of the mode of normal nutrition. A brief examination of these views will prove instructive, as exhibiting the opinions of two different periods of the science of surgery.

According to the views of Hunter, ulceration was the consequence of "excessive action in the absorbents." This doctrine, was based upon the generally received idea that there existed in the system two sets of vessels acting in antagonism to each other, the one, the "exhalants," being constantly engaged in throwing out new structure, whilst the other, the "absorbents," were as constantly employed in removing that which already existed, and was supported by Hunter's experiments upon the bones of a growing animal, in which the deposit and absorption of the coloring matter given as food to a young pig was positively shown. According to this theory, the normal state of the system was preserved only as long as a balance of power existed between these vessels; but so soon as this was destroyed, and one set acted more powerfully than the other, disease, either in the form of hypertrophy or atrophy, ensued. If the exhalants acted most powerfully, various tumors were the result; but if the over action was in the absorbents, atrophy, or the process of ulceration, rapidly occurred.

The views of more modern authors, or those of the last twenty years, with Bennet, Paget and Miller at their head, agree, on the other hand, in assigning the process of ulceration to "molecular death," or to the death of the cells of the part affected, the vitality of each part being due to the activity of its component molecules or cells. According to this theory, ulceration is created as follows:—

Inflammatory action being developed, at first produces congestion of the vessels of the part, and this congestion, by impairing the vitality of the structure, impairs that of its cells. When the inflammatory action goes as far as suppuration, and the vitality of the structure is so much diminished that the cells die, and are removed faster than they are reproduced by the organization of the lymph that is effused, a deficiency of structure results, to which the name of *ulcer* has been applied, whilst the *process* is called *ulceration*. In the development of ulceration, the formative lymph corpuscles, which had previously been effused, *degenerate*, from two reasons: first, from an imperfect circulation in the parts affected,

and secondly, from the fact that they are softened, or disintegrated by contact with the pus already formed. It is, therefore, easily perceived that the process of ulceration, under this view of the subject, can never take place in a healthy tissue, and that the parts must first be diseased, or inflamed to a greater or less extent, before ulceration is established; and this opinion best harmonizes with our present knowledge of nutrition, and the growth, as well as the removal of other deposits than those solely due to inflammation.

Ulceration, when once established, is extended, first by the molecular death of the parts immediately surrounding the primary ulcerative action, and secondly by the detachment and casting off of the particles thus destroyed by the pus which always accompanies the ulcerative action. An examination of any rapidly spreading or sloughing ulcer, where the structure is destroyed faster than it can be removed, will readily show this process, the dead matter which there accumulates being left directly before the eye of the observer as a mass, which has been specially designated as a "*slough*."

In summing up his opinions, Mr. Paget, therefore, says,¹ that "in the beginning of the process of ulceration, there is usually the detachment of a slough or portion of dead tissue by the removal of the layer of living tissue that bounded it; that the spreading of an ulcer, independent of such a visible sloughing, is effected by the inflamed tissues that form its boundaries becoming degenerated, and being detached in minute particles or molecules, or by their being decomposed and dissolved in the fluid discharges which accompany the process."

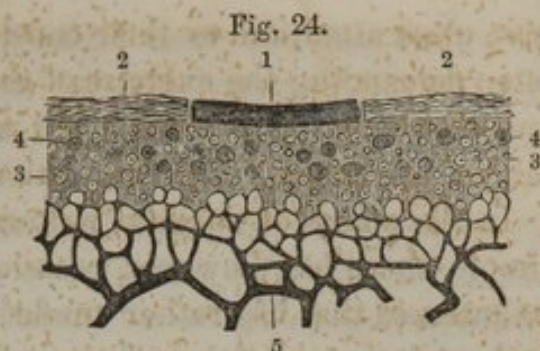
Ulceration may, now, according to this author,² be regarded as presenting four different periods. In the first, there are congestion and inflammation; in the second, the cells of the affected part, from compression, impaired circulation, or other causes, lose their vitality; in the third, they are detached by liquefaction, by shrinking, and by the swelling of adjacent parts; and in the fourth, they are separated either by degrees, as pus, or in a mass, as a slough.

Fig. 24 illustrates the conditions just described; the dead mass (1) is seen separating from the surrounding healthy tissues (2, 2); beneath it lymph corpuscles (3) are seen mixed with pus cells (4), and below, in the diagram, the congested vessels (5) may be seen lying beneath the layer of lymph by which nature closes them

¹ Lectures on Surg. Pathol., p. 273.

² Op. citat.

whilst attempting to check the progress of the ulcerative action. When ulceration ceases, this layer of lymph becomes the blastema, or source of the granulations, through the medium of which the reparative process is effected in the manner that will be detailed under the head of wounds.



A diagram explanatory of the separation of parts by ulceration. (From a sketch by Dr. J. J. Woodward.)

Ulceration may be noted in nearly all the tissues of the body, though the removal of articular cartilages does not present the same conditions as are noted in more vascular structures. The bony tissues also modify to some extent the course noted in the soft parts, as will be again alluded to in connection with the diseases of the bones.

Of the soft tissues, the skin and areolar tissue are the most liable to ulceration, the tendons, ligaments, bloodvessels, and nerves resisting this destructive action in a marked degree.

SECTION II.

The chasm in the tissues created by the ulcerative process constitutes the condition designated as an *Ulcer* or sore.

Ulcers have been variously defined, some of the definitions being, however, equally applicable to the condition of parts seen in the efforts of nature to repair wounds; thus, an ulcer was defined by Sir A. Cooper¹ "as a granulating surface, secreting matter," whilst other writers allude to it "as a solution of continuity in any of the soft tissues of the body attended with a secretion of pus, or some other kind of discharge."² The definition which best accords with the views of surgeons at the present time is that of Chaussier, to wit, "that an ulcer is a solution of continuity in any of the soft or hard tissues, created by a general or local cause, and accompanied by a discharge of pus, ichor, or sanies." The frequent creation of ulcers, and the inconvenience experienced by those who suffer from them—many of whom being of the laboring classes can ill afford to lose the time often required in their cure—should induce the surgical student to

¹ Lect. on Surgery by Lee.

² Cooper's Surg. Dictionary.

give close attention to their consideration, the healing of an ulcer often demanding the exercise of the highest degree of surgical skill, and requiring for its basis a full and correct knowledge of the details of the process of inflammation.

In the efforts of surgical writers to render this subject plain and simple, there has, however, occasionally been exhibited a degree of minuteness that has rather tended to the confusion of the student, each variation in the condition of an ulcer being spoken of as if it constituted a distinct class, or was due to a special vital action.

The opinions of Mr. Hunter and those who preceded him in regard to the over action of the absorbents in creating ulcers, as alluded to under ulcerations, have also left such an impression on the popular mind, that, though in a great measure thrown aside by the profession, it yet exercises an influence on those out of it, the popular notion of "drawing salves" being necessary to cure an ulcer, by checking the absorbent action in the part, being impressed as household words upon all, from their most tender years. Hence, the use of stimulants, as Turlington's balsam, &c., yet so popular with the old women who profess to cure sores of all kinds in all sections of the country.

As an example of the varieties made by writers in their classification of ulcers, may be cited that of Sir Everard Home,¹ who made no less than six different varieties:—

1st. Ulcers in parts which had sufficient strength to enable them spontaneously to recover.

2d. Ulcers in parts which were too weak to allow recovery to take place.

3d. Ulcers in parts whose actions were too violent to form healthy granulations, whether arising from the state of the part, or the state of the constitution.

4th. Ulcers in parts whose actions were too indolent to carry on healthy action.

5th. Ulcers in parts which had acquired specific action.

6th. Ulcers in parts which were prevented from healing by a varicose condition of superficial veins.

Even Mr. Miller, who is so favorably known in the United States for his excellent treatises on surgical subjects, makes the following widely extended classification of ulcers:²—

¹ Cooper's Surg. Dictionary.

² Miller's Principles of Surgery, by Sargent, 3d Amer. edit., p. 229, 1853.

1. The Simple Purulent, or Healthy Sore. 2. The Weak. 3. The Scrofulous. 4. The Cachectic. 5. The Indolent. 6. The Irritable. 7. The Inflamed. 8. The Sloughing. 9. The Phagedenic. 10. The Sloughing Phagedena.

Now as the process of ulceration exhibits only one stage in the progress of inflammation, and as granulation and cicatrization also constitute portions of the grand process by which nature repairs all solutions of continuity, a much more simple classification of ulcers would be that which would accord with the varieties of inflammation, as Acute and Chronic, or Healthy and Unhealthy Ulcers, to which might be added the Specific Ulcer. Under the first class, or the acute or healthy ulcers, I would therefore place all those whose natural tendency is to heal, or in which there might be noted the ordinary processes of healthy inflammation. In the second, or the unhealthy class, I would group all those whose tendency is to spread, or whose progress corresponds with the ordinary steps of unhealthy or chronic inflammatory action. This class would embrace the irritable, sloughing, phagedenic, and indolent ulcers of other writers. In the third might be grouped all such as are dependent on, or modified by a specific cause, as the cancerous, syphilitic, scrofulous, varicose, &c. In studying ulcers more in detail, we may, therefore, first examine the characters of the first class, or those designated as the acute or healthy ulcers.

§ 1.—OF THE ACUTE OR HEALTHY ULCER.

Ulcers of the acute or healthy class are sometimes alluded to as "The Simple Sore." The *edges* of this ulcer are characterized by their smooth, even, and unindented character, resembling in this respect the ordinary condition of a wound which has been made with a knife in a healthy structure, the skin up to the very margin of the sore retaining most of its natural characteristics, and not presenting signs of inflammatory swelling. When in the healthy ulcer the process of cicatrization has commenced, these edges also often exhibit little processes, or extensions of cuticle over the granulations immediately within them. The *granulations* are of a bright clear red color, smooth, shining, and covered more or less by "true laudable pus." They are also somewhat conical or pointed in their shapes, do not rise above the level of the adjacent

surface, and do not bleed unless roughly touched. The *discharge* is a cream-like pus of a whitish-yellow color, which may be readily wiped off the skin adjacent to the sore, so as to leave no trace of its presence; that is, it is unirritating to the skin. It is neither acid nor alkaline, is inodorous, and when examined under the microscope, presents true pus globules floating in the liquid matters. The *seat* of this ulcer may be in any portion of the body, and the *patients* who labor under it are usually the young and middle-aged, who possess good constitutions.

The *causes* of the healthy ulcer are varied, consisting of anything that will establish healthy inflammation and the ulcerative process in a good constitution.

Treatment.—The treatment of this ulcer is generally very simple, the natural tendency of the sore being to heal by the process of granulation and cicatrization. All that is necessary therefore is for the dresser to avoid officious interference with the process of nature; thus, in cleansing the sore, let him abstain from washing the pus from off the granulations, though he may thoroughly cleanse the skin adjacent to them. Let him also, when the ulcer is so situated as to be kept in constant motion by the action of the part, resort to such means as will insure rest, as a splint, or confinement to bed, or the use of a sling, &c., or the approximation of the edges by adhesive plaster. In order to favor the organization of the lymph, and the formation of granulations, it will generally prove useful to protect the surface of the sore from the action of the atmosphere by the use of the warm water dressing (see p. 64), or by means of lint spread with *fresh* simple cerate, or calamine ointment, or mucilage. These articles may be advantageously fastened on the limb by means of a handkerchief folded like a cravat, and then carried obliquely around the part.

Formerly heat and moisture were very generally applied to ulcers by means of poultices made of various substances, some of which were medicinally useful as stimulants, but the majority mere recipients of moisture and heat. When the application of heat and moisture is desired, the warm water dressing, just alluded to, will prove the most useful, the decomposition, and rancidity, created by the chemical changes in the substance of many poultices, rendering them rather a source of irritation than of relief. Instances in which the adjacent sound skin has exhibited evidences of Eczema simplex and Eczema rubrum after the application of the poultice

are sufficiently common, and it will therefore be found most useful to substitute as far as possible the warm water dressing; the addition of opiates or astringents to the water making this dressing far superior to the old one of poultices. When in the treatment of the acute or healthy ulcer the reparative process begins to flag, that is, when the granulations become paler, the pus less thick, and the cicatrization does not evidently advance, it will prove useful to stimulate the surface by touching the margin of the sore very lightly with the stick of the nitrate of silver, so as to form a white deposit, and this stimulus may be repeated every 24 or 48 hours until the reparative action again advances. It is also sometimes useful to paint the granulations near the edges of the ulcer with a camel's hair pencil, wet with a solution of nitrate of silver, 5 or 10 grains to the ounce of water, or to pour over it a solution of sulphate of zinc of the same strength. In some cases, the application of a piece of lint, moistened with the zinc solution, and lightly bandaged with a handkerchief, will prove serviceable by keeping the action up to the proper point for the organization of the effused lymph, from which the process of cicatrization results. Throughout the treatment of this ulcer, attention should be given to the state of the digestive organs, so as to guard against constipation, as well as to the amount and character of the food, lest it prove too much for the powers of the system, and develop irritation.

§ 2.—OF THE UNHEALTHY OR CHRONIC ULCERS.

Under this head, I would group all ulcers in which may be traced the ordinary evidences of unhealthy or chronic inflammatory action; that is, ulcers in which the color, heat, pain, and swelling are highly developed, as well as those in which one or more of these signs of inflammation are deficient, or only present in a modified degree.

Of those in which the heat, pain, and swelling are marked symptoms, we have the "Irritable," the "Sloughing" and the "Phagedenic," as well as the "Fungous" ulcers of the older surgeons, whilst the "Indolent" variety exhibits all the evidences of chronic inflammatory action, with the failure of the reparative process of acute inflammation to heal the chasm developed by the original source of the ulceration.

In the class of unhealthy or chronic ulcers, I therefore place two varieties, the one being marked by *excessive* inflammatory action, the other by a *deficiency* of vital force:—

1. ULCERS DUE TO ACTIVE UNHEALTHY INFLAMMATION, or those known as the Irritable and Sloughing ulcers, present marked characteristics, which will readily enable the observer to distinguish them from those of the acute and healthy class.

The *edges* of the skin near the Irritable Ulcer are usually shining, red, hot, painful, and swollen, giving evidence of high inflammatory action, whilst its margin is serrated, indented, undermined, or irregularly destroyed in consequence of the burrowing of the pus, and the absence of the layer of lymph which checks the destructive process in healthy inflammation. (Fig. 25.) The *granu-*

Fig. 25.



A view of the Irritable Ulcer, showing the irregular serrated character of its edges, and the spongy bleeding granulations. (After Nature.)

lations are either very deficient, owing to the degeneration of the lymph layer which forms their basis, or give evidence of over-action, being of a deep red color, raised above the level of the skin, spongy, very painful, and bleeding on the slightest touch, or even simply from the dependent position of the part, or the action of the neighboring muscles.

The *pus*, or rather *ichor* from this variety of ulcers, is thin, acrid, and irritating, of a pinkish-yellow from the admixture of blood, or of a light brown, like pus, blood, and water when mixed together. Wherever the discharge remains, it is disposed to evaporate, and form crusts or scabs, sometimes drying in patches on the surface of the sore.

Seat.—The irritable ulcer is chiefly seen on the leg above the ankle, or between it and the knee. The whole adjacent structures, particularly when the ulcer is on the leg, are heated and

swollen, and the pain, especially at night, is very severe and burning, the patient being restless, feverish, and exhibiting the other constitutional evidences of inflammation.

The *patient* is most commonly one of irregular habits, a high

liver, or drunkard, or of a cachectic or bad constitution, and with an especial derangement of the digestive organs. The *causes* are varied. Sometimes a healthy ulcer degenerates in consequence of a want of attention to the sore; errors of diet; too much exercise, or the frequent application of sources of irritation, as repeated blows, friction of the part by clothing, &c. In the intemperate, or those with disordered digestion, a scratch of the skin will sometimes suffice to establish the irritable ulcer, the tendency of which is constantly to spread. When its tendency is to slough, and the edges lose their vitality rapidly, it constitutes the variety known as the "Phagedenic Sore," this being a higher, or more marked grade of the "Sloughing Ulcer."

Treatment.—All this class of unhealthy ulcers being evidences of excessive inflammatory action in the part, in consequence of which the reparative material degenerates more or less rapidly instead of continuing to be productive in its tendency, the indications in the treatment are, 1st, to allay the local irritability and vascular action; and 2d, to improve the general condition of the patient's system.

Local Treatment.—As the local irritation causes the patient considerable suffering, attention should be first given to the dressing, and this should generally be of the mildest possible character.

Few articles are better adapted to the unhealthy and irritable ulcer, as a primary dressing, than that of warm water, applied as before directed; the patient being placed in bed, and the limb elevated so as to drain the blood from it and diminish the local congestion. Should the pain be very marked, it will prove useful to add ʒj of the Extract of Opium to a half pint of the warm water, and renew it by wetting the lint in this solution every hour or two, the solution being kept warm by placing it in a vessel of hot water, or by means of a spirit-lamp underneath the cup which holds it. Sometimes, and especially when the whole limb is swollen and painful, lint wet with cold anodyne water, so as to envelop it entirely, or the dressing by irrigation (page 63), affords the greatest relief.

When the unhealthy or irritable ulcer takes on the sloughing or phagedenic character, its progress may be arrested by the application of lint wet with very dilute nitric acid, of the strength of one drop of the officinal acid to the ounce of water, or 50 drops to the quart, as advised by Sir Astley Cooper; a piece of oiled silk being placed over the lint, and the dressing retained by a turn or

two of a roller, or of a light handkerchief, these ulcers being often very intolerant of pressure.

Cooper's anodyne wash is also sometimes very useful in this class of sores. It is composed as follows:—

R.—Ext. opii ʒij;
 Pul. gum. acac. ʒij;
 Aquæ calcis fʒij;
 Aquæ fontan. ʒiv.

When the ulcer has lost its irritability, and is disposed to take on the characters of a healthy sore, moderately stimulating applications will often prove useful, as the Aromatic Wine of the French Hospitals,¹ and water, in the proportion of half and half; this proportion being increased or diminished according to its stimulating effects, these being shown by the patient's sensibility. The healing of this ulcer after it has ceased to be irritable will often be expedited by the application of lint soaked in mucilage, as that of flaxseed, gum Arabic, or pith of sassafras; ointments having a marked tendency to irritate this class of ulcers, even when prepared with care and apparently free from rancidity, the heat of the body soon tending even with fresh ointments to the production of oleic and margaric acids, and thus stimulating the parts to a renewal of the unhealthy condition.

Constitutional Treatment.—From the very first visit and local application, the surgeon must, however, remember the importance in the treatment of this as well as every ulcer, of giving attention to the condition of the patient's general health, and especially to his digestive organs. When he presents a heavily furred tongue, with a yellow and bloated skin, and gives other evidences of hepatic disorder, nothing is better than an emetic of ʒj or ʒss of powdered Ipecacuanha, followed after the nausea has passed away by a purge of Calomel and Jalap, each grs. x; or nine grains of Blue Mass may be given at night, and followed by a saline cathartic the next morn-

¹ R.—Mentha piperita,
 Origanum vulgare,
 Rosmarinus officinalis,
 Salvia officinalis,
 Thymus vulgaris,
 Flores lavandula vera, āā ʒij;
 Vini rubri (claret) Oij.
 Mix, and let it stand 15 days.

ing. After freely evacuating the alimentary canal, diaphoretics and sedatives often prove useful, and may be continued for several days, or until the pain, sleeplessness and irritability have passed off. A good prescription that may be continued for two or three days after free purging, is as follows:—

R.—Pul. Doveri ʒj;
Hydrargyri chlorid. mite grs. x;
Syr. q. s.—M. et ft. pil. xx.
S. Take one pill every four hours.

The additional dose of ten grains of Dover's powder at bedtime is also sometimes necessary to secure sleep. The action of opiates and diaphoretics having been already explained in connection with the constitutional treatment of inflammation, it is unnecessary to do more at present than state, that throughout the entire course of this class of ulcers the constitutional treatment of inflammation is essential to their cure; but bloodletting, either locally or generally, is badly borne by those who suffer from the irritable ulcer.

2. ULCERS DUE TO CHRONIC INFLAMMATORY ACTION.—When the process of repair has been arrested in the simple healthy ulcer, or in one of the irritable, sloughing, or phagedenic class, the sore may continue in the same open unhealed condition for a period which may vary from thirty days to as many years. Hence this kind of sore is often designated as the Chronic or Indolent Ulcer, and is the second species of the unhealthy class.

The *Indolent Ulcer* constitutes the greatest number of the ulcers found in the laboring classes, among soldiers and sailors, as well as in the wards of hospitals and almshouses.

Its *causes* are neglect of the simple sore, repeated attacks of ulceration, constant exposure to irritating agents, or the cessation of active inflammatory action in the irritable sore.

Its *seat* is most commonly on the lower portion of the leg just above the ankle, especially towards the malleoli, and in preference the inner one, its seat on this side being probably influenced to some extent by the position of the great saphena vein.

Its *edges* are elevated, protuberant, rounded, smooth, and often whiter than the adjacent skin; whilst the surface of the sore looks as if much deeper than usual, though in reality nearly on the level of the adjacent skin, the apparent depth being due to the elevation of its margins. (Fig. 26.)

The *granulations* are so badly developed that they are often not recognizable, the surface being formed of a gray, pultaceous-looking

Fig. 26.



A representation of the Edges, Seat, &c., of the Indolent Ulcer. (After Nature.)

structure; or if distinct granulations are visible, they are pale, flabby, and jelly-like, do not bleed even when somewhat roughly touched, and are often so insensible as to sustain for an instant, without feeling it, the direct contact of a hot iron. This insensibility is, however, sometimes due to a crust of dirt which has collected on their surfaces. When the granulations of the indolent ulcer are very exuberant, and rise above the skin, they constitute the "fungoid ulcer" of some authors.

The *pus* is viscid, gluey, thick, or muco-purulent, disposed to dry and form thick hard scabs, and is often very deficient, the amount of the discharge being trifling. The odor of the indolent sore is peculiarly offensive and permanent, a room being often scented for hours after a visit from one of these old sore legs.

The *limb* often gives evidence of long-continued irritation, is swollen, and has the skin apparently hypertrophied; the veins are often also more or less enlarged and varicose; and the skin immediately around the sore, as well as in other points where former ulcers have existed is livid, mottled, brown or dark-red, being not unfrequently accompanied by Chronic Eczema Rubrum.

The *pain* is trifling; the chief inconvenience being the enlarged

heavy state of the limb. The general health is fair, or such as is usually seen in the laboring classes, especially if *moderate* drinkers.

Treatment.—From an examination of the characters of the Indolent or Chronic Ulcer, it is evident that the reparative process consequent on the first production of ulceration in the part has been arrested; hence the thickened everted edges, which show the efforts of nature to check the progress of the disorder by the effusion of lymph; and hence the flabby granulations and permanently congested capillaries, the formation of the granulations proving that the primary condition of healthy inflammatory action had existed.

The indications in the treatment are, therefore, to get rid of these useless materials, and excite active healthy inflammation, so that a new reparative substance may be produced in the part. The means of fulfilling the first indication, or the removal of the useless materials, are varied; thus the thickened edges may be pared away with the knife, or absorbed by nature under pressure, or the vascular action excited in them and in the granulations by stimulants, as by pouring on the sore hot beeswax and turpentine, as advised by Stafford, the two being mixed and applied as hereafter stated.

In paring off the callous edges of the indolent ulcer it is necessary to apply the scalpel flatwise to the limb, and, starting from the sound side on a line with the sound skin, shave off all that intervenes between this point and the sore. The hemorrhage that ensues is trifling, as the thickened edges which are in this manner removed possess but little vascularity. The surface of the sore being then covered with dry lint, as a stimulant, or painted with the nitrate of silver, a new inflammatory action will be set up, and the part take on more of the character of the simple healthy ulcer, and require to be treated on the general principles of inflammation.

A better plan for removing the edges, and stimulating the surface of this sore, is, however, to be found in the application of pressure. The advantages of pressure in the treatment of indolent or callous ulcers appears to have been suggested by Wiseman, who was surgeon to Charles II. of England in 1762, and who recommended the use of the laced stocking for this purpose. Whately, in 1799, revived this practice, covering the sore with a plaster composed as follows:—

R.—Emplast. plumbi ℥iv;

Aceti f℥j;

Axunge porcina ℥xij.

M. et ft. ungt.

S. To be spread evenly on kid.

And then applying very accurately a soft flannel bandage previously well shrunken by washing it in very hot water. In several instances this treatment has proved in my hands an excellent dressing.

Baynton, about the same period, also treated ulcers by approximating their edges by means of strips of adhesive plaster, covering them with compresses, and then bandaging the limb from the toes to the knee; wetting the bandages each morning whilst on the limb with cold water, so as to promote evaporation from the limb.

These plans, with some trifling modifications, are the means most employed at the present time, a combination of all of them being often the best plan of treatment. When, for example, an indolent ulcer of two or more years' standing enters a hospital, the treatment should be as follows:—

Apply at night a hot poultice of powdered white-oak bark; have the limb thoroughly washed and shaved next morning; and then, as advised by Stafford, mix four parts of beeswax and one of Venice turpentine, melt them together by a moderate heat, and when it is on the point of cooling, cleanse and dry the ulcer by wiping its surface with dry lint; dip a brush into the wax, and drop it on the sore, so that the whole excavation may be filled

with it, or pour it from the vessel into the ulcer until it covers the edges as a cake. After the wax has become solid, fasten it in its place by a strip or two of adhesive plaster. On the third day this dressing may be renewed, and, if granulations have appeared, it may be reapplied; or the limb, after its cleansing, may be dressed as follows, as advised by Mr. Crichton.

Cut a number of strips of adhesive plaster about a half inch wide, and long enough to extend a little over two-thirds of the circumference of the limb. Then, warming a strip by holding it on a can of *boiling* water, commence an inch or two below the ulcer by fastening one end to one side of the leg, and, drawing firmly

Fig. 27.



A REPRESENTATION OF THE APPLICATION OF THE ADHESIVE STRIPS, AS DIRECTED BY MR. CRICHTON, TO AN INDOLENT ULCER ON THE MALLEOLUS AND LOWER PART OF THE LEG, ACCOMPANIED BY A VARICOSE CONDITION OF THE VEINS OF THE FOOT.—The strips were first applied from the ankle upwards, and then those around the foot were placed as in the cut, the free ends on each side of the limb being fastened by a vertical strip. (After Nature.)

on the strip, cause it to pass around and adhere to the limb. Then apply a new strip, so that it will cover about one-third of the preceding strip, and continue to apply them until they reach at least an inch above the upper edge of the ulcer, fastening the ends by a vertical strip so as to prevent their curling up. (Fig. 27.) Over this apply the spiral bandage of the lower extremity, and let the dressing remain for three days, the patient using the limb moderately in the mean time. On the third day remove the bandage, and, if the plaster is yet firm, cleanse its outer surface of the pus, which often escapes through the strips, by wiping it carefully with a damp sponge, and reapply the bandage as before. On the sixth or ninth day the plaster should be removed and the surface thoroughly cleansed, when the ulcer will generally show a marked improvement; the dressing may then be renewed as before, until the sore assumes more of the characters of the healthy ulcer, when it should be treated accordingly.

Pressure, under these circumstances, often acts most admirably, causing the removal of the lymph which formed the thickened edge of the ulcer, and stimulating the circulation in the part to the production of granulations.

§ 3.—BANDAGING.

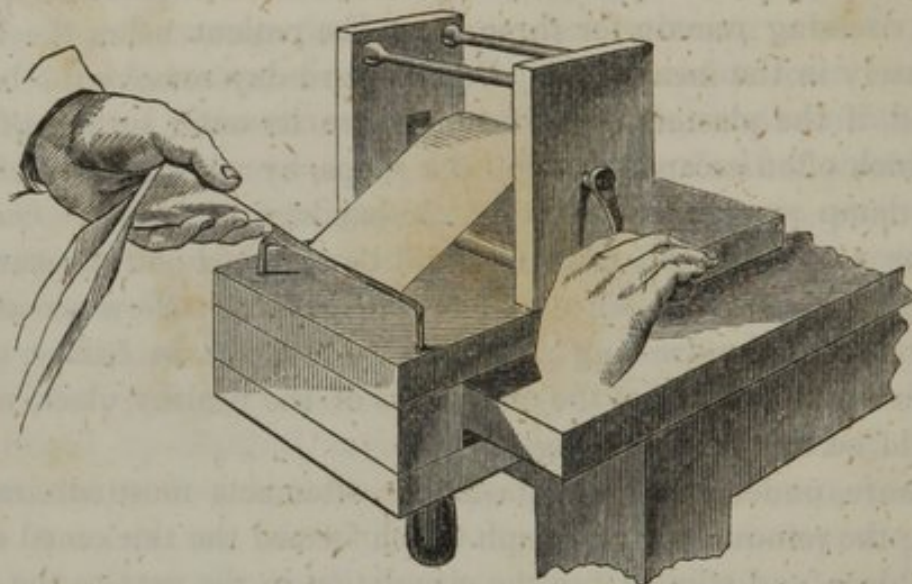
As the treatment of ulcers as well as many other surgical disorders requires the application of the Bandage or Roller, the student should give some attention to the manufacture and application of this powerful agent, the good effects of which will be very apparent in the treatment of ulcers, as without it the dressing would be but imperfectly made, and the reparative action often defective.

Bandages are generally made of coarse, open, *unglazed* muslin, of the quality which commonly sells for six or eight cents a yard. That which is finer is not so well adapted to the surgeon's use. Bandages should be made of strips torn from the sheet, as follows: For the head, five yards long and two inches wide. For the chest or abdomen, ten yards long and four inches wide. For a thigh or arm, eight yards long and three inches wide. For a leg or forearm, seven yards long and two and a quarter or two and a half inches wide, though the latter size also often suffices for the entire limb of either the upper or lower extremity. After tearing it from the sheet, roll the strip up into a *cylinder*, and then pull off all the loose

threads from each end. When the ravellings are removed before the strip is rolled it runs to waste.

A bandage may be rolled either by means of a machine or by hand.

Fig. 28.



A VIEW OF A MACHINE FOR ROLLING BANDAGES.—Whilst the fingers of the left hand are spread out so as to direct the course of the strip upon the spindle, the latter is turned by the right hand until all is rolled up and the "*cylinder*" or "*roller*" fully formed, when the left hand holds the roller firmly whilst the right reverses the spindle and draws it out of the roller. (After Nature.)


The bandage machine (Fig. 28) explains itself. The strip being placed upon the spindle and wound into a cylinder, reverse the spindle for a few turns, and, drawing it out, the roller will be ready for use. Where it is desired to prepare a number of rollers at one time, such a machine will prove very useful, and is an essential implement in the surgeon's office. But there are many occasions where the surgeon finds it necessary to prepare or re-roll a bandage on the instant. To do this let him proceed as follows: Fold up twelve or eighteen inches of the strip, and roll it on the thigh or on a table into a small cylindrical mass, by placing the palmar surface of the ends of all the fingers flatly upon it, and pushing the hand directly forwards until the roll reaches the front of the wrist. Then, after repeating these movements four or five times, or until the cylinder is about as thick as the thumb, seize its two ends between the thumb and first three fingers of the left hand, Fig. 29; let the loose strip of muslin run over the forefinger of the right hand, where it is to be firmly held by the pressure of

the right thumb, whilst the remaining three fingers of this hand pass around the cylinder, so as to hold it against the palm.

Fig. 29.



Rolling a Bandage by Hand. (After Nature.)

The fingers and thumb of this hand, if rightly placed, will resemble in position that seen in the hand of the sign-post , the cylinder being held in the hand by the doubled fingers, which press it against the ball of the thumb. Whilst thus held rotate the cylinder from right to left with the left hand (Fig. 29), whilst the opposite passes round it from left to right, drawing tightly on the strip, which passes over the right forefinger, by pressing on it with the thumb, and by thus rapidly pronating and supinating each hand, the bandage may be quickly and firmly rolled to the shape of a cylinder and fitted for immediate use.

In applying a bandage to the limbs place the *outer* face of the cylinder next to the skin, holding the roller so that it may unroll into the palm of the hand, and thus be prevented from being jerked upon the floor or accidentally dropped.

As all the limbs of a well-formed subject are conical, and every bandage requires to be applied from the apex of the cone towards its base (as from the ankle to the knee), it must be evident that if the upper edge pressed on the skin, the lower would not touch it. To obviate this, and make equable pressure on all the portions that are to be covered, it is necessary to give the bandage a half turn,

so that it may fold over on itself, or be "reversed." The making of "reverses" embraces the most difficult part of the art of bandaging, but may be easily accomplished by a little attention.

To make a smooth and proper reverse which shall not create unnecessary pressure on the part, proceed as follows: 1. Be careful to apply the bandage in a line which is spiral or moderately oblique to the axis of the limb holding the cylinder, so that the fingers shall not encroach on the loose or unrolled portion of the bandage.

Fig. 30.



A VIEW OF THE APPLICATION OF THE SPIRAL REVERSED BANDAGE OF THE LEG—showing the patient's heel resting on the point of the surgeon's knee—the turns around the heel and the hands of the surgeon in the act of making the reverse. (After Nature.)

2. Draw it firmly enough to cause the bandage to lay smoothly on the limb, *but not too tight*, or so as to cause pain, and fasten the turn just made by the perpendicular pressure of the forefinger (Fig. 30), or thumb of the opposite hand, so as to prevent this portion from becoming loose, as seen in the same figure.

3. Hold the cylinder in the proper degree of obliquity to the axis and slightly *above the level* of the limb.

4. *Make no traction* on the bandage whilst doing this, so that the portion of the bandage between the two hands may be perfectly *slack*.

5. Turn the hand holding the cylinder from semi-supination into simple pronation, and the reverse will be smoothly made by the turn of the upper edge of the loose portion of the bandage.

6. Pass the cylinder around the limb to the left hand and draw it moderately tight.

7. Then passing it from the left to the right hand again, proceed to make another reverse, taking care to cover in only *one-third* of the width of the preceding turn, and making the edge of each reversed turn perfectly parallel with that which preceded it.

In order to apply the "spiral reversed bandage" to the Leg, as in the treatment of the indolent ulcer, proceed as follows:—

Apply the external face of the free end of the cylinder to the surface of the right leg, just above the ankle, and pass once or twice *circularly* around the limb so as to fasten this end of the bandage. On coming to the fibular side of the limb in the second turn, pass from the external malleolus very obliquely across the top of the foot to near the inner side of the ball of the great toe. Pass around the joints of the toes and then around the upper ends of the metatarsal bones or instep of the foot, and then directly around the point of the heel from the inside to its outer side, the limb of the patient resting on the surgeon's knee, as represented in Fig. 30. Then come in front of the ankle-joint to the inside of the instep, under the sole, and obliquely behind the heel to the lower edge of the internal malleolus; thence around the front of the ankle, under the foot, and obliquely around the heel on its inner side, or from the internal malleolus around the tendo-Achillis to a little above the external malleolus. Then ascend the limb by passing over its inner side; to the outer side, giving the bandage the proper *spiral* course, and fixing it by the forefinger and making the reverse as before directed. Continue these reverses until the bandage reaches the head of the tibia, and terminate it at this point by one or two circular turns; after which apply one pin at the knee and one at each of the turns on the side of the heel, and the bandage will be completed. In removing this or any other bandage gather its folds loosely in one hand, and pass them rapidly from this to the other hand as the bandage is unrolled, taking care, on reaching the heel, to reverse the turns of the figure of 8 made in its application around the ankle.

In bandaging the Upper Extremity, commence above but near the wrist, by one or two circular turns, in order to fasten the free end of the bandage. Then pass obliquely across the back of the wrist over the metacarpal joint of the forefinger, and make one, two, or three *oblique* turns, so as to cover in all the fingers. On reaching the interdigital space between the thumb and forefinger, pass obliquely across the front of the wrist to its ulnar side; then across its back to the interdigital space, so as to form a figure of

8, then around the palmar surface of the wrist to the ulnar side; and, having thus covered in the wrist, proceed by spiral reversed turns up the limb to the elbow, precisely as in the leg; terminating the bandage by a pin at the upper end of the radius, and also by

Fig. 31.



A REPRESENTATION OF THE SPIRAL REVERSED BANDAGE OF THE UPPER EXTREMITY, showing the figure-of-8 turns to cover the wrist, and the position of the reverses. (After Nature.)

one on the back of the wrist, to keep it from slipping. When it is requisite to bandage the arm or thigh in addition to the forearm or leg, cover in either the elbow or knee-joints by figure of 8 turns, and then proceed with spiral reversed turns as before, and as shown in Fig. 31.

By a little practice upon the patient, it is in the power of any student soon to acquire a proper knowledge of this important and often required duty of the surgeon in the treatment of many of the surgical affections of the limb beside those of ulcers.

§ 4.—SPECIFIC ULCERS.

Under the head of Specific Ulcers may be placed all such as are due to special causes, as the Varicose Ulcers, or those induced and kept up by a varicose condition of the veins; the Toe-Nail Ulcer, as well as those due to constitutional disorders, as Scrofula, Cancer, and Syphilis. As the consideration of the latter will be reserved for the detailed account of the disorders which originate them, we shall examine first the peculiar characteristics of those due to varicose veins.

1. VARICOSE ULCERS.—Varicose ulcers may present the characteristics either of the Irritable or of the Indolent species; the obstruction of the capillary circulation, caused by the enlarged veins, resulting in either of the conditions of tissue alluded to under each of these varieties of ulcers. Most frequently, however,

Varicose Ulcers present all the signs of the Indolent Ulcer. In either case they require no other treatment than that already advised for the relief of these ulcers, except that such a degree of pressure as will afford support to the veins, or otherwise diminish their calibre—as by the constant use of a laced stocking—is essential to the permanency of their cure. The treatment required by the enlarged veins by which this class of ulcers are developed, will be given hereafter, in connection with the disorders of these vessels.

2. THE TOE-NAIL ULCER.—The Toe-Nail Ulcer is a form of the irritable ulcer, which is found on the inner, and sometimes also the outer side of the flesh adjoining the nail of the great toe (Fig. 32). This ulcer is the result of inflammatory action, developed in the part either by the great toe being compressed against the second toe by a narrow and short boot, or by a stocking which is too short in the foot, or by “stumping the toe,” or sometimes in consequence of blows, or heavy weights falling upon the top of the toe. In consequence of the inflammation developed by any of these causes the skin swells and rises over the side or end of the nail, in consequence of which the latter appears to be buried in or “to grow into the flesh.” The latter, however, is seldom the case, the origin of the ulcer from the incurving of the nail being rare, as compared with the uprising of the skin consequent on the development of inflammation. When inflammatory action distends the soft tissues, the continuance of the irritation soon produces an abrasion or bursting of the cuticle, which rapidly creates an ulcer, of the inflamed and irritable variety, which is accompanied by considerable suffering as compared with its size, owing to the continued irritation of the edge of the nail. Sometimes the inflammation travels around the nail and involves its matrix, so as to create a form of onychia, and sometimes exuberant granulations surround one or more sides of the nail, according to the extent of the ulceration. When the inflammation extends to the bone, caries and the destruction of the phalanx of the toe, similar to that seen in the whitlow of the fingers, are very apt to ensue.

Fig. 32.



Diagnosis.—The seat and history of the disease render its diagnosis easy.

Prognosis.—The prognosis should be guarded, as a cure without the removal of the nail is somewhat uncertain, and it is unpleasant to a surgeon to find his opinion of such an apparently trifling complaint proved to be incorrect by the return of the disorder.

Treatment.—The indication in the treatment of the toe-nail ulcer is to remove the cause, and this may be accomplished either by a palliative and temporary plan, or by one that will thoroughly eradicate the disorder.

The *Palliative Treatment* consists in directing the patient to wear a loose and very square-toed shoe, so as to prevent the great toe from being pressed against the second by the lateral pressure of the boot, or to wear stockings or boots which are not so short as to force up the end of the toe against the nail. When a tendency to inflammation of the skin becomes apparent, and irritation is induced, relief may be had by soaking the foot in warm water, scraping the top of the nail tolerably thin, and then lightly packing a little charpie, or soft thread, under the edge of the nail, so as to elevate it above the sore, as advised by Sir A. Cooper; or by placing a very small compress over the swollen flesh, and fastening it down by a little strip of adhesive plaster carried around the toe and over the side, so as to force the flesh off the nail, as advised by Dr. Meigs, of Philadelphia. At the same time the irritability of the ulcer, especially if accompanied by exuberant granulations, may be relieved by touching it lightly with the nitrate of silver every forty-eight hours, or by keeping a piece of lint spread with Turner's cerate on the ulcer before applying the compress, or by powdering it every day or two with arsenious acid, which is then to be covered with a compress of lint. As the nail grows in length it should be but lightly trimmed, and that only at the end, caution being given to prevent the patient from trimming it at the corners.

The *Radical Cure* of this disorder can only be accomplished by the removal of the nail, an operation which was formerly one of the most painful in surgery, but which may now be performed without the consciousness of the patient, as follows: After creating perfect anæsthesia, by causing him to inhale one part of chloroform, well mixed with three of ether—each by weight—run one blade of a sharp-pointed pair of scissors under the nail from its point to the base, so as to divide it in the middle. Then pass a spatula or scal-

pel handle around the fold of the skin at the root of the nail, and, seizing the two halves in a pair of forceps, turn them out. After checking the slight bleeding by the pressure of a piece of lint, pass a sharp pointed stick of nitrate of silver entirely around and within the matrix, so as to thoroughly cauterize the surface from which the nail grows, and introduce with a probe a morsel of lint into the matrix, so as to prevent its closing up. Then cover the whole toe with the warm water dressing, and let the patient be roused from the anæsthetic state by such means as will stimulate his brain. The water dressing should now be continued until free suppuration is established, care being taken throughout the first week to keep the matrix from closing up, or contracting adhesions with the surface which was below the nail. Subsequently dress the sore as a simple ulcer, and in about three weeks it will be healed, and the patient radically cured. Without the separation of the fold of the skin from the nail previous to the evulsion of the latter, and unless the cauterization of the matrix after the evulsion of the nail be thoroughly done, a new nail will be liable to reproduce the disorder. The tender state of the toe for some weeks subsequently will require a loose boot, and the absence of all pressure on the top or sides of the toe.

§ 5.—OF THE SEQUELÆ OF ULCERS.

Ulcers having been shown to be the result of inflammatory action, and their reparation to be due to the organization of lymph through the process of granulation and cicatrization (as will be again alluded to in connection with wounds), it might be thought that a thorough cure could, in most instances, be readily and certainly obtained. Experience, however, proves the reverse, and that an ulcer once established is very liable to heal up to a certain point and then have its progress arrested, or, if healed, to open again at or near the original seat of the complaint. The cause of much of this difficulty may, it is thought, be made apparent by a brief allusion to the state of parts seen in many limbs anterior to, during, and after the occurrence of an ulcer.

One of the most common causes of the arrest of the reparative or healing process in many ulcers is the neglect of rest, or of the employment of such means as will prevent the stretching of the newly formed skin, such, for example, as that which ensues on

muscular action in the part. When the tender character of the newly formed skin and the vessels beneath it is recalled, it must be evident that this newly formed tissue cannot sustain much tension without giving way, and that even a slight rupture or crack in it will be sufficient to develop enough inflammation to start anew the ulcerative action. Hence the importance of quiet as obtained by the use of splints, rest in bed, &c., as well as by the use of strips of adhesive plaster applied over the cicatrix and then carried partly around the limb, or at least on to the adjacent sound skin, so as to support that which is recently formed. In a certain class of cases, as the indolent ulcers, motion in the part has been shown to be sometimes useful, and to aid the reparative process; but it only does so by exciting the very action in the indolent structures which is so injurious in those which are more delicate and newly formed. Attention to the condition of the newly formed skin for a few weeks, is then essential to the preservation of its soundness in a limb which has been ulcerated.

Another point demanding attention is the tendency of the congestion of tissue left by the healing of an ulcer, and constantly seen during its existence, to result in an effusion of serum beneath the cuticle, and the production of Eczema Rubrum, or the pustules of Impetigo, Ecthyma, or even of Rupia.

These affections of the skin, even when consequent on ulcers, have been so long regarded in the United States as peculiarly appropriate to treatises on Dermatology, that it is rare to find even an allusion to them in works which are purely surgical. As they are of very common occurrence, and frequently the origin of ulcers, as well as a great obstacle to their cure, they deserve the special consideration of every one investigating this subject, being as truly surgical complaints as the ulcers with which they are more or less directly connected.

§ 6.—OF SKIN DISEASES AS CONNECTED WITH ULCERS.

ECZEMA SIMPLEX is a vesicular complaint of the skin, which shows itself frequently upon the legs, either in consequence of vascular congestion or repeated though slight irritations; or as the result of the application of poultices or their long-continued use in the treatment of ulcers.

Symptoms.—Soon after the application of any irritant, the patient complains of itching, heat, and fulness of the part, the skin becomes of a bright red color, which is more or less diffused, and sometimes occupies the entire front of the leg for an extent of four or six inches. When closely examined, minute *vesicles* or small and fine blistered points may be seen, of about the size of a pin's head, seated directly in the inflamed skin. These vesicles, being soon ruptured, leave the skin moistened, or as if varnished, and, by exposing the true skin to the action of the atmosphere, increase the burning and itching which previously existed. As the serum of the discharge dries, it forms thin white scales on the skin, which are similar in appearance to those created by a dried solution of gum Arabic or starch, and give to the whole surface of the part a white scaly and cracked appearance. A continuance of the disorder, leading to new vesicles and increased flow of serum, soon thickens these scales and makes them more brownish, though they continue soft and comparatively thin; that is, not so thick as the scab seen in a dried vaccine pustule. If this acute attack passes off, the skin is left covered with a delicate cuticle, which wrinkles superficially on motion, and is accompanied by a dark red color of the tissues below it, which ultimately becomes brown, and leaves the peculiar discoloration so often seen after the healing of any ulcer.

ECZEMA RUBRUM.—When eczema simplex has existed for a few days and developed this redness, it is designated as Eczema Rubrum, a condition that is common in connection with the indolent as well as the irritable variety of ulcers. When eczema rubrum affects several inches of the limb, and the latter becomes slightly swollen under its irritation, it is not unfrequently spoken of as "Chronic Erysipelas," though very much misnamed, erysipelas generally producing large bullæ or blebs, and not the fine vesicles of eczema.

When this condition has lasted a few weeks it is called CHRONIC ECZEMA RUBRUM, and leaves the skin cracked, excoriated, and presenting a red, soft, swollen surface, which continues for months. This is one of the most frequent sequelæ of ulcers. Sometimes chronic eczema rubrum results in scales of considerable thickness, which have been mistaken for Psoriasis inveterata, from which it may be told by picking off the scales and carefully examining the part, a moist surface or a few vesicles being always found in

Eczema underneath the scales, whilst Psoriasis does not at any period of its course give evidence of the presence of moisture.

Treatment.—The indications in the treatment of Eczema Rubrum are the same as those given under the constitutional treatment of Inflammation, as purging, cooling drinks, mild diet, and the removal of all sources of irritation. When connected with ulcers, it will generally yield to the use of a foot-bath, night and morning, of warm water slightly thickened with wheat bran, or to the application of mucilages; or, if there is much discharge and excoriation, to the anointing of the surface or the application of linen spread with the following ointment:—

R.—Hydrarg. chlorid. mite ʒj;
 Pul. plumbi acet. grs. vj;
 Axunge ʒss.
 M., et ft. Unguentum.

attention being given, at the same time, to the substitution of the warm water dressing for all poultices. In the irritable ulcers, and in patients with marked disorder of the digestive organs, or in those much annoyed by the itching (in consequence of which the skin is irritated by scratching), the administration of the Liquor Potassæ in the dose of 15 drops, increased to 30 or 50, three times a day, and given in a little sweetened water, will prove highly useful.

IMPETIGO FIGURATA.—This cutaneous disorder is also often seen on the legs, either as preceding or following the development of ulcers.

Symptoms.—Impetigo figurata appears in the form of slightly raised red patches, which are soon covered by small pustules which, by becoming confluent, originate ulcers. These pustules differ in their results from the vesicles of Eczema, being soon covered by thick greenish-yellow scabs; the skin around them becoming much thickened in consequence of the inflammatory action which accompanies their development.

Treatment.—Impetigo figurata requires the application of the warm water dressing, or, if the scabs do not readily separate, the addition of the Carb. Sodæ in the proportion of grs. xij or xv to the ounce of water, or the soda may be applied as an ointment in the same proportion to the ounce of Unguentum Aquæ Rosæ, though the wash is preferable when the discharge is free and the surface of the skin remains superficially ulcerated. After the removal of

the scabs, the application of a wash of Acetate of Lead or Sulphate of Zinc, in the proportion of 6 or 12 grains to the ounce, will sometimes be necessary.

ECTHYMA AND RUPIA.—The pustules of Ecthyma and Rupia are not so common in connection with the presence of ulcers as eczema and impetigo, though they are frequently the starting-point of the ulceration. Being both due to inflammatory action, general principles suffice for the direction of their treatment.

Summary.—In summing up the consideration of the treatment of ulcers, it will now be seen that the origin, duration, and cure of these very troublesome and often chronic surgical disorders require that the surgeon should examine carefully the condition of the parts, both in the ulcer and in the surrounding tissues; that he should subdue or excite the inflammatory action until he brings it to that degree which is essential to the effusion and organization of the lymph or plasma, which is the blastema of tissues generally; and that, whilst the reparative process is proceeding, he should guard the patient from any source of local or constitutional derangement which can interrupt it. The best test of a proper degree of inflammatory action, as connected with the healing of ulcers, is the presence of healthy granulations. If the granulations are pale and flabby, stimulate them; if not sufficiently formed, favor the circulation through the part by heat and moisture; and when new skin is forming, or the cicatrization is completed, protect the new tissue from being strained, by means of an equable support, either as applied through adhesive strips, or by the use of a bandage.

CHAPTER VII.

OF MORTIFICATION.

BY mortification (*mors*, death; and *fiō*, I become) is understood the loss of the vital functions of a part, or the destruction of its organic texture, either in consequence of the action of some direct cause, as heat, cold, &c., or from the application of such means as produce immediate disorganization of the tissues, or from the effects of indirect causes, as the degeneration and destruction which

ensue when tissues are deprived of that which is essential to their nutrition. As the mortification which results from heat and cold will be again alluded to under the heads of Burns and Frost-bite, attention may now be given to that which is due to the destruction of the powers of nutrition by general causes.

In the definition of inflammation it was shown that the inflammatory process created a change in the natural preservative action of the part affected; and it may, therefore, be readily understood that, when this process goes too far, it may end in mortification. Inflammation is, therefore, often closely associated both with the creation of mortification as well as with the efforts of nature to check the progress of death, and repair the loss which it has occasioned. Mortification is, in fact, one end (death) of the chain of the inflammatory process, whilst resolution (health) is the other.

By surgical writers two distinct conditions of parts are recognized under the general term of Mortification: one, in which the superficial tissues are mainly involved, being named *Gangrene*; whilst that which also involves the deep-seated parts, and thus creates the entire death of the part, is called *Sphacelus*. The term mortification should, therefore, be regarded as the generic expression characterizing in a general way the death of structure, whilst gangrene and sphacelus indicate the specific extent or degree to which it extends. In gangrene, there is usually noted the death of the skin, fascia, and muscles; whilst the additional death of the bloodvessels, nerves, tendons, ligaments, and bones, constitutes sphacelus.

The dead portion resulting from a circumscribed gangrene is usually spoken of as a "slough," whilst the process which creates it is designated as "sloughing."

By the term slough is also understood the yellowish, soft, pultaceous, irregular mass, cast off by nature from the adjacent vital tissues.

The symptoms of mortification are both local and constitutional, both being modifications of such symptoms as have been alluded to under the characters of inflammation.

1. *Local Symptoms of Mortification*.—In the local symptoms of mortification, as well as in those of inflammation, there may be noted change of color, heat, and sensation in the part, together with a modification of secretory action in it, as well as in the organs of the general system.

When mortification has commenced, the *color* of the inflammation

which generally precedes it is changed from the red of acute, and the more purple tint of chronic inflammation to a hue which is of a darker character, being first brown and then black. The *temperature*, also, either rises to that of the highest grade of inflammation, or else, as is more usual, falls much below the natural standard, till ultimately it reaches the cold of death. The natural *sensation* of the part is also much modified on the occurrence of mortification, being sometimes very much increased, and at others diminished, until, as in death, the part becomes entirely devoid of sensibility. The *effusions* resulting from the process of mortification are also of a peculiar character, differing materially from those seen in ordinary inflammatory action; the effusion of lymph or of pus, so constantly seen in the different degrees of inflammation, being entirely absent in the mortified structure, though it may be present in the adjacent parts where nature is endeavoring to check the progress of the disorder. The effusion of serum in mortification is, however, greater than that which accompanies healthy inflammation, and usually shows itself more or less throughout the tissues which are involved; the cuticle being first elevated in patches, so as to form blisters or "phlyctenæ," and the subjacent parts being subsequently so infiltrated as to render them sodden, or as if liquefied.

The local disorder of secretion is also very evident; the degeneration and disorganization of tissue resulting in chemical changes, by which gases are formed, and particularly that of the sulphuretted hydrogen or sulphydric acid. In consequence of the presence of this gas, the cellular tissue soon becomes so infiltrated and distended as to crackle under the pressure of the finger, whilst, as the gas escapes into the atmosphere, it creates an odor which is highly characteristic of the presence of the disorder.

SPHACELUS.—When the complaint goes still further, and that condition is produced which has been alluded to as *Sphacelus*, all these symptoms are increased. The color is now no longer brown, as it was in gangrene, but becomes of a dark, livid purple, or even black. The odor also is changed, becoming either more heavy, or perhaps less offensive, especially if the liquid products of the disorder are rapidly evaporated, and as these liquids escape, there is usually more or less shrinking of the mass; the mortified parts becoming smaller and more shrivelled than they were before.

If nature now endeavors to get rid of the decomposing mass, it

accomplishes it by the development of healthy inflammatory action in the surrounding parts, which, leading to an effusion of lymph, results in a gluing together or adhesion of the neighboring tissues, as well as in the subsequent formation of the granulations of repair; whilst the same action (adhesion) in the bloodvessels closes the arteries for some distance from the dead structure; and thus prepares the part for the separation which is about to ensue. When the reparative inflammatory action has progressed still further on to the sound tissues in the neighborhood of those which are mortified, ulcerative action is established in those which directly join the dead parts; and it is by the continuation of the ordinary processes of ulcerative inflammation that these parts are finally separated from those which retain their vitality.

The progress of ulceration in separating the dead from the living structures presents two stages; in the first a red color of a linear shape, is produced by the inflammatory action in the skin, which resembles the red tint of acute healthy inflammation; and, as this soon

separates the dead from the living tissues, it is known as the "line of demarcation."

As the ulcerative action goes still further, the parts evidently begin to separate; a deep fissure or trench being formed, which becomes deeper and deeper, till the mass is finally thrown off. This furrow, or deep ulceration, is known as the "line of separation." When this line of separation progresses to such an extent as to divide the muscles, nerves, bloodvessels, and bones, and leave a stump, we are again presented with the ordinary characters of a simple granulating surface, these granulations being formed by the organization of that lymph which was the result of the inflammatory action in the sound parts, and which in the earlier stages prevented hemorrhage by circumscribing the ulcerative process, whilst it also closed the divided ends of the bloodvessels.

In studying the process of separation,

Fig. 33.



A REPRESENTATION OF SPHACELUS OF THE FOOT AND ANKLE, SHOWING THE SLOPING LINE OF SEPARATION, WITH THE GRANULATIONS OF REPAIR SITUATED ALL OVER ITS SURFACE.—The separation is nearly completed, the bones alone remaining undivided. (After Miller.)

it will be noticed that the different tissues resist it in various degrees, and preserve their powers for a greater or less length of time, in accordance with the degree of vitality or the amount of blood circulating in them; thus, as a general rule, the arteries and the nerves are the last to mortify, although sometimes the bones resist the process of mortification the longest, in consequence of the denser character of their texture, and the amount of lime which enters into their composition.

2. *Constitutional Symptoms*.—The constitutional symptoms which present themselves in cases of mortification may be described in almost one word as those of depression. Being generally the result of irritation and inflammatory action, the symptoms of depression which accompany extended mortification exhibit chiefly the disorder of the nervous system, as reacting on the circulation. There is, therefore, usually a quick, irritable pulse, not unlike that of inflammatory fever, and which it is sometimes difficult to distinguish from the pulse due to inflammatory action, and which demands the abstraction of blood. Indeed, the surgeon will often have to experiment somewhat in order to distinguish it, as may be done very safely by placing the patient for twelve hours on a full diet. If the pulse diminishes in frequency under this treatment, it may be safely asserted that it is one due to nervous irritation, and not to inflammatory action; and that, consequently, bleeding would be highly injurious.

Besides the derangement of the circulatory system, there is also disorder of the digestive apparatus, as shown in a dry, furred tongue, loss of appetite, with the other evidences of a typhoid disorder, such as diarrhoea, colliquative sweat, cold skin, &c. &c. As the typhoid symptoms are developed, the disorder of the nervous system becomes highly marked, and is shown in the anxiety of countenance, restlessness, insomnia, hiccough, floccitation, stupor, and death.

VARIETIES.—The varieties of mortification may be noted either in reference to the duration of the disorder, as *acute* or *chronic*; or in reference to the condition of the affected tissue, being sometimes spoken of either as *Humid* or *Dry*. It is also designated as *Traumatic* when it results from a wound.

Humid Mortification, or *Gangrene*, is so called from the fact that a certain amount of humidity is preserved in the dead tissues by means of the liquid effusions which ensue upon its development,

and are the result of the inflammatory action which usually precedes it.

Dry Gangrene is also often the result of inflammatory action, though usually of a lower grade than that seen in the Humid

variety, the inflammation being sometimes so slight as to be almost imperceptible. The effusions in this variety either form very slowly, or are much more limited in quantity, or escape more rapidly, though the first is most frequently the case, and hence its dry shrivelled character.

Fig. 34.



Humid Gangrene from the Strangulation of an Injured Limb by a badly applied Bandage. (After Jno. Bell.)

SECTION I.

OF HUMID OR MOIST GANGRENE.

Causes.—The cause of *Humid Gangrene* may be either inflammatory action or mechanical or chemical agents, or it may be the result of the obstruction of the venous or of the arterial system. It may also be produced by injuries to the nerves. The manner in which inflammatory action results in gangrene has been already alluded to. Under the head of mechanical causes may be placed gunshot wounds and fractures, which not unfrequently result in gangrene, as well as badly applied bandages, the tightness of which have sometimes created it. Under the head of chemical agents are to be found the application of the mineral acids, as well as

that form of gangrene which results from the escape of certain secretions into sound tissues, as in the infiltration of urine into the cellular tissue of the perineum and scrotum from rupture of the urethra. Under the head of gangrene from injuries to the nerves may be classed cases of sloughing of the cornea from injuries to the fifth pair of nerves, and bed sores, or even mortification of the feet seen after injuries to the spinal marrow, whilst it is seen as produced by obstructions to the circulation in cases of arteritis, ossification of the arteries, etc. etc.

Diagnosis.—Humid gangrene may be confounded by an inexperienced observer with a very simple and perfectly healthy condition of parts, as in a stump which has been closed with adhesive plaster, and in which the whole surface has become of a dark brownish or blackish color, simply in consequence of the action of the sulphuretted hydrogen liberated from the mortified structures upon the lead of the adhesive plaster, forming a sulphuret of lead. The true character of this discoloration will, however, be at once revealed by the fact that a sponge and a little warm water will readily remove it.

A severe bruise may also be mistaken for gangrene; but a bruise, in a day or two, will show its true character; for, besides the absence of the constitutional symptoms which usually accompany gangrene, a bruise which is black at first, soon becomes blue, and then yellow, or green, as is familiarly seen in the case of the ordinary black eye; it is also seldom accompanied by phlyctenæ or the serous effusions, which elevate the cuticle.

Prognosis.—The prognosis of humid gangrene will depend upon the cause, upon the age of the patient, and upon the condition of his general health, as well as upon the circumstances in which he is placed, the prognosis of a case in private practice being generally more favorable than it would be in the camp, on board ship, or in a hospital.

Treatment.—The indications for the treatment are—

First. To remove the cause, and when this is accomplished to remove the inflammatory action as far as possible.

Second. To favor the separation of the dead from the living tissue.

Third. To support the strength of the patient.

In the selection of the means of accomplishing these indications, much will depend on the particular case which is under treatment. Thus, in carrying out that portion of the first indication, which

relates to the allaying of inflammation, there are cases in which local bloodletting may be of great service, although, as a general rule, it would be badly borne, and should be practised with great caution. In carrying out the same indication, there may also be occasion to employ counter-irritants, and these are much more generally serviceable. The counter-irritants useful in the treatment of humid gangrene may consist of stimulating poultices, stimulating washes, or blisters, the latter being applied either close to the parts affected or removed some little distance from them, and placed on the perfectly sound tissues, as suggested by Dr. Physick, of Philadelphia. Stimulating ointments are sometimes useful; such, for instance, as the Kentish ointment, as it is generally called, though properly a *liniment*, which is formed of resin cerate and turpentine mixed together in the proportion of one part of oil of turpentine to four parts of the resin cerate.

With the same object, and also to remove the fœtor, such washes may be used as are not only stimulating, but antiseptic in their character, as Labarraque's solution, or a solution of chloride of lime. Or, if these cannot be obtained, a stimulating poultice made of raw carrots grated fine; or the fermented poultice, as made of porter or yeast mixed with corn-meal, and kept in a warm place until fermentation is established, may be substituted.

Few plans of checking the progress of mortification, and favoring the formation of the "line of separation" have, however, proved more useful in my hands than that recommended by Dr. Physick, to wit: the creation of healthy inflammatory action beyond the diseased structure, by placing a strip of blistering plaster around the limb just above the seat of the mortification. If it is in a finger, place it on the hand; and, if in the hand, place it around the wrist or forearm. The application of the Nitrate of Silver, or of the Tincture of Iodine, are both of much less value than the blister, their action being generally more superficial, whilst the object of the treatment is the development of a sufficient amount of healthy inflammatory action to excite a decided effusion of lymph and the commencement of reparative action in the adjacent parts.

The *constitutional treatment* of Humid Gangrene, or the fulfilment of the third indication, consists in supporting the powers of life by the use of tonics and stimulants, and especially by the preparations of Bark, such as the Compound Tincture of Bark, or the Sulphate of

Quinia, or the Bark itself in substance. The preparation of Iron, especially that of the protocarbonate generally known as Vallet's mass, with a full diet, should also be directed, accompanied by the use of malt liquors, or, if much depression supervenes, by the free use of brandy. Opium is often of great service in the treatment of this disorder, as it acts in two ways: first, by allaying pain and checking the nervous irritation, thus diminishing the inflammatory action; and second, by checking all other secretions, and yet acting on the skin so as to induce perspiration.

When gangrene has progressed so far as to result in *Sphacelus*, and when, by the process of separation, the dead portion has been almost completely detached from the living, or is held only by a very limited attachment, the dead portion should be separated at once from the living by the use of the scissors or knife, in order to free the system from contact with the putrefying mass. It will also be useful to operate surgically where the liquid effusions take place to such an extent as to threaten to do mischief, either by being absorbed or by burrowing into the adjacent cellular tissue. In such a case, several free incisions should be made through the skin and cellular tissue, in order to facilitate the evacuation of these fluids.

SECTION II.

OF DRY GANGRENE.

When gangrene comes on slowly, or depends upon a very low grade of inflammatory action, the part becomes dry, shrivelled, and mummy-like, and it is then spoken of under the specific term of *Dry Gangrene*.

Causes.—The causes of dry gangrene may be obstructed circulation, old age, improper diet, diseases of the arteries—such, for example, as ossification, or arteritis—the former, when combined with old age, being very apt to produce it.

CLASS OF PATIENTS.—This kind of gangrene is most frequently seen in hard drinkers, in men who are exhausted by gout, in old worn-out constitutions, in which the vital powers are below the normal standard. In Europe it is said to be found not unfrequently among those classes of the population, particularly in

Germany, who are compelled to eat the miserable brown bread of the country, which is made chiefly from rye, that is more or less spurred.

Symptoms.—The symptoms of dry gangrene, when it has been developed from any one of the causes just named, are local tingling and coldness of the limb, with a change in the local circulation, as indicated by the modification of the color from its natural tint to that of a deep red, or brownish hue. Phlyctenæ, or the little bladders filled with brownish serum, as already described, also frequently form, and soon burst, allowing the serum to escape, though they are also often absent, the parts becoming gradually darker in color, and at last are dried up and shrivelled, until a mere shell remains as a covering to the bone.

Fig. 35.



A representation of Dry Gangrene of the Arm, consequent on general debility in a patient aged seventy-five years. The line of separation of the dead from the living parts is well seen. (After Liston.)

When dry gangrene results from the use of bread that contains ergot in greater or less quantities, that condition of things results which is designated by many writers as Ergotism. This disorder is often described by European surgeons, though rarely seen in the United States. It may, therefore, be reasonably doubted whether ergot alone is the cause of its appearance, spurred rye being sufficiently common in certain sections of this country. Experiments have also shown that too much stress has probably been laid upon ergot as a cause of dry gangrene; many surgeons having considerable doubts of its power to produce this disorder, when not aided by the additional circumstances of ossification of the arteries, want of cleanliness, want of ventilation and of exercise, circumstances which are generally found combined among the peasantry of Europe, where ergotism is most common, and which, without the aid of ergot, would be quite sufficient for its production. The effects of ergot in creating gangrene have, however, been positively main-

tained by Thompson, in his work on Inflammation, and by some others, though post-mortem examinations were not made in many of these supposed cases. In one of a similar character reported by Elliotson, of London, the examination showed the conjoined existence of ossification of the arteries.

In connection with these opinions, it may be instructive and interesting to present a brief account of the experiments of Block upon the subject, made in 1811, which show that ergot does not readily produce dry gangrene in the lower order of animals. "Block fed twenty sheep upon nine pounds of spurred rye a day, and kept them upon this treatment for four weeks, without finding that any injurious results were the consequence. In another instance, twenty sheep consumed thirteen pounds and a half daily for two months, without injury. Thirty cows also took twenty-seven pounds for three months, with impunity; and two fat cows took in addition nine pounds of ergot daily, with no other obvious effect than their milk giving a bad caseous cream, which did not yield good butter."¹ Chickens have also been fed upon the ergot with like results, and in many instances it has been eaten by individuals in large quantities, either by accident or from necessity, without any injurious results. Medicinally, it is frequently given quite extensively in hemorrhages from the uterus; yet the cases in which it has produced any such effects as have been generally attributed to it are quite rare; and in all those recorded there has been the possibility of the existence of ossified arteries.

I have, therefore, but little faith in its efficiency as a cause of dry gangrene, and am far from being disposed to admit that it possesses the potency ascribed to it by many European writers. Among certain classes of people in the United States rye is largely used, and spurred wheat is not unfrequently seen—yet I have never met with a case of dry gangrene which could be attributed to it—those supposed to be so having in two instances exhibited on post-mortem examination well-marked evidences of ossified arteries. Where ergot is aided by any of the causes which have been already detailed, such as old age, debilitated constitution, &c., it may have some influence in expediting the occurrence of the disorder; but that it will produce dry gangrene in a healthy patient, may, it is thought, be justly regarded as doubtful.

¹ Chelius's Surgery, by South, vol. i. p. 75, Philad. edit.

Seat.—Dry Gangrene usually attacks first those parts in which the grade of vitality is lowest, and shows itself in the tips of the ears, at the end of the nose, in the fingers and in the toes, especially the latter. Having been once established, it will be found that its progress is very slow as compared with the humid form; but the prognosis is generally bad. A patient may recover from a very limited dry gangrene with the toes of a limb, but by far the greater number of cases will terminate fatally.

Treatment of Dry Gangrene.—In the treatment of dry gangrene, the indications are very much the same as those stated under the humid variety; thus it is necessary to keep up the temperature of the limb, to support the patient's strength, to favor the separation of the dead parts, and to watch the proper time for the performance of amputation.

The question of the propriety of amputation in any case of gangrene, whether humid or dry, is one which has been much discussed. It is, however, generally regarded as the safest practice to await the formation of the "line of separation" before amputating, as the operation has often been followed by the reproduction of the complaint in the stump, when it has been performed before this has taken place, even though the amputation was made at some distance from the gangrenous parts.

SECTION III.

OF SENILE GANGRENE.

Another variety of Dry Gangrene is that to which professional attention was at one time called by Mr. Percival Pott, and to which he applied the term of "*Senile Gangrene*," because usually found in old men. In consequence of his paper on this subject, the complaint is now often designated as "*Pott's Gangrene*."

Symptoms.—The symptoms of *Senile Gangrene* are as follows: An old man, in a debilitated condition, or after some injury to the bloodvessels of a limb, such, for instance, as is sometimes caused by the fragments in a fracture, or after a fall which has created a strain, or after exposure to cold, or sometimes without any appreciable cause, wakes up in the night with excruciating pain in one of his feet, which he generally finds hot and swollen, and which he

supposes to be attacked with gout or rheumatism, according as the pain presents itself in the ankles or toes. At the same time he will complain greatly of numbness, of cold, of a dead feeling, and of the other varied degrees of disordered sensation consequent on obstruction to the circulation in the part, all the various anodynes and narcotics failing to alleviate it or produce the slightest impression upon the suffering. After these symptoms have existed from one to five days, the surgeon's attention will be called to a small reddish or brownish spot upon one of the toes, which soon becomes vesicated, loses its cuticle, is surrounded by an inflammatory areola, and rapidly runs on to mortification, presenting all the symptoms which have been detailed under the head of dry gangrene.

The points upon the foot at which this kind of mortification is most apt to show itself are the smaller toes or the top of the instep;

Fig. 36.



A representation of Dry Gangrene in the Feet, with the line of separation well advanced. In this case the exciting cause appeared to be cold. (After Liston.)

whence it gradually progresses up the limb, resulting in the appearances shown in Fig. 36, and causing horrible suffering, till death ends his torment.

Diagnosis.—This disorder, from its insidious commencement, is very liable to mislead the inexperienced; but the age of the patient, the seat of the disorder, the violence of the pain without any appreciable cause, all tend to establish its existence. It has been and is most correctly ascribed to arteritis, to ossification of the valves of the heart, to obstructions in the local circulation, the disorder being nearly always fatal, no matter what treatment is resorted to. Anodynes, internally and externally, afford the greatest relief,

whilst warm and stimulating applications are the most rational means of carrying out the local treatment.

SECTION IV.

OF HOSPITAL GANGRENE.

Another form of gangrene, to which attention should be given, is that known as *Hospital* or *Epidemic Gangrene*—a condition of things which generally indicates an impure atmosphere, or some neglect respecting the patient's strength. Sometimes, however, it appears in hospitals in spite of the greatest precautions, assuming an epidemic form, and causing the destruction of every part which it attacks. When such a condition of affairs occurs in the wards of a hospital, every sore begins to slough; the slightest as well as the most severe wounds sharing the same fate, and presenting more or less of the following symptoms:—

Symptoms.—First a change in the character of the wound, which loses its healthy florid appearance, a white film-like membrane overspreading the granulating surfaces, and indicating an arrest of the healthy processes. The pus, also, is either entirely dried up, or much changed in its characters, becoming ichorous and unhealthy; the parts slough with extreme rapidity, whilst typhous symptoms, or those of extreme prostration, rapidly precede the fatal issue.

When epidemic gangrene has been established in the wards of a hospital, there is but one thing to be done; let in plenty of fresh air, clear out the wards, turn the patients into the street, if nothing better can be done, or place them in tents; do anything but allow them to remain in the building. Ventilate the wards, fumigate, paint, scrub, whitewash; and then, perhaps, when after two weeks they are reopened, the surgeon will have the satisfaction of seeing that the tendency to this form of gangrene has fortunately been arrested.

Still, in spite of every means that can be adopted, this disease will sometimes progress; and many instances are known to surgeons in which patients have lost their lives from the sloughing of ulcers which originally were not larger in size than a twenty-five cent piece. I have also known more than one instance in which am-

putation has been required in stumps that were so nearly healed that a mere spot, no larger than a sixpence, alone remained to be cicatrized.

Treatment.—The only additional treatment demanded by Hospital Gangrene over the general sanitary plan just alluded to, as well as that advised under the head of Humid Gangrene, is the use of the strong nitric acid, applied to the dead part on cloths wet with it, poured over the surface, or painted on it with the camel's hair pencil. Whilst the action of the pure acid is limited to the parts already dead, and the removal of which it hastens, the structures immediately adjacent, which retain some vitality, may be occasionally wet with a diluted acid, the strength of the solution being fifty drops of the acid to a quart of pure water, as suggested by Sir A. Cooper, though sometimes the patient will bear it less diluted. This application should create some little sensibility in the part if it is to prove useful.

CHAPTER VIII.

OF THE SPECIFIC FORMS OF INFLAMMATION.

AFTER the detailed account of the ordinary forms of inflammatory action that has been presented, attention may next be given to such modifications of inflammation as are seen when the disorder is developed under peculiar circumstances, to wit, when it is seated in the cellular tissue, as in Furuncle—or excited by unhealthy causes, as Erysipelas—or by poison, as the Malignant Pustule. In all these affections certain peculiarities may be noticed which require special consideration.

SECTION I.

OF THE FURUNCLE, OR BOIL.

The word Furuncle (*furiare*, to make mad), or boil of common language, is employed to designate a circumscribed inflammation of the derm, or of the cellular tissue, which is usually followed by

the death of the circumscribed portion of the skin which is over it, and by the separation of the central portion from the adjacent parts in the form of a slough or "core," as it is usually termed.

Seat.—The furuncle, or boil, may show itself on any part of the body, but especially on parts where the skin is liable to friction or irritation, or where it is thickest, as about the deltoid or gluteal muscles, on the thigh, or on the neck, near the head of persons who are in the enjoyment of good health, and who have been exposed to some slight exciting cause, as the chafing of a pimple or of an obstructed sebaceous follicle, or to some irritation about the root of a hair.

Symptoms.—The earliest sign of its presence will be found in a circumscribed redness, attended with considerable burning and a violent throbbing, pulsatile pain, after which swelling occurs, the part being raised more or less above the level of the surrounding parts, as a conical eminence, with a firm, hardened base. The summit of this cone soon presents a softened point, in which pus is quickly apparent. On the occurrence of the suppuration the pain and irritation diminish, though the swelling continues, and is soon followed by the bursting of the skin, the escape of a thick, yellow, and healthy pus, and the creation of a rugged circumscribed ulceration, which leaves apparent in the sore a soft, pultaceous, yellowish slough, which is generally spoken of as the "core." After a few hours or days, this core escapes, and the skin usually heals rapidly, though it is left tender and often redder than usual. After the lapse of a few days or weeks, another boil is apt to be located in the immediate neighborhood of the first. This also runs its course, and may be followed by various others, either near it or at some other portion of the skin, it being very commonly remarked "that one boil makes many."

Diagnosis and Prognosis.—The superficial and limited character of the inflammation, and the robust health of most of those who suffer from furuncle, generally suffice to distinguish boils from any other complaint, whilst the prognosis as to the ultimate result is favorable, barring the tendency to a reproduction of the disorder.

Treatment.—As boils are usually found in those who are free livers, and whose digestion and secretions are somewhat disordered, the best plan of treatment is to administer a full dose of blue pill at night, and follow it next morning by a saline cathartic;

repeating the cathartic in twelve hours if its action is not quite free.

The local treatment should consist in the application of heat and moisture by means of the warm water dressing, or by means of hot emollient poultices; or the popular stimulating salve of brown sugar and soap may be employed to hasten the suppuration. When pus is certainly formed, *but not before this*, the skin should be punctured and the matter evacuated, but without disturbing the core, the latter being left to be thrown off by nature, aided by the subsequent application of heat and moisture. Much unnecessary pain is often caused by puncturing a furuncle before the pus is fully formed, and this practice should therefore be carefully avoided. A little calamine cerate, or the cold cream of the shops, or the tallow of domestic use, generally suffices for the dressing of the ulcer, the healing of which is not usually a matter of difficulty. To prevent a reproduction of the complaint close attention should be given to the diet, which should be chiefly vegetable, whilst frequent purging with saline cathartics, and the removal of all local sources of irritation, will generally prove useful.

SECTION II.

OF ANTHRAX, OR CARBUNCLE.

The Anthrax, or Carbuncle, or *furunculus malignus* (*ανθραξ*, a coal, *carbo*, a burning coal), a malignant form of the boil, which deeply involves the subcutaneous areolar tissue, is a truly gangrenous form of inflammation, and has an especial predilection for the back of the head, neck, and shoulders, as well as the thigh, buttock, and arm of the middle-aged, or those advanced in life, who have been addicted to eating and drinking, especially the latter, though sometimes it is also found in the most abstemious. When a carbuncle is once developed, it generally terminates in the death of the integuments at the point affected, and though comparatively rare, this affection also occasionally prevails epidemically to a limited extent.

Local Symptoms.—After a short period of uneasiness, fulness, and irritation in the part, which is followed by great heat and an intense aching pain, vesication of the cuticle is seen, accompanied

by great itching. On examination of the seat of the disorder, a circumscribed, firm, and hard swelling, which is evidently deep-seated, is apparent. This soon assumes a dark purple or livid color in its centre; immediately after which numerous vesicated points appear and give exit to a brownish sanies. Shortly after this, a little brown or black slough shows itself, which seems, from its color, and from its resemblance to the condition created by the application of a burning coal, to have given rise to the name of the complaint. As the disorder progresses, the various vesicated points become the seats of numerous small ulcers through which the dead cellular tissue protrudes as a soft pultaceous mass, which is ultimately thrown off, if the patient sustains the irritation, and leaves a wide but superficial ulcer, which shows but little disposition to heal.

Constitutional Symptoms.—Soon after the first appearance of the local disorder there is a chill, followed by fever, and the pulse exhibits signs of irritation. This is soon succeeded by many of the symptoms of a typhoid condition, as nausea, loss of appetite, costiveness, or diarrhoea, with a furred tongue, inability to sleep, great restlessness, headache, or even delirium. There is also often difficulty of breathing, colliquative sweat, fainting, subsultus tendinum, and hiccup, all which may terminate in a return to health, but which in old persons, and especially when the disorder is seated near the head, frequently ends in death.

Diagnosis.—The age and constitution of the patient, the pain and gangrenous tendency of the inflammation, with the peculiar seat of the disorder generally, suffice to render the diagnosis of carbuncle from the furuncle or common boil sufficiently easy.

Prognosis.—The prognosis is dependent on the size and seat of the affection, the age and character of the patient, and the early period at which the surgeon is called in. From the serious constitutional disturbance which carbuncle often creates, the prognosis should always be guarded.

Treatment.—The indications in the treatment of carbuncle are, first, to excite healthy inflammation in the skin; second, to favor the exit of the gangrenous cellular tissue; third, to create healthy inflammatory action; and fourth, to support the general powers of life. In the milder forms of the disease, where it is apparently threatening an invasion, that is, whilst the skin is only discolored but not livid, and before ulceration is established, it is sometimes useful to apply a blister upon the part, so as to excite healthy

action, this application being followed by the use of the warm water dressing. But, unless seen at an early period, this mode of treating carbuncle will not prove of much service, and sometimes greatly augments the patient's suffering. In more severe cases, it is all-important that attention should be first given to the entire destruction of the skin which is involved in the disorder, and to the evacuation of the slough.

The treatment suggested by the late Dr. Physick, of Philadelphia, and specially applicable to those cases in which there is an evident mortification of the subcutaneous cellular tissue, consists in making a sufficiently long crucial incision entirely through the skin into the sloughing cellular tissue, after which a stick of caustic potassa (*Kali purum*) should be rubbed throughout the line of the cut and all over the surface of the livid skin, until it becomes black and is converted into an eschar. After this free application of the caustic, for about one minute the part should be thoroughly wet

Fig. 37.



A VIEW OF THE SLING OF FOUR TAILS, AS APPLIED TO THE BACK OF THE NECK.—In its preparation, cut a square piece of muslin of the proper size for the part, and divide it nearly to its middle. Then attaching four tapes to its ends, carry two of them round the throat, and tie them on the front of the neck. After which the other two should be carried over the ears and around the forehead. (After Nature.)

with sweet oil or vinegar in order to neutralize the caustic, whilst the surrounding sound skin, especially that over which the discharge will flow, should be also painted with sweet oil, or well greased with cerate in order to protect it. This application of the

caustic, if thoroughly made, destroys entirely the extreme pain of the disease, and gives the patient prompt and efficient relief. When the carbuncle has been thus cauterized, it should be covered with a fermenting or yeast and corn meal poultice, which should be spread on oiled silk, and renewed every four hours. As soon as the parts show a disposition to throw off the dead mass, the flaxseed poultice or the warm water dressing may be substituted, this, like the fermenting poultice, being also changed three times a day, in order to get rid of the irritating and fetid discharge which escapes from the sore. When the carbuncle is seated on the upper part of the neck, these dressings can be best retained in position by means of the four-tailed sling, as represented in Fig. 37. But when it is seated on the back of the shoulders, there is no dressing which is neater or more thorough in its application to this part of the body, than the Scapulo-dorsal handkerchief of Mayor. (Fig. 38.)

Fig. 38.



A REPRESENTATION OF THE "SCAPULO-DORSAL HANDKERCHIEF" OF MAYOR, formed by tying a cravat around the waist, and applying a second handkerchief in the shape of a triangle, so that one angle can be fastened to the circular cravat on the back, whilst the other two ends are pinned to the same cravat on the front of the chest (After Nature.)

After the separation of the slough, the ulcer should be treated on the general principles of healthy ulcers by means of the warm water dressing, to which may be added a little of the aromatic wine of the

French pharmacopœia if the granulations seem to require stimulation. A half ounce of the wine to two ounces of water applied by means of lint wet with it is sufficiently strong, though sometimes the anodyne wash of Cooper, as advised in the treatment of the irritable ulcer, answers admirably. Mild ointments, as the calamine or red precipitate or Basilicon cerates are also useful as a change of dressing when the cicatrization appears to be tardy. But it is not unusual for a bad carbuncle to require six or eight weeks before it heals, even under favorable circumstances.

Constitutional Treatment.—Throughout the entire period of the local treatment, attention should be given to the constitutional symptoms caused by carbuncle. If the patient is seen early, and the digestive organs are loaded, an emetic followed by a mercurial cathartic is generally useful, after which the nervous irritation should be allayed by the free use of opiates and diaphoretics, especially the Dover's powder. Owing to the severity of the pain, large doses of opiates, as from two to four grains of opium in twenty-four hours, may be demanded. At the same time the patient's strength should be supported by quinine in doses of twelve to twenty grains a day, combined with a nutritious diet, and when prostration becomes evident, the stimulants should be augmented by the free use of alcoholic drinks, the previous habits of the patients as well as their age not unfrequently rendering such articles essential to the maintenance of the powers of life. In fact, the constitutional treatment should be conducted on the plan already mentioned under the head of mortification.

CHAPTER IX.

OF BURNS.

To the student who is possessed of a correct knowledge of the various changes produced by inflammatory action, the investigation of that condition which ensues upon the application of powerful irritants, requires only a specification of the peculiarities created by such a modification of the ordinary process of repair as is induced by these agents. Thus heat, cold, and chemical substances,

when applied to the body, develop only such inflammatory action as has been previously studied, though the special effects of their application are generally described as a distinct class of surgical disorders, under the name of Burns and Frost-bite.

BURNS, or that variety of injuries created by the application of an unnatural degree of heat, or one greater than the highest temperature of the blood, present a series of changes in the action of the tissues which are correctly included under one general head, though the special designation of Scalds is given to those produced by hot liquids.

The effect of a high degree of heat upon the animal tissues is usually dangerous in proportion to the extent and depth of the portion injured, it being received as a sound surgical aphorism that a severe burn of more than one-third of the superficies of the body is generally fatal. As a general rule, it may also be stated that burns or the injuries created by heated solids produce a more serious class of injuries, in reference to their duration, than heated liquids, though the former are often the most circumscribed, the depth of the burn being generally greatest in the case of solids, and the reparative effort required for their cure correspondingly tedious.

Thus, if the skin be touched with a red-hot iron, or if a child's clothes take fire, the source of heat, particularly in the latter instance, remains some time in contact with the tissue burned; whereas a liquid substance, as hot water, flows off quickly, and does not become so glued to the part as solids are apt to be. In those cases of scalds in which the clothes become saturated with the heated liquid, the depth of the burn may, however, be fully as great as that produced by solid bodies when heated.

The *dangers* arising from severe burns may be classified under four distinct heads. 1. The shock, or dangers arising from the primary depression. 2. Dangers from the subsequent reaction. 3. Dangers from the effects produced upon the internal organs. 4. Dangers arising from the efforts of nature to repair the damage, and shown in the repair of the ulceration which is left behind.

Varieties.—Burns have been variously divided, for purposes of study, by different authors, but the most useful is that of Dupuytren, as it accurately indicates the extent of the injury.

I. All burns which produce merely superficial redness or inflam-

mation, but without vesication. Here a simple erythema, or a turgescence of the vessels, is the ordinary result.

II. Those in which the inflammation goes still further, and results in the effusion of serum, the cuticle being elevated into blisters, constituting the condition ordinarily known as vesication.

III. Those in which the heat is applied in a still higher degree, or for a greater length of time, thus producing not only redness and vesication, but also the destruction of the derm or true skin.

IV. Burns in which not only the cuticle and skin, but the subcutaneous cellular tissue is converted into an eschar.

V. Burns which are attended by the destruction of the subjacent tissues, muscles, etc.

VI. Those in which the entire structure is carbonized, or burned to a coal.

In the first class we have simply the symptoms of inflammation in its first stage, or that of congestion, which have been already described. In the second, we have the effusion of serum and a superficial raw surface resulting from the rupture of the bullæ, this superficial sore or abrasion being similar to that produced by a fly blister. In the third may be noted instances of limited gangrene, the dead parts being separated by the process of sloughing. In the fourth class the vital structures are encroached upon to a greater depth; and the fifth and sixth furnish examples of true sphacelus, which, when limited in extent, is usually spoken of as an "eschar."

Seat.—Burns may be found in any situation, but they are very often seen upon the back, especially in females, as in consequence of the skirt of the dress coming in contact with the fire, the flames rise, and, before they can be extinguished, produce a burn of an extensive character. The same accident happens at times to children, though in these little patients, it is usually the front of the dress that is set on fire, there being a corresponding change in the locality of the burn, which is thus apt to reach the front of the neck and the face.

Although Dupuytren's classification of burns is very useful for the purposes of study, it must not be expected that a similarly exact division will be ever seen in nature, the simple redness of one part, the vesication of a second, and the entire carbonization of a third being often apparent in the same patient.

Symptoms.—The local and constitutional symptoms of burns differ according to their extent. The most marked of the local symptoms

is usually pain, unless the skin is entirely destroyed, and then there is little or none, until the inflammatory action is induced in the surrounding parts to a sufficient extent to produce it, whilst the most serious of the *constitutional* symptoms are those due to the shock, these being generally shown in a chill followed by reaction and fever, with the modifications of pulse and of secretion which have been already described under the head of Irritative or Inflammatory Fever.

Diagnosis.—The diagnosis of burns sometimes becomes of great importance in a legal point of view, as the surgeon may be called upon to say whether the injury has been the result of a scald or a burn, as where a woman has sworn that she has been pushed into the fire by her husband, but where the character of the injury proves that it was not due to a burn but to a scald. The establishing of this fact would, in most cases, be sufficient to vitiate the action; and it becomes therefore a matter of consequence to recognize positively the difference between them.

As a general rule, a burn may be told from a scald by its limited character and by its depth, though the latter difference is not always marked. A very good rule, and one which will apply to most doubtful cases is this: if the hair is singed we may pretty safely assert that the injury in question was a burn; as in scalds the hair is most generally left, or is not removed unless the cuticle has been removed with it; but even then, the hair of adjacent parts will indicate the character of the injury. Great caution should, however, be observed by every surgeon in giving an opinion under such circumstances.

Prognosis.—The prognosis of burns will be governed by the extent, by the degree, and by the character of the portion burned: thus a burn near the eye or near the mouth would be much more serious in its consequences than a burn upon one of the extremities. The age and habits of the patient will also materially affect the prognosis, as a young person will bear a serious burn better than one enfeebled by years, and a temperate person will be less likely to succumb than one of intemperate habits. Certain circumstances will, however, materially influence the prognosis even under these conditions, as the fact of the patient being under the influence of alcohol at the time of the injury, by which the sensibilities were blunted, as was once presented to me in the case of a man, who, having sat down whilst drunk near a stove, fell with his knees

against it, and did not awake till they were literally roasted through. This man, however, recovered after an amputation of both limbs, having apparently been unaffected by the excitement and suffering on the reception of the burn, which would otherwise probably have been sufficient to destroy his life.

With regard to a special prognosis, it may be stated that, as a general rule, the experience of all surgeons agrees with that of Dupuytren, "that a burn of the first or second class covering *one-half* the body will be likely to prove fatal; that one of the *third* class occupying *one-fourth* of the body will most likely terminate in the same manner, whilst the fourth, fifth, and sixth classes will be apt to produce death if only one square foot of the body be affected."

Treatment.—The local and constitutional treatment of burns varies with the extent of the injury. In superficial burns, where there is simply redness, and the ordinary signs of commencing inflammation, the indication is first to diminish the sensibility, and check the vascular action of the parts. No application is likely to prove of greater service in carrying out these indications than that of cold water, applied to the part by means of irrigation. It is, indeed, the most natural thing in the world after burning a finger to put it into cold water with a view of allaying the pain, and, as both cold and moisture have a sedative effect, no better plan of treatment can be pursued. If the burn is of a very limited extent, a bladder may be filled with cold water or pounded ice, and laid upon the parts; but it should not be filled too full, or its weight will make it painful, but only half filled, so that it may lay over the surface and keep up a moderate degree of coldness; or lint may be wet and applied to the burn, as in irrigation. To the cold and moisture of the water dressing we may also add some sedative article, as the watery extract of opium. Ink, and the domestic applications of scraped potatoes, &c., are chiefly useful as means of applying cold. The sugar of lead, Goulard's extract, or some other mild astringent, may often be advantageously added to the water dressing. In the case of burns of the second class, or those in which the cuticle has been more or less vesicated, it will sometimes prove useful, with a view of shielding the skin, and doing away with the irritation likely to be produced by the contact with the atmosphere, to resort to raw cotton, carded and laid on the part; or to the Linimentum Aq. Calcis of the United States Pharmaco-

poeia, or Carron oil, as it has been called, because originally extensively used and kept constantly on hand at the Carron Iron Works, in England. This liniment consists of equal parts of linseed oil and lime-water, and should be spread upon rags and laid over the parts. It has, however, one objection, and that is its very disagreeable smell, which, to most persons, is exceedingly offensive. Glycerine has also been recommended, and is to be used in the same way. As it is a very mild, unirritating substance, it will, in many cases of superficial burn, prove useful.

With the same view—that of excluding the atmospheric air—it has been recommended to dust flour over the parts, and this is sometimes highly serviceable, although it is not applicable to that large class of burns which result in suppuration, as in these cases the pus mixing with the flour, cakes it, and the whole drying, more or less sharp irregular masses are produced, which lacerate the injured surface upon every movement of the limb, and develop a very considerable amount of inflammation. It is therefore an application which is specially applicable only to very superficial burns. Other articles of a similar character have been recommended at different times, and may be noticed, in order to present a list of such as may be obtained when others cannot. Thus, chalk finely powdered and dusted like flour over the part, is sometimes useful. White lead ground with linseed oil, as in the ordinary white paint, has also been highly recommended by Barry, in England, and by Dr. Gross, of Louisville, Ky.; the lead being ground in the oil and spread thinly over the surface, so as to give it a complete coat of paint. If the burn is of a very limited extent, the surface may sometimes be very advantageously painted with collodion or the ethereal solution of gun cotton. This is at first painful, from the stimulus of the ether which it contains; but, as the latter soon evaporates, the collodion shields the parts from contact with the atmosphere, produces contraction of the tissues, and thus promotes the healing of the ulcer whilst obviating external sources of irritation.

In the more severe forms of burns, where there is a disposition towards sloughing, as it is always desirable to favor the early separation of the slough, there is nothing better than the warm water dressing, applied from the very first moment, and continued throughout the treatment as long as heat and moisture can be beneficial. One great recommendation of this dressing is its cleanliness, the constant flow of water washing away the pus before it can be de-

composed, thus securing the purity of the air of the chamber, and removing one great source of annoyance in these accidents. The old method of burying the patient in poultices is objectionable, because they are heavy, liable to become rancid, to interfere with cleanliness, to adhere to the diseased surface, and to act as receptacles for the very free discharge of pus, which generally ensues upon a burn, and which soon becomes offensive from its decomposition. Spongio-pileine, or patent lint, kept saturated with warm water, as in the warm water dressing already described, gives moisture and heat in a much neater form, and does not oppress the patient. As soon as the slough seems disposed to separate, it will be useful to stimulate the action of the parts so as to favor the cicatrization, evidences of a want of action being generally present in the granulations of the ulcer which remains after a burn. A very good application for this purpose is the ointment of Mr. Kentish, made, as already mentioned, of turpentine and basilicon ointment. This ointment was applied by Mr. Kentish, of England, to all classes of burns, but is especially useful in those which are deeply burned, as it stimulates the local circulation and resuscitates the vital powers of the part. When it cannot be obtained, its place may be temporarily supplied with the fermenting poultices or similar stimulating applications.

A very important part of the treatment of burns is the management of the ulcer, which is left after the separation of the eschar or slough. This is often very difficult to heal, and presents the characters of the ordinary irritable ulcer. In order to favor its cicatrization, sedatives will often prove useful, such as the cold water dressing, which is very soothing, and, by washing away the pus from suppurating burns, keeps off one source of irritation. Sometimes, in the ulcerated stage of burns, stimulating applications are demanded, in order to excite reparative efforts and overcome the local depression consequent on the injury, such as touching the edges of the ulcer with a stick of nitrate of silver, stimulating the parts and inviting the scabbing process, by dusting the surface of the ulcer with finely pulverized calamine or prepared chalk, and then covering it with a piece of spread cerate and oiled silk, so as to exclude the air.

The *Cicatrix* from burns is often a source of serious difficulty, as it has a greater tendency to contract than any other cicatrix or inodular tissue resulting from injury. So marked is this tendency

in some cases, that the motion of limbs is lost, and surrounding parts are drawn out of their line, so as to create great and striking deformities. Generally this contraction shows itself by the influence which it exercises in the traction made upon surrounding tissues, rather than in the substance of the inodular tissue itself,

Fig. 39.



A representation of the Deformity caused by the Contraction of the Cicatrix of a Burn on the Neck. (After Liston.)

the adjacent skin being very much puckered, and presenting ridges, furrows, seams, and all other varieties of disfiguration. (Fig. 39.) Sometimes, also, the cicatrix presents such a low degree of vitality that ulceration is constantly taking place in it. The relief afforded by the division of any of these cicatrices is exceedingly doubtful, and, as a general rule, it may be said that it is useless to cut through any adhesions which result from burns, unless a plastic operation is also performed in order to replace the tissue that has been destroyed. Thus, for instance, in an adhesion of the arm to the side resulting from a burn, it is worse than folly to cut through the cicatrized portion in order to free the limb. If the arm be tied up over the head, so as to prevent the possibility of any contraction, the ulcer will not heal; and if we let it down to heal the ulcer, the contraction will be reproduced. The same is true of adhesions be-

tween the fingers; unless we can introduce a portion of new skin by a plastic operation, it is useless simply to divide the cicatrix. It is necessary therefore to watch burns when first healing, in order to prevent these adhesions as much as possible, and particularly in the case of those situated near orifices, such as the mouth, the nostril, the anus, or the vagina, where it is particularly desirable that the patulous condition of the part should be maintained. The same precautions will be required in burns near joints on the fingers and toes.

CHAPTER X.

EFFECTS OF COLD.

WHEN cold is first applied to the body in a moderate degree, its effects are those of a gentle and pleasant stimulant. Carry it a little further and the stimulation becomes painful, producing an aching, tingling pain. Carry it still further, and the depression which always ensues upon superexcitement is developed in the part, which now becomes numb and devoid of sensibility. Carry it still further, and there will be a depression of the vital powers both in the heart and nervous system, from which the patient generally cannot recover.

When the sedation produced by cold, as applied to the entire body, is carried to such a degree as to impair materially the power of the nervous centres, we have all the constitutional symptoms which result from congestion of the brain. Thus the patient will have a marked disposition to sleep, or at times exhibits tetanic spasms, as was the case in some of those exposed to Polar cold in the late expedition of Dr. Kane, after the loss of their vessels. More frequently, however, stupefaction and coma supervene on the exposure, the patient sinking quietly and unconsciously into the sleep of death.

The effects of cold upon a limited portion of the surface of the body may be classified under two distinct heads. To the first, the name of *Pernio* or *Chilblain* is given, which indicates a condition resulting from the stimulus of cold creating and resulting only in irritation or inflammation of the skin; whilst the second or more

marked degree, or that of the depression supervening on stimulus, and which results in the production of gangrene, is designated as Frost-bite.

Those portions of the body which possess the least vitality are most apt to suffer from the depressing effects of severe cold, and accordingly we find chilblains and frost-bite first appear in the tips of the nose or ears, or of the fingers and toes.

SECTION I.

OF PERNIO OR CHILBLAIN.

IN PERNIO or CHILBLAIN, or that superficial irritation which is developed in parts exposed to cold, we have the following symptoms:—

Symptoms.—In the first place, there is a tingling or benumbing sensation which is much augmented, and gives rise to the burning sensation, with which most persons are familiar when the extremities after exposure to cold are brought near to a fire. The part, then, also assumes a violet or livid color, which depends for its intensity upon the degree of cold which has been applied. After this a reaction shows itself as the result of the depression produced by the cold, and this reaction results in inflammatory action, producing vesication and ulceration, the latter of which may show itself either as a simple fissure of the skin or acquire a more extended form.

PATIENTS.—Chilblains are most common among women and children, as might be expected from the greater delicacy of their skin.

Treatment.—The treatment of chilblains may be classified as prophylactic and curative; the former being the most important. It consists in protecting the part in the first instance from the application of cold and moisture; and next, when that cannot be done, in avoiding sudden changes of temperature, as by keeping away from the fire after exposure to low temperatures. The curative treatment of chilblain is to be carried out by such means as will regulate the vascular action in the parts. As the first effect of the cold is depression, resort should be had as a general rule to local stimulants, a class of applications many of which are in domestic

use. Thus it is very common for the old women to recommend any one suffering from frosted feet to put them every night into a bucket of hot mustard and water, and it is not a bad application. Washes of spirits of turpentine, of the solution of the sulphate of copper, or of sulphate of iron, or of a solution of the nitrate of silver, are often employed, of a strength sufficient to create a feeling of warmth, and are very useful in aiding the restoration of the local circulation, and relieving the nervous sensibility. In the fissured form, or in limited ulcerations, collodion is an excellent application, but each returning winter will often develop neuralgic pains in the tender skin left after the primary attack.

SECTION II.

OF FROST-BITE.

FROST-BITE presents us, in a slightly modified form, with all the symptoms which have been detailed under the head of Gangrene. It is, in truth, a term only expressive of the fact that the gangrenous condition has been induced by exposure to cold. The portions of the body which suffer from frost-bite are very much the same as those alluded to in chilblains.

Treatment.—With regard to the indications in the treatment of frost-bite, it is a repetition of the principles laid down, when speaking of mortification, that is, to favor the formation of the line of separation and ulceration, that the dead parts may be thrown off, and afterwards promote the processes of granulation and cicatrization, that the ulcers may be made to heal, which it is sometimes difficult to accomplish, owing to their unhealthy and irritable character.

SECTION III.

OF SUSPENDED ANIMATION FROM COLD.

Another point connected with the effects of cold requires here brief reference, and that is, the suspended animation resulting from exposure to cold for a considerable length of time. When called to a person under these conditions, the surgeon should proceed as

follows, in order to restore a healthy condition of parts without creating a violent reaction: Strip the patient, carry him into a cold room, or out into the open air, if a room sufficiently cold is not convenient, and there rub him with ice, snow, or cold water, till an improvement in the condition of the circulation is perceptible. Then place him in a room the temperature of which is a little higher, and give him warm drinks, such, for example, as balm tea, elder tea, black or green tea; then apply heat very gradually, whilst at the same time injections of warm water may be advantageously introduced into the rectum. As the respiration gradually becomes more easy, the temperature should be slowly raised, till the patient finally regains his natural healthy condition, any catarrhal or pneumonic symptoms that may be subsequently developed being treated on the general principles of such disorders when due to other causes.

The prophylactic treatment in a case of suspended animation, as in most others, is infinitely better than the curative; thus persons exposed to cold should, under no circumstances, be allowed to give way to the feelings of torpor and drowsiness which are generally induced by it. Those who have read Captain Cook's Voyages must be perfectly familiar with the adventures of Dr. Banks and Dr. Solander, and the difficulty they experienced, when exposed to cold, in keeping each other awake.

Throughout the treatment of the injuries resulting from cold, it should be remembered that patients suffer much more from changes of temperature, and from moisture and cold, than they do from mere exposure to a low degree of cold steadily maintained. In Baron Larrey's memoirs it is stated that in the Russian campaign of Napoleon, the troops under his observation would frequently do very well whilst marching, even when exposed to a temperature of 15° below zero, and with comparatively few cases of injury from cold; but, when a soldier came near the bivouac fires, he was apt to suffer directly from severe frost-bite, losing fingers, toes, and even limbs. He also mentions one case in which a soldier having come from an exposure to this degree of cold went into a warm guard-room and immediately fell down asphyxiated and died.¹

¹ Larrey, *op. citat.*

CHAPTER XI.

OF ERYSIPELAS.

THE next complaint to which attention may be given is a peculiar form of unhealthy inflammation which is designated as Erysipelas.

The name of this complaint is derived from two Greek words, *ερυω*, I draw, and *πelas*, near, and points out the marked tendency of the disease to spread itself and involve adjoining parts.

It has been called "the Rose," from its color, and St. Anthony's fire from the burning character of the pain, and from the supposed power of the saint to cure it. If limited to the skin alone it is called *Simple* erysipelas, but if the subjacent cellular structure is involved it receives the appellation of *Phlegmonous* erysipelas. It also receives various names from accidental complications; thus it is called *Edematous* when there is serous effusion into the surrounding cellular tissue; *Bilious*, when complicated with disease of the portal circle; *Erratic*, when it frequently changes its seat, disappearing in one part and reappearing in another; *Idiopathic*, when it results from constitutional causes, and *Traumatic* when it follows upon some external injury.

Erysipelas may be defined as "an inflammation of the skin and subjacent cellular tissue, characterized by the deep red color and swelling of the affected part, and by a marked tendency to spread."

Seat.—It seldom exists, except under peculiar circumstances, in any other part than the skin and adjoining cellular tissue.

Symptoms.—The symptoms of erysipelas are of two classes, constitutional and local; the former generally preceding the latter. Thus, when erysipelas is about to appear there is, in the first place, a severe chill, with pain in the back and limbs, nausea, loss of appetite, restlessness, frequent pulse, dry tongue, great anxiety and despondency, which is soon followed by defective secretions of all the glands and the symptoms formerly detailed under the head of inflammatory fever. At various periods of these constitutional

symptoms, local changes become apparent, the secretions of the wound are modified, and the character of its surface becomes changed, as is shown by the difference in its color, as well as in the character of its pus. The adjacent skin also becomes dry, bluish, and shining, and the surface of the wound or ulcer is covered by a green, thin, offensive, irritating pus or ichor. The edges of a wound also show unhealthy action, and have, in some instances, a marked tendency to slough. As the disorder progresses, the skin becomes irregularly vesicated and the color variegated, with an edge which is separated by a margin of a marked color from that of the healthy structure.

After these changes in the condition of the wound, local affections of the internal organs may complicate the disorder. Sometimes the serous membranes become involved and create peritonitis, as after wounds of the abdomen; or there may be inflammation of the brain, as after those of the scalp. Sometimes also in both these instances the mucous membranes become involved and diarrhoea appears.

Soon after the occurrence of the primary constitutional disturbance, a change becomes apparent in the skin in some cases, even when there is no wound, as after violent contusions followed by ecchymosis. The skin now becomes of a bright arterial red, or of a yellowish or brownish hue, and is elevated into blisters by the serous effusion under the cuticle, or it becomes hard, dense, and unyielding, from the lymph which accompanies the serous effusion. In bilious erysipelas there is also more or less of a jaundiced hue soon apparent, which renders the color browner than is usual in cases uncomplicated by deranged biliary secretions.

The pain of erysipelas is characteristic of the disorder, and is described as of a burning, tingling, irritating kind, the approach of the attack under conditions favorable to it being indicated by this fact.

Etiology.—The etiology of erysipelas is extremely doubtful; many causes having been assigned, but none so far as is positively known, which can be regarded as a constant source of the complaint. Thus, the disease has been said to originate in bilious and gastric disorder; from the presence of irritating ingesta, and from acidity of the stomach. But occasionally it is found to exist independently of these conditions, as well as in cases where the slightest imprudence could not be charged on either patient or surgeon. In

the latter it has been supposed to depend upon some peculiar condition of the atmosphere.

As a source of local irritation many have thought that the employment of adhesive plaster was especially injurious, as its removal in the dressing of wounds, irritated the cutaneous follicles by pulling out the hairs of the skin, but in many instances, even with a tendency to the disorder, it has not invariably followed the use of adhesive strips. The alternate compression and expansion of the capillaries, under the application and removal of a bandage, have also been regarded as exciting causes, whilst heat and moisture, cold, &c., have all been supposed to be equally powerful excitants of it. It is apparent, therefore, that but little is known respecting the etiology of the complaint.

There is one singular fact which deserves mention in connection with erysipelas, and that is the conjoined existence of puerperal fever and phlebitis during the same period. This singular coincidence has led to many discussions, and volumes have been written without adding very materially to our understanding of the matter. It is right, however, that this connection should be remembered, even though unexplained, because whilst attending a case of erysipelas a surgeon ought *not* to attend one of midwifery, lest puerperal fever should be developed in the woman.

The connection between these two complaints has frequently been exhibited in hospitals, and especially the Pennsylvania Hospital, of Philadelphia. In the latter institution, the long surgical ward is at one extremity of the building, and the obstetric department at the other end of the grounds; the buildings are therefore separated by several hundred feet of open space; the medical officers and nurses are also different, and no connection exists between the two, yet frequently erysipelas has become epidemic in the surgical ward, whilst puerperal fever has prevailed in the lying-in department. So also, on the other hand, practitioners making *post-mortems* of puerperal peritonitis have not unfrequently had erysipelas developed in their own persons. In explanation of these singular phenomena, it has been said that in both there is phlebitis, that there is a marked sympathy existing between serous membranes and the skin, etc. etc.; but nothing satisfactory has yet been suggested which is applicable as an explanation in the majority of cases.

Diagnosis.—In studying the symptoms of erysipelas more in detail, it will be seen that its redness has some peculiarities which

distinguish it from the redness of ordinary inflammation. At first, the erysipelatous redness spreads rapidly; but, after its primary violence is spent, it ceases to extend, or more frequently extends irregularly, giving to the margin a feathered edge, which is quite characteristic of the complaint. The creation of this edge is said to be due to the fact that the inflammation is of the unhealthy variety, in consequence of which there is no effusion of lymph to limit the progress of the inflammatory action; but when the effusion of serum takes place, as it generally contains more or less lymph, an imperfect limitation may be noted, and the color consequently spreads irregularly. In consequence of

Fig. 40.



A VIEW OF THE EFFUSION OF SERUM, EXPLAINING THE CAUSE OF ERYSIPELATOUS SWELLING IN SOME INSTANCES, AND SHOWING HOW IT TENDS TO LIMIT THE EXTENSION OF THE DISORDER.—A distended capillary vessel is seen coated with granules and granular masses, which also fill the areolar tissue. The transparent nuclei of cells are seen at different points among the granules in the inter-vascular deposit. (After Bennett.)

the pain, etc., and the absence in cases not erysipelatous of the constitutional symptoms generally present in the disease, will be quite sufficient to guide the surgeon in the formation of an opinion.

Prognosis.—The character of the prognosis of Erysipelas will depend very much not only upon the extent of the disease, but also upon the nature of the parts affected. Thus, erysipelas in the scalp would be much more dangerous than erysipelas in the extremities, on account of the possibility of the first involving the membranes of the brain.

The terminations of Erysipelas are two in number. 1. It may end by resolution. 2. It may terminate by suppuration. In most

a certain similarity of symptoms, Erysipelas may be confounded with Erythema or Phlegmon, or with simple redness of the skin produced by irritation, such as the chafing of the clothes or the action of the sun. A patient, for instance, may be brought into a hospital with redness or even vesication of the back of the neck and head, and at first erysipelas might be suspected, but the history will generally show that the color is only the result of a very delicate skin having been exposed for some time to the direct rays of the sun. Usually there is but little difficulty in arriving at a correct diagnosis in erysipelas; the history of the case, the symptoms, as the burning character of

instances, where there is a circumscribed Erysipelas which is limited to the skin, its tendency will be to resolution. If, however, it invades the cellular tissue, it will most probably end in suppuration.

Among the constitutional symptoms, moreover, are certain which have an influence upon the prognosis. When the pain in the back is very severe, for example, we may, as a general rule, expect to have trouble. The habits of the patient also influence, in a very marked degree, the prognosis, erysipelas in an intemperate person being much more serious than in one of temperate habits. The previous history of the case should also have its weight in the formation of a prognosis, as an attack supervening in a patient who has been exhausted by a long suppuration would be much more serious than one occurring after a recent injury. When erysipelas assumes an epidemic character it is much more serious than when simply sporadic; and its repetition is materially influenced by the state of the weather, mild and dry weather being much more favorable than that which is cold and damp; hence erysipelas is especially prevalent in February and March in this latitude. The prognosis, in some instances, will also be influenced by the circumstances of the patient, as whether he can have fresh air, good diet, and all those little comforts which are needed by the sick, or whether he is deprived of these by his position; whether the surgeon finds him in private practice or in the wards of the hospital, as erysipelas developed in a hospital is much more apt to prove serious, and to cause sloughing, than the sporadic cases which occur in private practice.

Treatment.—The treatment of Erysipelas will depend upon circumstances. If it arises from a wound, the first indication is to allay irritation. In doing this, everything calculated to inflame the skin should be carefully removed, as bandages and adhesive plaster; the warm or cold water dressing being substituted, in accordance with the feelings of the patient.

But generally the treatment of erysipelas should be directed almost entirely to the constitutional derangement, the local disturbance being only evidence, as a general rule, of constitutional derangement of an asthenic character. The treatment, therefore, should be based on this principle: Thus, in the first place, it is a good practice to administer an emetic, as it empties the stomach, gets rid of indigestible articles, and affects favorably the portal circulation, or, as the celebrated Dr. Rush used to say, in homely language, "shakes the gall bladder;" and, when followed by a dose of calomel

and jalap, "clears the ship fore and aft." After thus thoroughly clearing the alimentary canal, resort may be had to diaphoretics; and, among these, nothing is better than Dover's powder, the ipecacuanha modifying the action of the circulation in the skin by the perspiration it produces, while the opium serves to tranquillize the existing nervous excitement.

When erysipelas, however, is of an epidemic character, and has a special tendency to assume the asthenic form, stimulants are required from the very commencement. Indeed, in the forms of traumatic erysipelas, and among patients suffering under the depressing influence of serious injury, as in complicated fractures, amputations, &c., no plan of treatment has proved more useful in my hands than that of stimulants both in food and drink, after the use of a thorough mercurial purge. In some instances, and especially in those who have been high livers, I have administered over a pint and a half of the strong beef essence as made by Liebig's formula,¹ together with twelve ounces of the best brandy, and fifteen grains of quinine; the pulse under this treatment sinking from 120 to 98 in the minute, whilst it lost its irritability. The tongue also became more moist and cleaner, and a free perspiration, accompanied by sound sleep, proved of great comfort to the patient. When, however, such a plan of treatment increases the frequency of the pulse, so as to cause it to count 140 or 150, whilst the skin becomes dryer and hotter, and the tongue browner and drier, it will do harm, and should be superseded by saline cathartics, cremor tartar water, and gruel, until signs of debility become apparent. Great caution should always be employed in this as in other diseases, in deciding between the inflammatory or debilitated and irritable pulse; and there is no better mode of settling its true character than by testing the effects of stimulants. If the frequency of the pulse diminishes, and the patient perspires freely under their use, stimulants will prove useful, but not otherwise.

In the local treatment of erysipelas, little or no benefit need be expected from external applications, except in so far as they may add to the patient's comfort or protect the part from the action of

¹ Beef, free from fat, and cut into small pieces, $\frac{1}{2}$ pound; muriatic acid, 4 drops; salt, one teaspoonful; cold water, 12 ounces. Let it macerate for two hours—then pour it through a sieve, and pour the water a second time over what remains on the sieve. This beef essence, when well made, is almost as clear and free from color as water, and is entirely devoid of the empyreumatic odor of the older formula.

external irritants. The most comfortable of the local applications is lint wrung out of warm flaxseed or slippery elm mucilage, and covered after its application with a piece of oiled silk; or if there is a free discharge from a wound cover the part, especially if in a limb with a thick layer of wheat bran, which will absorb the matter and shield the skin from the atmosphere. Cloths, wet with a solution of the sulphate of iron, twenty or more grains to the ounce of water or stronger, was at one time highly lauded by Velpeau; but even in his own wards, as well as in those of American hospitals, it has, according to my experience, not sustained the character which was at first demanded for it. It is also a dirty dressing, as it stains all clothes that it touches. The perchloride of iron, in the proportion of one part of the salt to three of water, is also highly spoken of by the French surgeons, but its results are similar to those of the sulphate. Frictions with mercurial ointment, washes of nitrate of silver, of the tincture of iodine, &c., have also disappointed many who have relied upon them, and in the vesicated form of erysipelas, often prove a source of additional suffering. Nor will the attempts to check the progress of the disorder by drawing a circumscribing line between the sound and the diseased skin, prove of much service, as it has over and over again passed its boundary without even temporary delay, and the same is true of strips of blistering ointment.

It is, therefore, judging from personal experience, injudicious to rely on a local treatment of erysipelas, except as a palliative; and of these, the mucilages are decidedly the most soothing, especially when combined with extracts of opium, aconite, or belladonna. In all cases the importance of the constitutional treatment cannot be too strongly impressed on the mind of the young surgeon, and especially the utility of invigorating the powers of life after the use of such purgation as will correct the condition of the abdominal organs.

PART III.

PATHOLOGY OF ABNORMAL GROWTHS IN THE SOFT TISSUES.

IN the consideration of the inflammatory process, allusion has been frequently made to the action of the component parts of the body towards their own preservation, under the general name of "healthy nutrition;" and before proceeding to the investigation of such deviations as result in abnormal growths or deposits in the Soft Tissues, it will prove useful to the young student to state very briefly the general steps of healthy nutrition, as well as those of the development of normal structures. The first result noted in the effort of nature to develop structure is the formation of a plasma, nidus, or blastema. In this blastema or lymph, granules, nucleoli and nuclei soon appear, from which, by the formation of an investing membrane, cells or cytoblasts are produced, which are the natural germs of all organic tissues. From the varied modifications of these cytoblasts are formed all parts of the body, as muscle, tendon, bone, and bloodvessels, each of which is continually undergoing destruction and repair, in accordance with the powers of life of the individual. This power of repairing its own losses by the action of the component cells of a part corresponds with the idea which was expressed by ancient writers under the general title of the "*Vis Medicatrix Naturæ*." Were it continuous, life would never end, because, as fast as any structure was worn out, it would be replaced by a fresh one, and man would flourish in eternal youth. The failure of the system, as regulated by Divine laws, to accomplish this constant repair, creates in many instances such a modification of healthy action as gives rise to abnormal structures, which, in most cases, are readily distinguishable from the normal tissues either by their physical characters or by their subsequent

progress. When the tendency of these deposits is to form a structure whose constant progress is to destruction, and in which nothing avails to prevent its ultimate loss of vitality, they are designated as "Malignant" diseases or growths, in contradistinction to such as, though abnormal, are known as "Benignant," because more amenable to treatment even though causing inconvenience and suffering.

CHAPTER I.

OF MALIGNANT DEPOSITS OR GROWTHS.

THE alteration of normal structure which is created by the deposit and growth of such a substance as has a malignant or destructive tendency, has been designated under the generic term of "Carcinoma;" and the affections resulting from it are, therefore, known as "Carcinomatous disorders." In the progress of a Carcinomatous growth various changes may be noticed; thus, at first, the deposit is imperceptible, but, when it attains even a moderate size, it is characterized by extreme hardness, as compared with that of the natural tissues, or by a soft and pulpy structure unlike the normal structures. The hardened state of these growths is usually designated as Scirrhus, whilst that condition in which their ulceration and the destruction of tissue become very evident is called "Cancer," or sometimes "True Cancer," or "Open Cancer," or the ulcerated stage of "Carcinoma Reticulare." When the deposit is pulpy and soft, and like the marrow or medulla of bones or the substance of the brain, it is designated as Soft, Medullary, or Encephaloid Carcinoma, the bleeding stage of which, when accompanied by exuberant granulations, is termed "Fungus Hæmatodes." When the malignant deposit is highly colored, or contains a black pigment, it is known as "Carcinoma Nigra," or as "Melanosis;" and when its chief characteristic is that of cells filled with a jelly or glue-like matter, it is spoken of as "Colloid Cancer," or the "Carcinoma Alveolare of Muller." As the pathology of each of these requires special study, owing to the frequency of their occurrence, and the suffering which their development entails upon those who are affected by them, they will be described under distinct heads.

SECTION I.

OF CARCINOMA.

The origin of the common term "Cancer," which has been popularly applied to Carcinoma and Carcinomatous disorders, has been variously explained, some asserting that it is derived from the Romans, who gave it the name of the Crab (*Cancer*), because the pain was of a gnawing character, as though caused by the pinching of the claws of the creature; or, as others assert, because the progress of the disease resembled the retrograde or irregular movements of this shell-fish. Other writers state that the name was given to it on account of some supposed connection between the origin of the disease and "*Cancer*," one of the signs of the Zodiac; whilst others entertain the opinion that it was named from some fancied resemblance between the roots of the tumor and the claws of the crab. However derived, the general term cancer is applied by many to all carcinomatous affections, though it should be limited strictly to the ulcerated form of hard or reticulated cancer.

Etiology.—The origin of Carcinomatous diseases, even with the minute investigation of microscopists, is yet, to some extent, unknown, and will doubtless remain so as long as the cause of the resemblance of the child to the parent, the modifying influence of vaccination on smallpox, or the extension of syphilitic virus from the parent to the infant continues to be unexplained. In the first instance there is, doubtless, such an impress of the individual peculiarity of the cells of the parent as gives a specific character to the germ which constitutes the infant. So with vaccine and syphilitic inoculation, in both of which there is probably some peculiar modification of the cell germs which continues till the end of a certain period. But how this is accomplished is yet a mystery. That certain constitutions are predisposed to carcinomatous disorders, and that sisters and nieces, brothers and cousins, will all suffer from it whilst others escape, is well known to every surgeon. In one family from North Carolina, individual experience has shown me cancer of the breast in the third generation, though the second had escaped it. Without any explanation being presented, the fact must, therefore, be assumed that there is a condition of the blood

or a peculiar formative tendency in the germs of some patients that will lead to the production of carcinoma by any exciting cause; whilst in others not so predisposed these causes produce no such results.

The question of the contagiousness of carcinomatous disorders has also excited much interest, as has that of the possibility of benignant growths degenerating into malignant disorders. That cancer is not contagious has been proved in various ways, whilst many arguments might be adduced in support of the opinion that under the action of such causes as impoverish the blood, cancerous matter, like tubercle, may be deposited in the tissues of those who were without hereditary taint, and whose previous health was once good. Waiving, therefore, any explanation of the ultimate source from which carcinomatous disorders originate, I would express the opinion that they are, as a class, true blood disorders; that is to say, hereditary in many persons, developed by trifling excitements in others, and liable to impoverish the blood of all in whom they appear. Cancer, when once developed in any structure should, therefore, be treated as a disease liable to infect the whole system—to cause a marked degeneration of all the powers of life—and as always likely to be redeveloped in those who have once suffered from it. Every plan of treatment likely to obtain a successful result must therefore be based on the employment of such means as will tend to prevent its formation in constitutions which are hereditarily predisposed, as well as check its progress when once developed. The means most likely to accomplish this are such as improve the digestion and augment the quality of the red corpuscles circulating throughout the system.

The exciting causes of carcinomatous disorders are blows, and such other injuries as develop local inflammatory action in a constitution suited to its formation; otherwise such causes will simply lead to hypertrophy of tissue, or to simple and benignant growths.

Microscopical Characters of Carcinoma.—From the observations of pathologists and microscopists, surgeons have lately become very familiar with the appearance of carcinomatous deposits, though yet ignorant of the manner of their production. In its earliest development, a carcinomatous deposit exhibits under the microscope a simple modification of the normal cells of the part near which the disorder has shown itself, and presents characters which are sufficiently specific to enable us to designate them as the

carcinomatous cells. Of these there are two varieties, that of hard and soft cancer, though each preserves certain generic characteristics. The generic cell of *Hard Cancer* is usually larger than the normal exudation corpuscles, and is of an oval, caudate, round, angular or spindle shape, the majority being broadly oval, whilst others are fusiform, reniform, or nearly lanceolate, these various forms being probably due to the pressure made upon it by the fibres which surround and constitute the firmest portion of the hard carcinomatous growth. These cells appear to possess increased formative power,

Fig. 41.



A microscopic view of the Cells of Hard Cancer, showing their varied shape, with the numerous free Nuclei, as seen in Scirrhus of the Breast.—Magnified 500 diameters. (After Paget.)

and to contain an unusual number of distinct nuclei, which in some cases are largely surrounded by granules, as in the Encephaloid variety, and sometimes by pigment cells, as in Melanosis. It is also not uncommon to find some of each variety in all the deposits of a malignant character. It is evident that the reproductive power of these cells is greater than that seen in those of healthy tissue, as all malignant deposits extend themselves rapidly into the surrounding structures, and also attract to themselves a larger share of blood, in consequence of which they sometimes grow with great rapidity and attain considerable size. Though thus active at first, these carcinomatous cells soon lose their vitality; much sooner, indeed, than those of the normal tissue; and hence, though carcinomatous deposits grow rapidly, they also ulcerate, slough, and die under the action of caustics more rapidly than those of healthy or normal tissue.

The interest shown in studying the peculiarities of the cancer cell soon led microscopists to express different opinions respecting its peculiarities. Thus, Müller asserted that it was "impossible to distinguish the carcinomatous cell from the cells of other abnormal or even normal tissues, and Dr. Bennett agreed with him in the opinion that no single element could positively be said to

be characteristic of the cancer cell."¹ Lebert, however, who is certainly high authority, and admitted as such by Dr. Bennett, positively asserts "that the cancer-cell may be distinguished from all others;" though he admits that, if an isolated cell were presented, he could not by microscopical examination tell whether it belonged to a cancerous growth; but, that if "any morbid tissue was given to him, he could say from an examination of its cells whether it was cancerous or not."²

Cancer-cells appear to have an especial tendency to infiltrate glands and such tissues as contain a large amount of the fibrous element, the varied amount of the fibrous tissue, developed during the growth of the tumor, creating the varieties of carcinoma above described. Thus, in Scirrhus and Cancer, the fibrous structure is in excess, and hence the firm, hard character of these tumors; in Encephaloid carcinoma it is less, and the tumors are consequently softer; whilst in Colloid carcinoma the fibrous element is expanded into cells and filled with a jelly-like substance.

The microscopic characters of these varieties of carcinoma are also somewhat varied, differences being found in "both the corpuscles and their basis, stroma or intercellular substance of the cancers."³ There is, however, no mark by which the cells of encephaloid may always be distinguished from the cells of hard cancer, though the former may be softer, less exactly defined, more easily disintegrated by water, and flatter than those of scirrhus cancer. "The only constant difference is in the mode of compacting, Scirrhus cells being closely packed in a spare, firm intermediate substance, or tightly packed among the contracted structures of a mammary gland, whilst those of Encephaloid or Medullary cancers are more loosely held together in a more abundant and much softer or liquid intercellular substance."⁴

The carcinomatous cells are generally found in a matter of varying density. In encephaloid, the most of it is of the consistence of brain, whilst in cancer they are mixed with a thick cream-like fluid, which can be squeezed out of the deposit, and is known as the cancer milk or juice.

After thus briefly examining the microscopic characters of ma-

¹ Müller's Principles, Phila., 3d edit., by Sargent, p. 308.

² Op. citat., by Sargent, of Phila., p. 308.

³ Paget, p. 537, Phila. edit.

⁴ Opus citat., ibid.

lignant deposits, attention may be given to such peculiarities in the course of the disorder as have been shown by clinical observation, and these are so constant that they may be mentioned under special heads, as the laws which regulate these deposits generally.

1. Carcinomatous deposits of all varieties are disposed to transform and cause degeneration of the tissues in which they are deposited.

2. They tend to invade and destroy the adjacent tissues.

3. They are disposed to travel along the lymphatics and to attack the nearest lymphatic glands.

4. Though at first apparent in some one point, they soon invade several other parts, and cause or are attended by an impoverished condition of the blood.

5. When removed, the wound heals rapidly.

6. They tend to reappear in or near the cicatrix when removed by an operation.

7. They seem to prefer the glands as a nidus, though they may invade all the tissues of the body, as the muscles, skin, cellular tissue, bones, &c.

As carcinomatous deposits, in whatever structure they may be seated, produce the same kinds of local and constitutional disturbance, the latter may be explained before taking up the special consideration of the seats of each deposit.

§ 1.—OF SCIRRHUS.

General Appearance.—Scirrhus, wherever found, presents a hardened mass, varying in size from that of a pea or chestnut to that of a potato, or it may attain the size of the fist; but, as a general rule, hard carcinoma does not attain any very great bulk. As the tumor increases, it produces by pressure more or less congestion of the neighboring bloodvessels, particularly those of the skin. This, however, is true of any non-malignant tumor which causes an interruption to the superficial circulation, as was stated on page 24. As the disease progresses, the tumor forms adhesions with the surrounding structures and becomes irregularly lobulated, whilst the part first deposited, and which is the most advanced, begins to soften, to ulcerate, or even to slough. To the touch, the scirrhus tumor is found to be hard, firm, and resisting, and is evi-

dently heavy. When removed from the body and cut with a knife, it creaks under the edge of the instrument, or as the French express it, "Cries under the knife" like a raw potato. Its surface is also not unlike that of a potato, having a bluish, pearly aspect, and being frequently intersected by fibres or bands, which appear as if formed by the cellular structure of the part crowded together by the development of the abnormal growth. These bands often extend from the tumor itself into the adjacent cellular tissue, and constituting what is popularly spoken of as the *roots* of the disease. They seem to have the power of influencing the neighboring parts to reproduce the disease after an operation, and serve probably as channels of communication between the diseased and the healthy cells. They should therefore always be carefully removed in an operation, lest they prove to be the extended nidus of cancer cells.

The microscopic views of Scirrhus are said by Mr. Paget¹ to exhibit the infiltration or insertion of the cancer substance into the interstices of the affected tissue.

Fig. 42.



A microscopic view of the Cancer-cells filling the interstices among the bundles of the fibro-cellular tissue in the skin of the breast. Magnified about 200 times. (After Paget.)

When deposited, the materials of cancer either expand these interstices by accumulating quickly—hence the rapid growth of cancerous tumors—or they shrivel and degenerate, and thus allow the affected tissues to shrivel and collapse, as is often seen in the breast. "The elementary structure of the cancer substance, as infiltrated in the breast, are chiefly two: 1. Certain cells and other corpuscles; and 2, a fluid or solid blastema, or nearly homogeneous substance, in which they lay imbedded.

The blastema, or intercellular substance, presents no peculiar features."

Local Symptoms.—As first developed, the Scirrhus tumor or deposit is movable and painless; but, after a time, it becomes immovable by contracting adhesions with the surrounding parts, and begins to ulcerate, though sometimes it ulcerates before adhesions occur. A movable tumor is, therefore, usually less serious than one that is adherent.

¹ Lect. Surg. Pathol., Phila. edit., p. 495, ut supra.

The *pain* from Scirrhus is usually dull and heavy; but, as the disease approaches the skin, it changes its characters and becomes more burning. When the lymphatics become involved, the pain takes on a shooting or lancinating character, which generally extends towards the nearest lymphatic glands. Thus, in cancer of the breast, it shoots towards the axilla; in cancer of the testicle, it extends towards the groin; and, in cancer of the lip, towards the lymphatic glands of the neck. As the nerves follow very much the same course as the lymphatics, the direction of the pain corresponds with their line; thus, the lymphatics from the breast go to the axilla, whilst the origin of the nerves of the breast is also in the axilla; hence the pain is said to follow the course of the lymphatics, though they do not excite it.

When ulceration ensues on the scirrhus condition, the variety known as "open cancer," or as ulcerated carcinoma, is produced. The *cancerous ulcer* presents edges of an inverted, irregular character, and is surrounded by a puckering of the skin. Or the edges may be everted, or elevated and covered with exuberant granulations. The pus from such an ulcer presents the characteristics of ichor or sanies, and possesses a smell which is at once peculiar, and, when accompanied by sloughing, horribly offensive.

Constitutional Symptoms.—When scirrhus is once well developed, or when it progresses to ulceration, the constitutional symptoms become very marked; thus there is often, from an early period, loss of appetite, nausea, difficulty in obtaining sleep, and, if the disorder attacks the liver as well as shows itself externally, a peculiar sodden, leaden hue of the skin appears, which has been aptly compared to the appearance of "a cold buckwheat cake," as it is yellow in its tint, and wants the warmth of life. As the cachectic condition progresses hectic symptoms appear, and the patient sinks and dies from exhaustion and constant nervous irritation.

Treatment.—The general treatment of carcinomatous disorders consists in fulfilling the following indications:—

1. As the disease is due to or accompanied by a perversion of nutrition, an effort should be made to remove any derangement in the nutritive organs, whilst the general health should be built up by the use of tonics and alteratives.
2. To remove or check the local irritation.
3. To continue the constitutional treatment through all stages of the disease.

4. To operate early, if the disease presents such conditions as may be deemed sufficient to justify an operation.

5. To select such means for its removal as will be likely to produce the least irritation.

With regard to the tonics suitable in these cases, by far the greatest amount of good may be expected from the use of Chalybeates. Justamond, of London, gave from sixty to one hundred and twenty grains of the ammonio-chloride per diem; and Carmichael, of Dublin, derived much benefit from washing ulcerated scirrhus with a solution of the sulphate of iron. The iodide of iron has also been used with advantage. Vallet's mass, in doses of from five to ten grains three times a day; the muriated tincture and the prepared carbonate have also been frequently given, and individual experience has shown me several instances in which these preparations have retarded desperate cases. In one case in which I was consulted with a view to operation, I declined on account of the rapid progress of the disease, but suggested the use of Vallet's mass, conjoined with the application of the powdered carbonate to the sore, and the patient lived for eight years without the disease having made any very great progress. In regard to the fulfilment of the second indication, benefit will sometimes be derived from applying leeches around the tumor (not ON it), especially in the early and inflammatory stage of the disorder.

Narcotics of various kinds, both internally and as plasters, prove useful, such as opium or belladonna pills for internal exhibition, and the emplastrum saponis of the Pharmacopœia, either alone or mingled with due proportions of stramonium, belladonna, aconite, opium, &c., may be employed externally. The administration of opiates requires, however, great caution, as they tend to weaken the digestive organs and check the secretions, producing loss of appetite, nausea, and constipation, all of which tend to impoverish the blood by impairing the source of its nutriment. The temporary relief afforded is, however, in hopeless cases a great object, and patients will often employ narcotics themselves, and conceal the fact from their surgeon. As the pain is excruciating, and from its duration leads to the frequent administration of opium, the amount that will ultimately be requisite to afford relief is incredible to those who have not seen it. An instance has come under my personal notice where from sixteen to twenty-four grains of sulphate of mor-

phia, or about one hundred and twelve grains of opium were taken in the course of twenty-four hours.

The external and internal use of the preparations of iodine was at one time strongly urged by Lugol, and facts cited in support of their utility; but though active in removing tubercular or scrofulous deposits, and improving the general health, they have not, according to my observation, an equally beneficial effect in scirrhus. Externally, iodine stimulates the circulation, and is often positively injurious by causing an afflux of blood to a part from which every sound principle indicates it should, if possible, be abstracted.

The constant use of the emplastrum saponis spread on kid, and kept constantly on the part, is often a source of comfort, as well as beneficial in promoting perspiration, and thus preventing local congestion. It also is often tranquillizing to the patient, and protects the part from friction, &c.

In all cases the patient should be strictly cautioned against handling the tumor, or moving the adjacent parts, as this only adds to the irritation, and disposes the disease to run its course more rapidly.

If the removal of the tumor is to be attempted, it should be remembered that it is worse than useless to operate while the local excitement is high; that cancer which is progressing rapidly will not be checked by an operation, and that it will, after such an operation, take on a more rapid career in the cicatrix or elsewhere.

§ 2.—CANCER OF THE SKIN.

Cancer, as developed in the skin, is a true scirrhus, presenting a small, long, or oblong flattened swelling, similar in appearance to the common mole. Its seat is generally in the neighborhood of the ala of the nose, though sometimes it is found on the top of the lip, on the side of the cheek, or, indeed, anywhere.

Symptoms.—The symptoms are as follows: At first there is a little tumor in any of the above-named situations, painless in the beginning, but, by and by, more or less painful, giving rise to a burning sensation. As the disorder progresses the skin cracks, and a little serum is effused, which dries and forms a scale or scab over the crack; when this comes off a superficial ulceration is left, which spreads, resists all ordinary treatment, and even grows worse under the applications usually employed for similar ulcers, and this in so

marked a degree that the sore may be designated as "Noli me tangere," or touch-me-not. When it attacks the lips, the eyelids, the prepuce, or any place where it is likely to be much handled, it spreads rapidly, and the ulcer, which is usually superficial, assumes a thickened edge, that gives it an apparent depth, though really limited to the skin.

Diagnosis.—Skin cancer may be confounded with lupus, or more frequently with chancre; but it may be readily distinguished from both, by characters which will be apparent after these diseases shall have been described.

Prognosis.—The prognosis of cancer of the skin is favorable, more so, indeed, than that of any other form of malignant deposits. It seldom invades any other part than the skin, and generally yields to appropriate treatment. After an operation it will sometimes return, but, in the majority of cases, the patient will continue free from the complaint.

Treatment.—For the removal of epithelial cancer resort may be had to the knife, to the ligature, or to caustics, the latter being especially useful in skin cancer. The whole class of caustics present us with a set of remedies which are very serviceable, not only in epithelial cancer, but also in other forms of the disease, especially where the patient is unwilling to submit to the knife, or where the tumor having been once extirpated by the knife returns in the cicatrix. Unfortunately, however, the removal of cancerous deposits by caustics has latterly been very much cast aside by the profession in the United States; and they have fallen, therefore, into the hands of empirics, who do a great deal of mischief, because applying them to improper cases. As personal experience has shown me that some of the old formulæ for caustics are very useful in certain cases, I think their employment may now be advocated with advantage, if only by recalling attention to this means of treatment, and keeping it within proper professional bounds.

§ 3.—TREATMENT OF CANCER BY CAUSTICS.

In the application of caustics in the treatment of cancer, the vitality of the deposit is destroyed, inflammation is developed, and the malignant growth is thrown off as a slough. The pain is, therefore, very much greater than that felt from the operation of

excision; yet there are some patients who, whilst possessing an unconquerable dread of the knife, yet do not fear caustic. When caustic is applied to a cancer the part rapidly sloughs, because the morbid growth being a degenerated structure, possesses less vitality than the healthy tissue, and is hence acted upon by the caustic more readily than the surrounding parts. For this reason caustic, by its extended action, will in some instances remove the disease with much greater certainty than can be done by the knife, the operator being sometimes unable to recognize the degenerated tissues, whilst they are readily destroyed by the caustic. When the disease reappears in or near the cicatrix, the use of caustics will also be found preferable to the repetition of the operation of extirpation.

In the formula for these caustics it will be seen that the chief ingredient in nearly all of them is arsenious acid, and at first sight it might be feared that the constitutional effects of arsenic would be induced by such an application. But the general rule that, in order to favor the absorption of any substance, it must be applied in such a manner as not to create irritation, holds good also here, the irritation being so great in the application of these caustics that effusion occurs, not absorption; hence there is no risk of mischief from the poisonous effects of the arsenic.

The first of the caustics, of which the formula will now be given, as collected from various sources, is that commonly called "Helmund's Powder," which is very similar in its composition to Frère Cosme's paste. It is as follows:—

R.—Acid, arsenious ℥ij;
Cinnabar ℥ij;
Pulv. carb. lig. grs. xij;
Sang. draconi grs. xvi.

M.

The purpose of the charcoal in this preparation is to correct the fœtor of the slough, whilst the dragon's blood is probably used merely to conceal the other constituents. It should be applied to the sore or tumor either by mixing it with one ounce of resin cerate, or with one ounce of the following ointment, which it may be perceived, from its name—the Narcotico-Balsamic Ointment—is a very ancient prescription:—

R.—Balsam Peru,
Ext. hyoscyam., āā ℥ss;
Plumb. acet. ℥iv;
Tr. opii ℥xl;
Ung. cetac. ℥iv.

M.

In its application to a cancerous growth this caustic should be spread upon a piece of lint of such a size as will cover the whole sore, and extend a little beyond its edges, when it should be fastened down by strips of adhesive plaster, and covered by a compress and bandage. During the first hour, perhaps, it will produce little irritation; but after four, six, or eight hours, the pain will become more severe, and subsequently so violent that it may be found necessary to give an anodyne to alleviate the suffering.

After a lapse of forty-eight hours the caustic plaster may be removed and another put in its place, if the slough is not deep enough; but after obtaining a white, felt-like slough, of sufficient depth, it only remains to favor its separation by the use of poultices or the warm water dressing, repeating them until the slough comes away, when the ulcer that is left should be dressed with the narcotico-balsamic ointment, or with simple cerate, or basilicon, which answers the purpose quite as well.

Sometimes it happens that while the slough is separating the odor of it is very offensive, and to counteract this the parts should be washed with the following lotion:—

R.—Potassæ sulph. \mathfrak{zj} ;
Aq. rosæ $\mathfrak{f}\mathfrak{z}\text{iv}$;
Ext. hyoscyam. \mathfrak{zj} .

M.

the extract of hyoscyam. aiding in allaying the local pain.

Another caustic, which was once quite celebrated, is “Justamond’s powder.”

R.—Oxid. antimon. $\frac{1}{3}$;
Arsenious acid $\frac{2}{3}$.

To which equal parts, or three parts of opium are to be added. Justamond applied this powder by making it into a paste with the white of eggs, and smearing it over the sore with a spatula.

A notorious and old cancer prescription, much used in Philadelphia and New York, is the *Red Ointment* of certain unprincipled men who are designated as “cancer doctors.” It is evidently the same as Dubois’s paste, and is the basis of most of the quack prescriptions at present in use.

R.—Hydrarg. sulphuret. \mathfrak{zj} ;
Acid, arsenious \mathfrak{zss} ;
Sang. draconi \mathfrak{zss} ;
Ung. cetacei \mathfrak{zj} .

M.

In the use of this paste the patient is directed to spread the ointment on a piece of rag, and apply it to the sore, changing the plasters from day to day till the cellular attachments of the tumor loosen and come away, or, as the quacks and the vulgar say, till "the cancer comes out by the roots."

They then apply the *Brown ointment* over the sore thus left. This, also, is an old prescription, and is simply a mild, soothing ointment.

R.—Litharge ℥j;
Ol. lini f℥iij;
Cerat. resin. ℥j.
M.

There are several other articles in use, and one of them, which has become quite celebrated in the hands of Indian doctors, corresponds very much with "Plunket's caustic."

R.—Pulv. rad. ranunculus bulbosus,
Acid. arsenios.,
Sulphur. sublimat., equal parts.
M.

Any of the more powerful caustics will also answer the same purpose; thus, corrosive sublimate or caustic potash may be serviceably employed. Another popular caustic is made by burning any number of herbs, boiling their ashes so as to make a lye, evaporating it till it forms a true caustic potash, and then applying it on the part.

One of the best caustics that can be employed in the treatment of such cases as demand caustic applications is the Chloride of Zinc, as suggested by Mr. Ure, of England. This substance, when used as a caustic, should be mixed with flour or calcined gypsum, in about the following proportions, and either made with water into a paste, or used as an ointment, as follows:—

R.—Zinci chloridi ℥j;
Farinæ ℥j;
Ext. aconiti ℥ss;
Cerate, simple ℥j.
M.

It should be spread on kid or muslin, and applied to the ulcerated cancer, or the ulcer may be sprinkled with the zinc and flour, and then covered with the cerate; or, if it is intended to remove a distinct tumor beneath the skin, but over which the integuments are not ulcerated, the cuticle should be first taken off by means of

a blister, in order to expedite its action. After its application, the pain is sometimes very severe, but often the plaster can be worn for twelve or twenty-four hours, especially if Dover's powder is given at the same time. On removing it, if the slough which it has made is not deep enough, it may be reapplied, after which the warm water dressing or warm mucilages or poultices should constitute the dressing, in order to favor its separation. Five or six days of this treatment sometimes suffice for the removal by caustic of tumors of some size, whilst those which are smaller and more superficial will slough out in less time. The ulcer usually heals promptly under the ordinary treatment of the "*Healthy Ulcer*," and the whole time occupied in this mode of treatment varies from one to six weeks, according to the depth and extent of the portion that is to be removed.

§ 4.—CANCER OF THE EYEBALL.

Hard carcinoma of the eyeball is an exceedingly rare disorder, the deposit of encephaloid matter being much more common. Cancer of the eye usually commences in the anterior coats, and progresses inwardly at first; whilst encephaloid cancer, commencing in the choroid or retina, extends forwards. Both impair and destroy the usefulness of the organ from the commencement of the disorder, and both are liable to be reproduced, though hard cancer is less so than encephaloid. Cancer of the eye usually occurs in the old and middle-aged, whilst encephaloid disease is seen in the young and at adult life, though sometimes, also, it is met with in those who are more advanced.

Symptoms.—When cancer is developing itself in the conjunctiva, cornea, or sclerotic coats of the eyeball, the earliest symptom is an irritation of the eye, accompanied with redness and vascularity similar to that seen in catarrhal ophthalmia, but the source of which is often not recognized at the moment. Then, after the continuance of these symptoms for a week or ten days, a small tuberculated spot is seen, which, if in the cornea, at once impairs the sight; but, if in the conjunctiva, is simply an increased source of lachrymation. The tumor increasing, there is shortly an ulcer seen, which gradually assumes the everted edges of the cancerous class; the eyeball becomes prominent; the lids distended, oedematous, and ulcerated;

the pain becomes severe and deep-seated; the disorder extends to the lachrymal gland, leads to absorption of the bony walls of the orbit, and the patient dies exhausted by pain, or of the extension of the irritation to the brain.

The diagnosis will be given in connection with the symptoms of encephaloid growths in the eye. The prognosis is unfavorable as is that of cancer generally.

Treatment.—In the treatment of cancer of the eye, but little is demanded in its earlier stages, the ophthalmic symptoms being treated in the manner that will be stated under the affections of the eye. But, when the presence of the cancerous tumor is established, extirpation of the entire ball becomes the only rational plan of treatment, and this is useful rather as diminishing suffering, than as affording any hope of preventing the return of the disorder.

For a detailed account of the operative proceedings in extirpation of the eye, the reader is referred to the volumes on operative surgery¹ by the author.

§ 5.—CANCER OF THE LIP.

Cancer of the lip shows itself generally on the lower lip, and most frequently at its edge, as on the everted portion of the mucous membrane, though sometimes it commences lower down, between the margin of the lip and the edge of the chin.

Symptoms.—The symptoms of this form of cancer are as follows: When the cancerous deposit is developed at the edge of the lip, it shows itself in two forms; in the first, it appears only as a slight scale, due to the degeneration of the epithelial structure of the part, which, separating, leaves a superficial ulceration or crack, from which a fungous granulation or two are very apt to spring; in the second, it is seen in the middle of the lip, and then the first thing noticed is the presence of a little shot-like body beneath the skin, which is quite movable in the tissues of the lip. In this latter form, it is probable that the cancerous deposit has taken place in some of the labial glands. As this little tumor enlarges, it distends the skin, and the integuments take on ulcerative action, creating the everted edges and peculiar appearance of the cancerous ulcer. As the disease advances, irritation of the glands of the neck ap-

¹ Operative Surgery, vol. i. p. 292, 2d edit., 1855.

pears; the tumor spreads, and the patient at last sinks under the effects of hectic fever. Before this termination, however, the ulceration may extend itself to a frightful degree, it having been known in some cases to remove the whole lower lip, lay bare the jaw, and produce a change in the countenance that it was terrible to look on.

Etiology.—The exciting cause of this form of cancer is to be found in local irritation of any kind, the biting of the lip being sometimes sufficient to create it in those predisposed to the deposit. Smoking of a clay pipe has also been said to excite it; but it may be doubted whether this practice exerts any influence of a specific character, the use of the pipe being very common, and this form of cancer comparatively rare.

Diagnosis.—The diagnosis is generally easy. Sometimes, however, a simple ulcer of the lip, such as that which results from a chaf or a fissure, and which it becomes difficult to heal—in consequence of the flow of the saliva over it washing away the reparative lymph—might create a doubt of its true character; but the history of the case, and the absence of any very great amount of irritation in the lymphatic glands of the neck, will generally show the simple character of the latter, and distinguish it from cancer. So, again, difficulty may occur in the diagnosis of cancer of the lip from the syphilitic ulcer or chancre, although the occurrence of chancre on the tongue or lip is not so common in this country as it is in France. As the two present different appearances, the details of the diagnosis will be given in the description of the character of chancre.

Prognosis.—The prognosis of cancer of the lip is serious; and the opinion of a positive cure should be very cautiously given; the general belief that this seat of cancer, when unaided by surgical treatment, proves fatal in about three years, and that if excised it is apt to return in a few months, being quite in accordance with the most extended experience of surgeons. But the removal of cancer of the lip by an operation is much more desirable and justifiable than the operations of extirpation elsewhere, because, although the excision does not cure the disease, it removes a disgusting source of irritation, prevents foul matters from passing into the stomach, and generally prolongs life.

Treatment.—The operation that is required for the removal of cancer of the lip depends upon the extent of the disease. If the whole lip has been destroyed, and the surgeon ventures to excise the edges of the ulcer, a plastic operation will be required—the mode of per-

forming which will be found in the volumes on Operative Surgery.¹ Where, however, the deposit is smaller, it may be removed by excising a V-shaped piece containing the cancer, and also a broad margin of the healthy structures, the wound being subsequently closed with hare lip sutures. After the operation, though the patient may be well for about two years, yet the disease will be very apt to return.

§ 6.—CANCER OF THE TONGUE.

Cancer sometimes shows itself in the Tongue, where it is presented in the form of a small tumor, which is first seen as a little flattened circumscribed swelling, situated generally opposite the first molar tooth. Or it may be a more extensive induration of tissue, accompanied by a superficial ulceration, from which fungous granulations sprout, and the pus of which being swallowed to a greater or less extent, soon aids in contaminating the system.

Etiology.—Any local irritation may cause cancer of the tongue in those predisposed to it, as the contact of hot liquids when taken suddenly into the mouth, or the rough edge of a tooth, or frequent pinching of the tongue in convulsions, &c.

Diagnosis.—The diagnosis is to be based on the characters already detailed in connection with Carcinoma generally.

Prognosis.—The prognosis of Cancer of the Tongue is much more unfavorable than that of cancer of the lip, from the fact that the matters swallowed more certainly disorder the digestive apparatus, and thus aid the disease in breaking down the patient.

Treatment.—The apparently *radical* treatment of cancer of the tongue consists in removing as far as possible all sources of irritation, by filing off the rough edge of the teeth, and giving the patient a mouth wash of honey and alum, which also contains ʒss extract of cicuta to every six ounces of the wash. If the glands beneath the tongue enlarge and become painful they may be leeches, and the ulcer on the tongue be touched with a strong solution of muriatic acid or nitrate of silver. Mr. Earl, of England, has highly recommended touching this ulcer with a solution of arsenious acid.

Where it is possible, however, it is much better to remove the tumor by the ligature, or preferably by the knife.²

¹ See Op. Surg., by the Author, vol. i. p. 357.

² See Operative Surgery, 2d edit., vol. i. p. 369.

If the knife is used, the organ should be steadied by transfixing it by a tenaculum, which an assistant may hold while the surgeon removes the diseased parts, ligates the arteries, and closes the wound by sutures. As the wound heals, the granulations, if disposed to be too luxuriant, may be touched with nitrate of silver.

Ligature of the lingual artery has also been recommended as a curative measure; the mode in which it is performed being stated in the volumes just quoted.

§ 7.—CANCER OF THE PAROTID GLAND.

Cancer of the parotid gland is a complaint occasionally seen. Generally, however, the cancerous deposit is at first made not in the gland itself, but in the lymphatic glands exterior to it; and this observation is equally applicable to all the salivary glands. As the lymphatic gland at first affected becomes enlarged, it soon invades the proper structure of the parotid, and the whole becomes one indistinguishable mass of disease, creating a tumor directly in the parotid region. This tumor is not very bulky, being generally not larger than the fist, and bound down by the dense fascia of the part. It, therefore, progresses inwardly to such an extent as to compress and sometimes completely obliterate the carotid artery; so that in operating in these cases it has occasionally been unnecessary to tie the external carotid after it was cut, the hemorrhage from the operation of extirpation being much less than might under ordinary circumstances be expected.

Prognosis.—The prognosis of this disorder when left to itself is generally unfavorable, the disease being exceedingly apt to run its course within eighteen months.

Treatment.—The palliative treatment is the same as that already detailed under the general head of Carcinoma. In regard to the curative treatment, it may be attempted by the ligation of the carotid, but generally the collateral circulation is so soon re-established that this affords only temporary benefit, and the extirpation of the tumor is therefore more reliable.

§ 8.—CANCER OF THE SUBMAXILLARY AND SUBLINGUAL GLANDS.

The primary deposit of cancer in the proper substance of the

submaxillary gland is rare, the lymphatic glands of the neighborhood being generally first involved. Neither of these glands, however, present us with any features demanding special consideration.

§ 9.—CANCER OF THE MAMMA.

Cancer of the breast is most common in females, being very seldom seen in males. As a general rule, it shows itself more frequently in the unmarried than in the married woman, and especially in those who are forty-five years of age and upwards; the disorder being rarely found in females younger than eighteen or twenty.

Symptoms.—Cancer of the breast shows itself as a small tumor loosely connected with the gland, and movable in it at first. It is generally seated not far from the nipple. As it subsequently enlarges the skin over the tumor becomes congested from the distension of its vessels, inflammation is developed, the tissue becomes fissured, and then gives out a thin serous discharge. The nipple soon becomes retracted; ulceration is developed; a portion of the ulcerated structure sloughs, and there is thus created a most offensive and irritating discharge. The skin is now often puckered, around the sore, and the entire breast appears more or less flattened, especially when it becomes adherent to the pectoral muscle. The tumor of cancer of the breast is always of a moderate size as compared with that of encephaloid. When the breast is extirpated it resembles Fig. 43.

Etiology.—The etiology of the disease is that of hard cancer elsewhere.

Diagnosis.—The diagnosis of cancer of the breast is important, as there are various non-malignant tumors of this gland with which it may be confounded. These tumors have, therefore, been arranged in a tabular form so as to facilitate examination.

The diagnosis of carcinoma of the breast from other tumors, as stated by Velpeau, may be made by the following comparison of it with—

Fig. 43.



Cancer of the Breast after it has been removed and bisected; showing the flattening of the gland and the retraction of the nipple. (After Liston.)

I. *Chronic mammary tumor*.—This occurs before thirty-five; in healthy constitutions; is circumscribed; rounded; not painful; quite movable; and increases very slowly.

II. *Irritable mammary tumor*.—This is mostly seen before middle age; in nervous habits; it is not large, nor well defined; is tender, painful, and often accompanied by general swelling of the bosom.

III. The *Adipose tumor* has great size, elasticity, regular surface; mobility, freedom from pain, and generally occurs in healthy females.

IV. *Scrofulous tumor* (or tuberculous tumour of Velpeau) is seen in early life in those of scrofulous habits. This tumor is large, irregular, indistinct, not painful, and varies in size at different times.

V. *Cancerous tumors* are generally seen between forty and fifty, often in those whose relatives have likewise suffered from the complaint. They are painful, the pain being of a lancinating character; are hard and irregular; move with the gland, but not *in* it like the chronic mammary tumor; contract adhesions; pucker the skin; depress the nipple; ulcerate and develop hectic fever. They are also often accompanied with the pallor or yellow hue of the skin spoken of in connection with the cancerous cachexia.

VI. The *Encephaloid tumor* occurs in young patients; it is large and elastic; consists of two or more lobules; increases rapidly; ulcerates, bleeds, creates a fungus, and sloughs extensively, wearing out the patient's strength with great certainty through the renewed hemorrhages and hectic fever.

Prognosis.—The prognosis of cancer of the breast is that of carcinoma generally. The prognosis after an operation will be stated after the account of the treatment.

Treatment.—The indications in the treatment of cancer of the breast are the same as those mentioned in the general treatment of carcinoma; but the frequent development of this disorder in the female breast, and the intense suffering, both mentally and physically, which it induces, demand a more special consideration at present. When a tumor presenting the hardness, pain, and other symptoms of scirrhus, forms in the breast, it should be regarded as a source of irritation, and it will be found to be good practice to leech it freely all *round* its base or a few lines *from* it, so as to abstract the blood without increasing the irritation in the tissue of the tumor. After free leeching, apply for twelve hours the

warm water dressing, or a warm poultice, giving the patient a thorough purge, and following it by a moderate dose of anodyne, such as Dover's powder. To retain a poultice or other warm dressing in position, and support the breast so as to prevent its dragging on the lymphatic vessels and the adjacent cellular tissue, fold a handkerchief into the shape of a triangle; place the dressing on the breast; lay the apex of the triangle over the shoulder of the affected side; carry its base obliquely across the chest, from the opposite side of the neck under the axilla of the affected side, and tie the ends together behind the back, attaching a piece of ribbon if they are not long enough. Then placing a hand on the breast as thus covered, draw the apex of the handkerchief over the affected shoulder until it fully supports the breast and dressing, and fasten it by a pin to the other ends on the back. As thus dressed the patient can readily change the dressing, and yet have the breast fully supported simply by carrying the hand of the sound side over the affected shoulder and unpinning the end. After changing the dressing let her pin it as previously directed.

In order to diminish the pain, keep up the action of the perspiratory glands, and prevent the patient from handling the tumor and thus increasing the flow of blood to the adjacent parts whence it draws the materials for its development, it will prove very useful to cover the breast with the emplastrum belladonnæ, or cicutæ, or opii, or the emplastrum saponis mixed with these anodynes, and spread on kid cut to fit the breast, the plaster being retained by means of the sling of the breast, Fig. 45, which is also useful in supporting the gland and exercising the gentle pressure of a well applied bandage.

To make this, cut a square piece of muslin large enough to cover

Fig. 44.



REPRESENTATION OF THE HANDKERCHIEF CAP OF THE BREAST AS SUGGESTED BY MAYOR, OF LAUSANNE.—1. The apex of the triangle carried over the shoulder of the affected side. 2, 3. The angles, which are to be carried obliquely around the neck and axilla of the affected side. (After Nature.)

the breast, and nick it in the middle of its four sides to the extent of one inch. Have these neatly hemmed to prevent their tearing, attach along one side a broad piece of tape, as at 1, 1, Fig. 45, and also attach to its two opposite corners similar pieces of tape

Fig. 45.



A VIEW OF THE SLING OF THE BREAST.—1, 1. The horizontal tape around the waist. 2, 2. The shoulder tapes which fasten on the back to the horizontal tape. (After Nature.)

(2, 2, Fig. 45). In its application carry the tape 1, 1, around the waist so as to encircle the body, and fasten the other two tapes (2, 2) to the horizontal tape behind, by carrying them over each side of the neck and down the back.

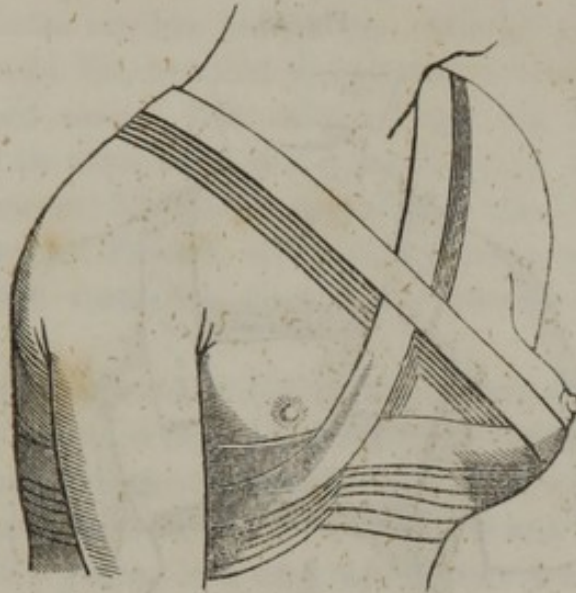
When the ulcerated stage of cancer is established this sling may also be employed to retain lint wet with liquor sodæ chlorinat., or lint covered with the powdered carbonate of iron, or with ointments of cicuta or belladonna.

The operation of excision or extirpation of the mammary gland is performed by making elliptical incisions in the skin, and then dissecting out the entire breast, with all such lymphatic glands and adjacent portions of cellular tissue as are indurated, in the manner which has been detailed in the volumes on operative surgery.¹ After removing the breast, and checking the hemorrhage, unite the wound by adhesive strips; apply over them a piece of lint spread with simple cerate; place over this a good compress, so as to pre-

¹ Operative Surgery, by the Author, vol. ii. p. 39.

vent any accumulations of pus beneath the skin, and retain the dressing in its place by carrying a four inch wide and ten yards long roller, once or twice around the waist; then coming round from the affected axilla, pass over the breast, around the opposite side of

Fig. 46.



A VIEW OF THE CROSSED BANDAGE OF ONE OR BOTH BREASTS.—When one breast alone requires dressing, the turns on the opposite breast should be omitted. (After Gerdy.)

the neck to the same axilla once or twice, and then again around the waist (Fig. 46), making a sufficient number of turns to cover in the part, allowing it to remain untouched for forty-eight or seventy-two hours, when the dressing should be renewed. As it is sometimes desirable also to support both breasts, the figure represents the bandage as thus applied, the second breast being covered like the first with alternate circular and oblique turns.

When cancer of the breast returns after an operation, it usually shows itself by the development of round masses of various sizes, in or near its original seat, as represented in Fig. 47. Such secondary tumors, as well as the primary growths, when small, may often be advantageously treated by the caustics previously advised; the caustic plas-

Fig. 47.



A view of the numerous Nodulated Tumors which often form in the cicatrix after the extirpation of the former growth. One is represented as ulcerated in the site of the mamma. (After Miller.)

ters, as well as the warm water dressings or poultices being subsequently retained in position by means of a broad band of muslin which encircles the breast and the waist, and is prevented from slipping down by the attachment behind and in front of two broad shoulder-straps, which are to be applied in the manner represented

Fig. 48.



A representation of the Body Bandage for the retention of Caustics, Poultices, &c., to the Breast. (After Nature.)

in Fig. 48. Compression of the tumor by compresses and a bandage in order to check the flow of blood and favor its absorption, has been advised by Young, of England, and in a modified form by Mr. Arnott, by means of a ring which compresses the circumference, but not the apex of the tumor. This plan of treatment has not, however, gained any extended degree of professional confidence, and, in two instances in my hands, was so great a source of irritation as to require its removal.

Prognosis of the Operation.—It appears, from the observations of Leroy d'Etiolle, Lebert, and others, in regard to the prognosis of the operation for the extirpation of cancer of the breast, that the average duration of life after the operation is two years and six months, whilst the average duration of life without an operation is three years and six months.

Paget, however, makes the time shorter, and says¹ that, of 66

¹ Lectures on Surgical Pathology, p. 525.

cases which came under his notice, and in which the disorder was left to take its natural course without an operation, the average duration of life was about forty-nine months, and that the more tender the age of the patient, the more rapid was the progress of the disease. In 47 cases operated on, the duration of the disease was somewhat longer; and he expresses the opinion that the removal of the local disease makes no material difference in the average duration of life, but that the operation retards the progress of the more rapid cases. But neither Paget nor Lebert has seen a case in which its recurrence was delayed longer than eight years. Such cases, however, have been recorded in the United States, by Drs. Hartshorne and Parrish, of Philadelphia, in one of which the patient lived, free from the disease, for twenty years after the operation.

Out of 68 cases reported by Lebert, the disease returned after the operation, in 23 cases, in from one to three months; in 22 cases, in between three and six months; in 8 cases, in between six and nine months; in 7 cases, in between twelve months and two years; in 3 cases, within three years; in 1 case, within four years; in 2, within six years; and in 2, in eight years.

Mr. Paget expresses the opinion¹ that the old rule of not operating when the lymphatic glands of the axilla are affected is a bad one, and he mentions cases to show that the operation will produce that temporary relief which alone is to be expected from it in these as well as in other cases.

"Thus, in 20 cases of the removal of the breast alone, the average recurrence of the disease was eight months, and death ensued within twenty-four months after the operation; while in 10 cases of the removal of the enlarged glands the average time of recurrence was thirteen months, death taking place in twenty-four months, or about the same period as in the other cases. He also thinks there is no evidence to sustain the rule that ulcerated cancers, and those adherent to the skin, should not be operated on."

As the opinions and statistics of the operation, as usually practised among American surgeons, have been given in full in vol. ii. p. 45 of the *Operative Surgery*, it is unnecessary to repeat them here.

Summary.—The most judicious treatment of cancer of the breast is—1. To allay the local irritation and inflammation by means of

¹ Op. cit., p. 527.

leeches, warm water dressings, anodyne plasters, and perfect rest of the arm of the affected side. 2. To improve the general health by purgatives, tonics, and chalybeates. 3. When, notwithstanding the employment of the preceding means, the tumor continues to be heavy, and is constantly painful, and a source of mental as well as bodily distress, to extirpate it, and any axillary glands that may be involved. 4. To remove small tumors by caustic. 5. To treat the reappearance of the disease by caustic.

§ 10.—CANCER OF THE PENIS.

Cancer may commence in the Penis either upon the prepuce or upon the glans, but especially upon the glans. It occurs generally in men who have passed beyond the age of fifty years, in those who have suffered from phymosis, or in whom the part has been frequently and constantly irritated by accumulations of the smegma around the corona glandis. It is also seen in sailors, carpenters, and others whose occupations are such as to expose them to injuries of the penis by contusions from ropes, the yard-arm of a vessel, &c. These causes, acting upon the penis of persons of the cancerous cachexy, generally suffice for the development of the disorder.

Symptoms.—Cancer of the penis shows itself first as a hard wart or knot in which there is no pain until it is irritated. It therefore, at first, not unfrequently causes the patient no mental uneasiness, and but little local pain. When irritated, however, the wart rapidly becomes painful, enlarges, ulcerates, extends, and creates a cancerous ulcer with everted edges and fungous irregular granulations, which gives rise to an ichorous discharge that is extremely offensive, particularly if the patient is of filthy habits, or unable from phymosis to cleanse the parts thoroughly. In consequence of the swelling in this last case, the orifice of the prepuce sometimes contracts till the urine cannot pass through it; when inflammation being developed, ulcerations occur at various points through the prepuce, by which the urine escapes, passing over and irritating the granulations which are formed in the reparative efforts. As the disease progresses, a train of symptoms appear, which are such as might naturally be expected from the locality of the disease, such as shooting pains along the line of the lymphatics of the groin, and either in one or both groins. When the lymphatic glands become in-

volved, pains are developed in the back, the glands of the lumbar region evidently participating in the disorder. The glands of the groin now usually begin to enlarge, the skin over them becomes distended; sloughing and ulceration ensue, and extensive cancerous ulcers form in this region. In the mean time, the usual constitutional symptoms of cancer have rapidly progressed; the digestive organs become deranged, the patient emaciates and presents all the appearances of the cancerous cachexy, until at last he dies worn out by hectic.

Diagnosis.—The diagnosis of cancer of the penis is a matter of some importance in reference to the operative treatment; thus it may be distinguished, for example, from venereal warts by the different color, by the ulceration, by the presence of the cancerous cachexy, by the history of the case, by the hardness and weight of the cancer, and by the comparatively light, spongy character of the warts, &c., &c. With chancre, when phagedenic, there could be but little difficulty in arriving at a correct conclusion when a truthful previous history is obtained and the duration of the disorder is noted.

Treatment.—The treatment of cancer of the penis is based on precisely the same indications as the treatment of cancer elsewhere. It may, however, be stated, in regard to this seat of cancer, that the removal of the tumor with the knife is preferable as a general rule to the use of caustic. When the disease is limited to the prepuce, the operation of circumcision may suffice for its removal; or it may even be useful to pare off the small portion of the glans penis that may be affected. But as the disease generally begins in this part, it is better when the latter is much involved to perform the operation of amputation of the body of the penis. (See *Operative Surgery*, vol. ii.) When, however, the glands of the groin are much involved, unless the penis has attained great size, which is rarely the case, it is not worth while to operate, as the inconvenience caused by the subsequent dribbling of the urine augments the patient's suffering when the disease reappears in the stump.

§ 11.—CANCER OF THE TESTICLE.

Cancer of the testicle is a very rare affection; encephaloid disease, fungus, or tumors of a benignant character, being much more

common. Great care is, therefore, necessary in the diagnosis, as it is sometimes advisable to remove the testicle for cancer, which would seldom be desirable in the chronic enlargement, which has been designated as sarcocele.

Diagnosis.—Inflammation and induration of the testis, such as sometimes accompanies gonorrhœa, simple epididymitis, or the “Hernia Humoralis” of the old writers, may be confounded with cancer of the testicle; and so, indeed, may hæmatocele, or hydrocele, particularly if they are combined with ossification of the tunica vaginalis testis. These two latter cases, however, would be at once distinguished by an examination with an exploring needle. Another condition which requires care to diagnosticate from cancer is an effusion of lymph into the cavity of the tunica vaginalis testis, constituting what has properly been known as sarcocele. One such case occurring in the practice of a most intelligent surgeon is well known to me, in which the testicle, which was perfectly sound, was removed in consequence of such a mistake. The absence of pain, of ulceration, of the cancerous cachexy, and the other symptoms of cancer should, however, suffice for a diagnosis. So, also, there may be a simple hypertrophy of the scrotum, such as occurred in the negro Nelson, whose scrotum was removed in 1837 by Dr. Picton, of New Orleans. This, however, may be diagnosed by its great bulk and by its indolent and painless character.

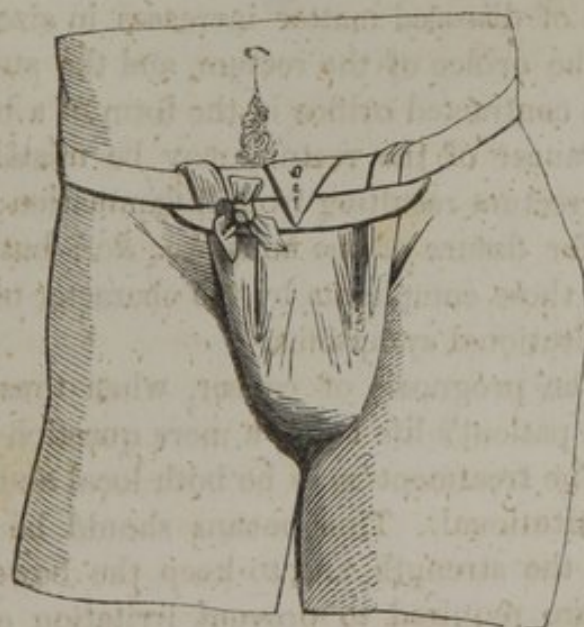
Sometimes it happens that the irritation produced by developing scirrhus will induce an effusion into the tunica vaginalis testis. Of course in such a case it will be difficult to diagnose the presence of scirrhus until after the evacuation of the serum by a trocar. To this condition the name of Hydrosarcocele was given by the old writers.

Symptoms.—Cancer of the testicle begins in the shape of a small hardened tumor, which enlarges, becomes painful, and involves glands of the groin, just as cancer of the penis did. As it enlarges the tumor invades the scrotum, which becomes adherent, tense, and ulcerated, after which the ordinary symptoms of open cancer ensue; but the ulcer in this case does not present a well-marked fungus; and by this fact, as well as by the smaller size of the tumor, cancer of the testicle can be readily diagnosed from fungus hæmatodes, or encephaloid cancer.

Prognosis.—The prognosis of cancer of the testicle is unfavorable, extirpation being generally followed by the return of the disease.

Treatment.—From the prognosis it is apparent that the treatment of cancer of the testicle is only followed by temporary relief. There are, however, many cases in which the operation of castration is justifiable, yet, before resorting to so serious a measure, the diagnosis should be made with great certainty. There is, also, a true fungus of the scrotum consisting of exuberant granulations, which, springing up from a scrofulous or syphilitic ulceration, may readily be cut down with escharotics, and then healed by the proper constitutional and local treatment, but which it is, sometimes, difficult to distinguish from cancer, unless close attention is given to the history and symptoms of the case. It may not be amiss to state here with regard to any abscesses of this organ, that great care should be taken not to pick away sloughs from the cavity of the abscess after it has been opened either by nature or by the knife; the whole proper structure of the testis having been thus picked out in strings, and irreparable mischief done through want of experience in the operator. After the testicle has been removed for cancer, the patient will, sometimes, survive longer without a return of the disease than after any other operation for a similar deposit elsewhere.

Fig. 49.



A representation of the Handkerchief Suspensory Bandage of Mayor. (After Mayor.)

During the existence of cancer, the enlarged state of the part, and the necessity of retaining a dressing upon it, render the use of the

ordinary suspensory bandage impracticable. Under these circumstances, one formed of two handkerchiefs, and applied as directed by Mayor (Fig. 49), will prove very useful. In its application fold one handkerchief like a cravat, and tie it round the pelvis, then taking the other and folding it from corner to corner to form a triangle, apply its base behind the scrotum, tie the two ends of this base to the circular cravat around the pelvis, and then turning up the summit, fasten it as in Fig. 49.

§ 12.—CANCER OF THE RECTUM.

Cancer sometimes shows itself in the rectum, where it occurs first as a deposit in the cellular tissue beneath the mucous membrane, just above the internal sphincter muscle. As the disease progresses, the deposits of cancerous matter encroach upon the mucous membrane; it ulcerates, and a thin sanies or extremely offensive ichor is discharged, which excoriates the orifice of the anus and the parts adjacent. At the same time the symptoms of the cancerous diathesis make their appearance, and pain is experienced, both locally and in the back, from complication of the inguinal and lumbar glands.

As the mass of diseased matter increases in size it produces a contraction of the orifice of the rectum, and the stool is squeezed out through the contracted orifice in the form of a broad tape.

Diagnosis.—Cancer of the rectum may be mistaken for simple stricture of the rectum resulting from inflammation; for piles; for fistula in ano; for fissure of the anus, &c., &c.; but it is to be distinguished from these complaints by the character of the discharge and of the constitutional symptoms.

Prognosis.—The prognosis of cancer, when thus seated, is decidedly bad, the patient's life being a mere question of time.

Treatment.—The treatment may be both local and constitutional, but chiefly constitutional. Thus, means should be taken to allay pain, to support the strength, and to keep the bowels free; whilst locally, means are required to prevent irritation of the diseased parts by the use of injections of a soothing character, and to correct the fetor of the discharge by the use of disinfectants.

SECTION II.

OF MEDULLARY SARCOMA, ENCEPHALOID CANCER, OR FUNGUS HÆMATODES.

The synonyms just mentioned are applied to the variety of malignant disease that is sometimes also designated as *Soft* or *Spongy Cancer*, from its consistence. The term *Encephaloid Cancer*, indicates the brain-like appearance of the deposit, whilst that of *Fungus Hæmatodes* is given to it from its disposition to produce a fungous growth, from which violent and repeated hemorrhages are very apt to occur. The best term for the complaint is certainly *Medullary Carcinoma*, as this at once indicates its true character and appearance.

Like carcinoma reticulare, or hard cancer, medullary carcinoma observes certain general laws, which are very much the same as those stated in the former variety. Thus, it has a tendency to transform the tissues in which it is deposited; to enlarge and encroach upon surrounding structures; to travel along the course of the lymphatics, and invade the nearest glands; to attack more than one point at the same time; and, when removed, the wound heals rapidly, and the disease is reproduced speedily either in the cicatrix or some other part of the body; the chief difference between the two being the greater development and more rapid course of medullary carcinoma.

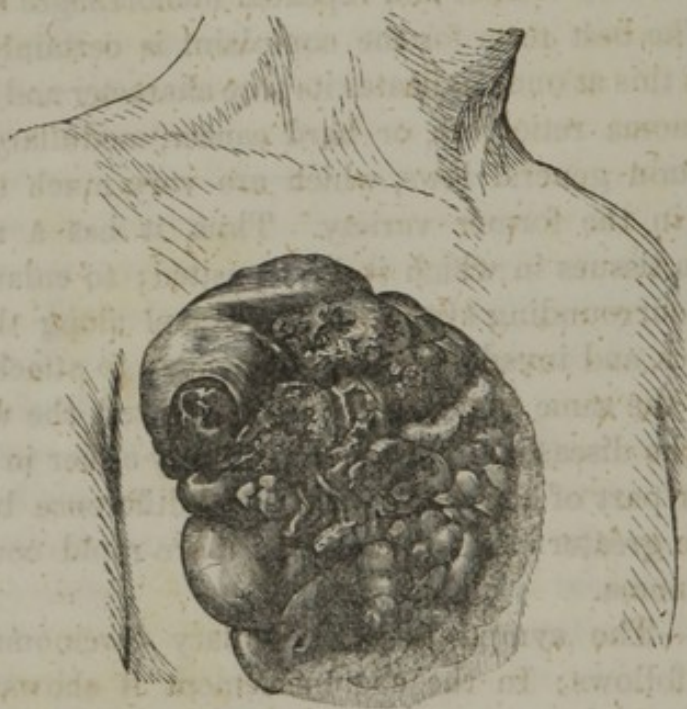
Symptoms.—The symptoms of medullary carcinoma in all its seats are as follows: In the commencement it shows itself as a small deposit which creates a moderate, defined, smooth, and even swelling. At first it is firm, and therefore may be confounded with scirrhus, but very soon the difference in consistence becomes obvious to the touch, and even in its earlier development the tumor, though firm, is not hard like cancer, and is wanting in the weight which is so apparent in scirrhus.

The congestion of the capillaries and small superficial veins over the tumor is also more marked in this variety than in hard cancer, the whole adjacent structure becoming congested with blood, whence doubtless the rapid development of this form of carcinoma. As the deposit progresses the tumor increases in size, and soon attains a considerable bulk, presenting at the same time

so deceptive a feeling of fluctuation, that a surgeon who is not on his guard, may be tempted to plunge a lancet into it, mistaking it for an abscess.

As the tumor of medullary carcinoma increases in size, its development distends all the tissues which cover it; the skin becomes thinner, and finally yields, cracks, ulcerates, and is followed by extensive sloughing of the diseased mass; or exuberant, pulpy granulations, of an imperfect shape, like a fungus, may show themselves, and sprout rapidly like a mushroom, bleeding upon the slightest touch. It is this stage of the complaint which is usually designated as *Fungus Hæmatodes*. As the fungus increases in size, being

Fig. 50.



A representation of the bleeding fungous stage of Medullary Carcinoma of the Breast, or the form often designated as *Fungus Hæmatodes*. (After Miller.)

limited about the neck by the orifice in the skin through which it escaped, it assumes more and more of the mushroom appearance, whilst the constriction of the stem destroys the vitality of the head-like fungus, and causes it to slough and bleed.

In its development inwards, the progress of the disease is such as frequently to create the absorption of surrounding parts; thus, it may destroy muscles and fascia, and encroach upon and lead to the absorption of bone itself, as is not unfrequently seen in its development in the eye, and in the bones of the extremities, where it

creates such changes as were formerly designated by writers as *spina ventosa*. These will be again alluded to.

While the tumor is small, there is generally but little pain, but as it increases in size the pain is very great, often excruciating, yet sometimes better tolerated than the pain of hard cancer, the nerves near the tumor being probably less firmly compressed in soft than they are in hard carcinoma.

The fungus which sprouts from the ulcer in medullary carcinoma is of a bloody or livid color, bleeds upon the slightest touch, and, when it sloughs extensively, gives rise to a most stinking discharge.

As the disease progresses, the neighboring lymphatic glands soon become involved, and the patient finally dies, worn out by hectic or by hemorrhage. The constitutional symptoms are such as have been described under the general head of cancer, though they generally occur in a more marked degree in this variety, and have superadded to them the constitutional symptoms which might be expected to arise from a loss of blood.

Pathology.—The pathology of medullary carcinoma has been most carefully studied, ample opportunities having been afforded pathologists, the disease being by no means uncommon, and soon terminating in death. The present position of the knowledge on the subject is as follows: The disease presents itself in two forms: in one variety a section made through the tumor shows a structure which is soft and brain-like, or rather like decomposed brain or the brain of calves; whilst in the other the substance is firmer, though not hard and tough like scirrhus, but comparatively dense, elastic, and compact, resembling somewhat in its consistence fibro-cartilage or coagulated albumen such as is obtained by boiling an egg. In the soft variety there is that deceptive sense of fluctuation, to which allusion has been made. This tumor is generally round, oval, smooth, or, perhaps, variously lobed, and extending deeply into the adjacent structure, inserting itself into the interstices between muscles, and into the cavities made in the neighborhood of bones, as, for example, between the clavicle and the first rib. In consequence of this tendency it may even receive a covering of muscle which is sometimes so attenuated—as the *Platysma-Myodes* in the case of medullary carcinoma of the neck—as to be scarcely recognizable. Or the deposit may surround vessels, such as the carotid artery in the case of medullary carcinoma of the parotid gland, where the carotid

is found passing through the middle of the tumor. In this respect soft cancer differs from scirrhus, which generally compresses the bloodvessels, and not unfrequently produces an obliteration of their cavity, but seldom or never surrounds them so that they can remain patulous and imbedded in its substance.

When a section is made of the medullary tumor, it appears lobed, and presents the outline of cysts. These are often filled with a soft brain-like matter, gray in color, often suffused with pink, which, when squeezed, yields a milky fluid that renders water turbid, but does not float about it in shreds, being the same as has been already designated as "cancer juice."

Owing to the great vascularity of the malignant structure, true apoplectic effusions are often found in its tissue, the liquid parts of the blood thus effused being absorbed, leaving a blackish or brownish deposit, resembling coffee-grounds or chocolate. According to the amount of these deposits, the vascularity of the tumor, &c. &c., the appearance of a section of an encephaloid tumor will vary considerably, a fact which at once accounts for the great discrepancies which exist in descriptions of its character.

The firm variety corresponds in shape, in seat, in size, and in constitutional symptoms with the soft, but is tougher, resembling somewhat in appearance the substance of the pancreas, or of the parotid gland. It is not nearly as hard, however, as scirrhus, and yields to pressure, though it requires some little force to compress it. In color, when it is cut through, it may resemble the soft variety, but more frequently it is yellow streaked with pink; and it does not yield the cream-like cancer juice with the same facility as the soft form, though it can be made to do so by soaking it for some time in water.

Microscopic Characters.—Under the microscope both varieties, the soft and firm, are found to present much the same characters, a delicate fibrous tissue being observed to be the stroma or basis of the deposit. It is reticulated in its arrangement, and forms cavities which contain caudate or tadpole-shaped cells with indistinct cell-walls, and not unfrequently free nuclei (Fig. 51) floating in the fluid and surrounded by a little group of granules. These cells are more caudate and have not the same dense cell-membrane as those of scirrhus, as previously described.

In the medullary deposit of the breast, Mr. Paget has seen free

Fig. 51.



Fig. 52.



Fig. 53.



Fig. 51. A microscopic view of the Nuclei of soft Medullary Carcinoma imbedded in a molecular basis substance or stroma without cancer-cells.—Magnified 500 diameters. (After Paget.)

Fig. 52. A representation of various fully-developed Cells and Nuclei of Medullary Carcinoma, as seen under the microscope.—Magnified 500 diameters. Some of them are larger than the average, others more peculiarly slender, elongated, strip-like or caudate cells, with darkly dotted granular nuclei. (After Paget.)

Fig. 53. A representation of the dotted Nuclei of Medullary Carcinoma of the Breast, described by Mr. Paget.—Magnified 500 diameters. (After Paget.)

clustered nuclei of a round or oval shape, containing four or five shining granules, but no special or distinct nucleolus (Fig. 53).

In another patient, with tumor of the head and neck and deposits in the lungs, he found the appearances shown in Fig. 54.

In the former variety of the disease the cells are more generally caudate, and by their parallel and nearly fascicular arrangement give the appearance of fibres. (See Figs. 55 and 56.)

Fig. 54.



Fig. 55.



Fig. 56.



Fig. 54. A representation of the clustered Nuclei of Medullary Cancer, composed almost exclusively of round shaded nuclei with three or four shining particles arranged in groups or clusters of five to twenty or more.—Magnified about 400 diameters. (After Paget.)

Fig. 55. A representation of the Caudate and variously elongated Cells of a firm Medullary Cancer. Magnified 450 diameters.—(After Paget.)

Fig. 56. Small elongated Cells and Nuclei with a Nucleus of the ordinary shape from a firm Medullary Cancer.—Magnified 500 diameters. (After Paget.)

The practical value of these facts is to be found in their influence on the prognosis of the result of the operation of extirpation. Thus, after having removed a tumor supposed to be medullary sarcoma, if

a microscopic examination of its substance showed that no such structure as those above represented were present, it would be a great relief to the patient and her friend, and enable the surgeon to make a much more favorable prognosis respecting the case.

Diagnosis.—Errors of diagnosis, especially in reference to the existence of an abscess, have been made in numerous instances of soft cancer, and should serve as beacons to those who may hereafter encounter it. In one case, an inmate of a public institution fell in the yard, and injured her leg near the middle of the calf. A swelling rapidly followed, which presented a sense of fluctuation so perfect that a very able surgeon, presuming that the blow had resulted in suppuration—so distinct was the sensation of fluctuation—plunged a bistoury into it for the purpose of evacuating the pus. No pus was, however, found, but from the wound thus made a fungus sprouted in a day or two, and thus soon revealed the true character of the disease. A cast of the limb is now in my cabinet. The difficulty of making a diagnosis between medullary carcinoma and abscess is indeed much greater than might at first be supposed. In both there is apt to be capillary congestion, heat of skin, pain, swelling, and often, in the tumor as well as in the abscess, a distinct sense of fluctuation, owing to effusions of blood into its cells. When, therefore, there is the slightest doubt upon such a subject, time should be taken before an attempt is made to open the supposed abscess; as by such a delay the character of the swelling will shortly become apparent. If it be an abscess, it will soon develop its characters beyond the possibility of a doubt by pointing, whilst if it is a medullary deposit the longer the soundness of the skin is maintained the better for the patient.

The hemorrhage which occurs under these circumstances can be controlled by the potential cautery, but it may be kept to some extent within bounds by pressure made upon the parts by a bandage and a compress wet with some styptic, such as the muriated tincture of iron, a weak solution of sulphate of zinc, of alum, or of tannic acid.

Prognosis.—In regard to the prognosis of medullary carcinoma, and its progress towards a fatal result, it may be said that, as a general rule, it progresses much more rapidly than scirrhus, and that its return, after removal by an operation, is also much more speedy.

Treatment.—As the general indications for the treatment of carcinomatous disorders have been already given, very little now remains to be said, except to express caution against the occurrence of hemorrhage. When this supervenes, as has been already said, caustic and the hot iron will rather add to the mischief than alleviate it, and pressure, with such means as will facilitate the formation of a clot, only can be relied on. A mass of cobweb, a piece of agaric, or of patent lint or charpie wet with the muriated tincture of iron, may be fastened on with a bandage, and so applied as to make pressure, and is the most successful mode of checking it.

If the diseased mass is to be removed by an operation, it should be done only in the early stages of the complaint. The result of such operations is, however, much more unfavorable, that is to say, the disorder reappears much more quickly than after the operation of extirpation in scirrhus. Yet, when extirpation has been performed early, it has been found to be comparatively useful, and for the reason that has already been given when speaking of the operation for scirrhus—to wit, that it removes a mass which, in sloughing, becomes so offensive as to drive off friends, and render the patient loathsome even to herself.

The progress of the disorder and the benefits from an operation, may be well seen in the comparative results given by Messrs. Paget and Lebert, in cases that have, and cases that have not been operated upon.

From these writers it appears that the average duration of life in medullary carcinoma, in cases which were not operated on, was about two years from its first being noticed by the patient, which is about one-half the average duration of life in cases of hard cancer; very few of these cases lasting as long as four years in the slow cases of cancer. But Mr. Paget¹ thinks that in some of these life was prolonged by an operation, as the average duration in some of those operated on was twenty-eight months, being four months longer than that which was obtained by general treatment without the operation. The duration of life was as follows: In 51 cases operated upon by Lebert (including 9 of extirpated cancer of the eye), 1 returned within six months after the operation, 13 between six and twelve months, 7 between twelve and eighteen months, 8 between eighteen and twenty-four months, 11 between twenty-four and thirty-six months, 3 between thirty-six and forty-eight months, and 8 above forty-eight months.

¹ Paget's Lectures, Philad. edit., p. 561.

But these results are perhaps slightly more successful than usual, as in several of the cases the deposit was situated in the most favorable parts. Thus, in the list just given, there were nine cases of fungus of the eye, where the disease does not progress as rapidly to a fatal result as in some other parts.

Prognosis of the Operation.—The prognosis of the probable period of the return of the disease varies somewhat in connection with the part operated on. Thus, a patient will live longer after the operation of castration for medullary carcinoma, than after the removal of it from any other part of the body. The eye gives the next greatest longevity, then the bones, and last of all the soft parts, of which those of the extremities present the least possible chance of success, as, after amputation of the thigh for this disorder, the patient not unfrequently dies in a few weeks, with general medullary infiltration through the lungs and other viscera.

§ 1.—MEDULLARY CARCINOMA, OR FUNGUS OF THE EYE.

Medullary carcinoma of the eyeball is not a very common disorder, yet it is seen more frequently than scirrhus of the same organ. It is also found in a different class of patients; scirrhus of the eye being seen in the aged, medullary carcinoma almost always in children, and most frequently in those beautiful fair-skinned, fine-haired, blue-eyed children, whose beauty, though too sure an evidence of the scrofulous taint, is so attractive.

Symptoms.—Often the first indication of the approaching inroad of medullary disease of the eye will be that the little patient complains of dimness of vision, or of some slight weakness of the eye, which is shown in increased lachrymation, and moderate turgescence of the conjunctival vessels, as well as of those of the sclerotic coat. Attention being thus drawn to the organ, the surgeon will sometimes see an appearance in the posterior chamber which resembles the lustre of polished steel or iron. As the disease progresses, the pupil becomes dilated and immovable, the iris changes its color, and at last a solid substance shows itself through the pupil, distends the coats of the eye by growing forwards, and protrudes the ball by growing backward, till at length the cornea and other coats of the eye burst, and a bloody fungus makes its appearance. Meantime the lids are distended, ulcerate, and present fungous granulations;

the pain becomes intense, and indicates great suffering, and a frightful appearance of the parts and of the countenance is created.

Diagnosis.—Medullary carcinoma may be distinguished from hard cancer of the eye by the difference in the age of the patient affected, by the fact that hard cancer commences in the anterior structures of the eye or of the orbit, such as the conjunctiva or cornea, or the lids, lachrymal gland, &c., while medullary carcinoma begins in the posterior part of the ball, as in the choroid coat and retina, growing from behind forwards. The size of the tumors is also different, the medullary carcinoma creating the greatest vascularity of the skin over it.

Prognosis.—The prognosis is unfavorable.

Treatment.—Some temporary relief may be afforded by extirpation of the entire eyeball in certain cases, but the disease will, of course, return and carry off the sufferer.¹

The *other seats* of this deposit are the same as those detailed under the head of Scirrhus, and require but a few words. Sometimes it is found in the Parotid Gland, where it frequently attains an enormous size. It also attacks the Breast not unfrequently; the general diagnosis and prognosis of carcinoma generally being applicable to it in all these situations.

When the disease attacks the Testicle, there is of course swelling of this gland, with great enlargement and a disposition in the deposit to travel along the course of the cord.

The disease is also seen in the Skin, in the structure of the Limbs, &c., but these do not require further allusion.

SECTION III.

COLLOID CANCER.

Colloid cancer, or the "carcinoma alveolare" of Müller, is a variety of carcinoma sometimes alluded to as a special form. It is, however, only a greater degeneration of the medullary carcinoma, and is generally found deposited in the internal organs, as in the stomach, the intestines, the uterus, &c., and therefore seldom requires

¹ For an account of the operation, see Op. Surg., vol. i. p. 292, 2d edition.

direct surgical interference. The constitutional symptoms are the same as those of medullary carcinoma.

When this form of the disease is examined under the microscope, a reticulated structure is seen filled with cells which contain a peculiar colloid, glue, or jelly-like substance, from which the disease derives its name. It is a mere degeneration of the other forms of the disease.

SECTION IV.

MELANOSIS.

Melanosis, or black cancer, is a rare variety of carcinoma characterized by the deposit of a blackish or bluish matter. It is generally found in the reticulated tissues, and particularly in those connected with the skin. It is also found in connection with the choroid coat of the eye. The microscope reveals that in all these cases the coloring is produced by a deposit of peculiar black pigment-cells.

Fig. 57.



A representation of the Cells of a Melanotic Tumor of the Cheek, which are more or less loaded with black pigment. (After Bennett.)

Mammary and *pancreatic sarcoma* were old names applied to the firm variety of medullary carcinoma, and intended to designate the resemblance in appearance between sections of the diseased mass and of the pancreas or mammary gland.

CHAPTER II.

OF BENIGNANT TUMORS.

TUMORS present a class of complaints which are interesting to the surgeon not only because they often require operative interference, but because they illustrate some of the modifications of the processes of healthy development and nutrition. So attractive has this subject proved, that these growths have been carefully studied, whilst many excellent monographs have been written upon them among which the American student may find that of his distinguished countryman, the late Dr. Warren, of Boston. With so extended a range it would be impossible, in a general treatise, to do more than give a very brief outline of their general character.

For the purpose of limiting discussion we shall confine ourselves to Hunter's definition of Tumors, although not strictly accurate, nor corresponding entirely with our present knowledge. According to Hunter, "tumors are circumscribed substances produced by disease, and differing in nature from the surrounding parts."

This definition, it will soon be apparent, is, in some points, inaccurate, for tumors may be produced by an action (such as simple hypertrophy), which cannot be properly called disease, because, as in the case of adipose and other homologous tumors, they do not differ in nature from the surrounding parts.

A close investigation of the origin of tumors would also lead to the consideration of some of the most occult questions connected with the process of nutrition, and though interesting, it is one which belongs more properly to a treatise on physiology than to one on surgery. It may, therefore, simply be stated that a tumor is generally the result of a modification of structure commencing, as Vogel says, in the organization of a blastema. Sometimes, however, tumors are formed, not from a blastema, but solely by an obstruction in the ducts of certain follicles or glands, as the ducts of the sebaceous follicles—in sebaceous tumors—or the ducts of the salivary glands—in ranula or salivary tumors—or the ducts of the

mucous follicles of the Schneiderian membrane, as in certain forms of polypus of the nose and of the uterus.

The exciting causes of tumors is unknown. They have been attributed to a great variety of causes, but it is better to confess our ignorance on this subject. With regard to their seat, it may be stated that they are generally found in connection with the areolar or dermoid tissues, and in the lymphatic and other glands.

Varieties.—Tumors may present many varieties, and have been variously classified:—

I. As *Analogous* or *Homologous*, where they consist of a structure similar to that of the surrounding parts; and 2, as *Heterogeneous* where the structure differs from that of the surrounding parts.

Then again they have been classified as *Benignant*, when the tendency of the disease is kind, and when the tumor seldom does other mischief than such as results from its bulk and its encroachment on surrounding parts; and as *Malignant*, the characters of which have been already described.

So also there are *Cystic tumors*, which consist of one or more cysts; and *Fibrous tumors*, which consist of a structure resembling the white fibrous matter of normal tissues; *Adipose tumors*, which consist of fat, and *Sarcomatous* or fleshy tumors.

A very interesting question arises in this connection. Can benignant tumors become malignant, and the reverse? With the present knowledge of histology there need be no hesitation in saying that there are circumstances depending upon the constitution of the patient, upon the diathesis, upon hereditary influences, &c., in which tumors primarily benignant may assume all the characters of malignant growths. But such change can not be accurately designated as a degeneration, the original cells not losing their true characters, though as a tumor of the benignant class may serve as a focus of irritation in a patient of the cancerous cachexia, it may become the nidus of a malignant deposit, which will subsequently blend itself with it, as it does with normal glands and healthy tissues.

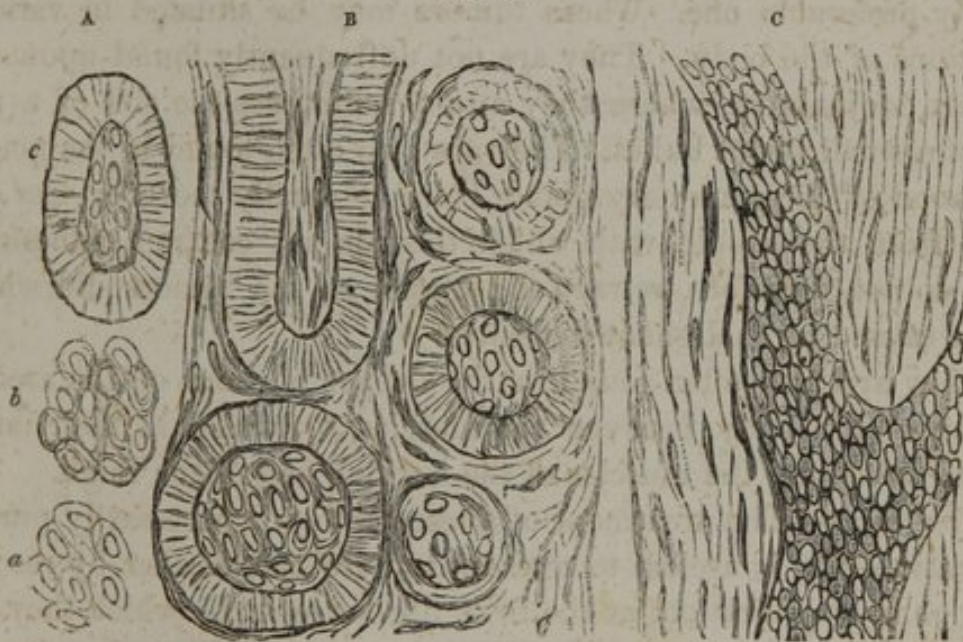
A brief enumeration of such points of the history and characters of benignant tumors as will suffice for their diagnosis is all that can now be offered.

SECTION I.

THE SIMPLE SARCOMA.

Sarcomatous tumors have been so designated because they present to the naked eye the ordinary appearance of flesh. These tumors consist either in changes of the skin due to hypertrophy, an example of which is to be seen in the case of the scrotal tumor of the negro Wilson already alluded to; or they may be due to changes in a gland in consequence of which the structure of the gland disappears and a tumor presents itself. This, when cut through, appears to be homogeneous, and to consist not of muscular fibre, as its name would indicate, but of fibrous tissue variously arranged, and the fibres of which can sometimes be seen when well developed with the naked eye. Under the microscope these tumors are found to contain cells like those of organizing corpuscular lymph, exuda-

Fig. 58.



A SERIES OF DIAGRAMS REPRESENTING MICROSCOPIC SECTIONS OF A SARCOMATOUS TUMOR, AS REMOVED FROM THE FEMALE BREAST, CONSISTING MAINLY OF THE FIBROUS STRUCTURE OF THE GLAND, WITH ENLARGEMENT OF THE INCLUDED DUCTS AND THEIR EPITHELIAL LININGS.—A. Section of the epithelium from one of the tubes. *a*. Section of epithelium. *b*. Group of epithelial cells. *c*. Same after addition of acetic acid. B. Thin section of the same tumor after the addition of acetic acid. C. Another section transverse to former, and similarly treated. (After Bennett.)

tion or granulation corpuscles. Fibres will also be observed; these fibres being like those found in the ordinary fibrinous lymph already described in connection with the subject of inflammation.

In external appearance these tumors vary very much. They vary also in size, and are most apt to occur in early life. Generally they are oval or globular in their shape, firm and doughy in feel, and present no sense of fluctuation. They are very loosely attached, and are not liable to inflammatory action, this last fact being of importance as aiding in their diagnosis. They also increase very slowly in bulk, are without pain, are surrounded generally by a fibro-cellular capsule which isolates them, and seldom degenerate, although cases will occur occasionally in which a deposit of cancer cells may be made in them in persons laboring under the cancerous diathesis.

The name by which they are designated (simple sarcoma or sarcomatous tumors) is a very objectionable one, and is a remnant of an old nomenclature based upon deceptive appearances to the naked eye, which the microscope has exploded. These tumors, properly speaking, are not sarcomatous; they are not fleshy, they contain no muscular fibres, and the name given to them by Lebert, of *Fibro-plastic*, and which indicates their true character, is an infinitely preferable one. These tumors may be situated in various portions of the body. They are not unfrequently found upon the ocular conjunctiva, where they attain sometimes the size of a pea or of a small pistol bullet. They are also often found in the neighborhood of the mammary gland, being generally more or less distant from the nipple, with which they do not contract adhesions, and do not, therefore, retract the nipple as the tumors did which were caused by malignant deposits.

They are also often found in the deeper portions of the areolar tissue of the body, between the muscles, or buried in their interstices, as among the muscles of the buttock and of the thigh.

Treatment.—The treatment of these tumors is necessarily purely operative. It is useless to attempt to cure them either by resolution or by suppuration, as the firm, fibrous sack, by which they are surrounded, prevents anything like absorption. They do not take on inflammatory action nor suppurate, and the only mode of getting rid of them is by extirpation.

SECTION II.

FIBROUS TUMORS.

Fibrous Tumors are also called *Desmoid*, from the Greek δεσμος(!) a ligament. They are firm and dense in structure, and often lobulated on the surface, being invested generally by a thick, strong sac, which surrounds them. They are circumscribed and movable independent of the surrounding tissues. When, on account of their size, they attain considerable weight, they induce elongation of the skin by traction, and hence they are very often pendulous, having a circumscribed base. They are painless, of slow growth, and have their seat in the neck, the mammary, or parotid gland, the back, the uterus, &c. The chief inconvenience which they induce is from their bulk and their pressure upon surrounding parts, as they are indisposed to take on inflammatory action, and seldom become the seat of malignant deposits, although of course that result may occur in those who are predisposed to carcinomatous disorders. They are never absorbed, and, like the sarcomatous or fibro-plastic tumors, can only be removed by extirpation. A favorite seat of these tumors is in connection with the bones, which sometimes they cause to be absorbed, producing, according to their position, deformities, which are very striking in certain localities, as, for example, where the antrum Highmorianum is involved, this locality being one of the most common seats of the complaint.

SECTION III.

ADIPOSE OR FATTY TUMORS.

The class of *Fatty tumors*, to which in old times the name of adipose sarcoma was applied, but which are better designated as adipose tumors, present various characters. To the eye they resemble ordinary fat, but, when examined with the microscope, present crystals of margarin and cholesterin, with cells containing a peculiar fatty matter, which has been designated as "Cholesteatoma" by Müller.

Fig. 59.



Fig. 60.



Fig. 59. A representation of the Structure of an Adipose Tumor removed from the Back. *a*. Isolated cells, showing the crystalline nucleus of margaric acid. (After Bennett.)

Fig. 60. A view of Cholesteatoma or Fatty Tumor removed from under the Tongue. It was as large as an orange. (After Liston.)

SECTION IV.

LIPOMA.

By the term Lipoma is designated a tumor consisting of cells which present a marked resemblance to the ordinary cells of fat. Such a tumor, when cut through, appears simply like a mass of ordinary fatty tissue.

Lipomatous tumors present the following general characteristics. They are generally lobulated, globular, oval, or cylindrical in their

Fig. 61.



A representation of the Lobulated Lipomatous Tumor, with its various lobuli. (After Miller.)

shape. They are elastic to the touch, and in true *Lipoma* give a sense of fluctuation which is very deceptive. Like fibrous tumors, or fibro-plastic, when they attain any very great size, they are apt to become pedunculated from stretching the skin by their weight. Their growth is slow, but steady; they are never absorbed, and cannot be discussed: they must, therefore, be extirpated, if the patient is disposed to get rid of them. They are not very vascular, and, when they are removed by operation, do not generally bleed freely; and although hemorrhage takes place occasionally from the cut edges of the skin, it is seldom of a character to require the ligature.

SECTION V.

ENCYSTED TUMORS, OR WENS.

The Encysted tumors, or Wens of common language, demand also a brief notice. The term wen is indiscriminately applied by the vulgar to all swellings of a chronic character. It should, however, be restricted to a class of tumors which are variously formed of cysts or sacs. Sometimes they consist of condensed areolar or cellular tissue; and sometimes the whole tumor is only the result of the obstruction of the ducts of certain glands or follicles, the cyst being formed by the enlarged and hypertrophied duct. Such is sometimes the case in obstruction of the duct of the submaxillary gland, where the tumor is designated by the special name of *Ranula*. Sometimes the obstructed duct is that of a sebaceous follicle, and then of course the tumor will contain sebaceous matter.

These encysted tumors have sometimes been designated as *Cysto-Sarcomatous*, an improper name, to which the objections already urged against the name *Sarcoma* will apply. One point may be mentioned here which is of practical importance, and that is that if in the removal of the tumor any portion of the cyst be allowed to remain, it has been found that the patient is liable to a repetition of the complaint, this being particularly the case in those forms of encysted tumors which are due to the obstruction of the ducts of glands. Encysted tumors are not unfrequently seated in the scalp, in the eyelids, in the cheeks, and upon the neck.

Treatment.—In the cure of these tumors it is essential that they should be thoroughly extirpated, the sac being entirely removed, either by the knife or caustic.

There are certain old names used to designate these tumors, derived from the appearance of their contents, rather than from

Fig. 62.



Example of the *Cysto-sarcomatous Tumor of the Breast*—the cysts being distinctly lined by a secreting membrane, and filled with a glairy fluid. The cells are part of the original structure dilated. (After Miller.)

their structures—such as melicerous, atheromatous, and steatomatous.

By a *melicerous* tumor is meant an encysted tumor, the contents of which bear a resemblance in appearance to honey (from the Greek word μέλι, Honey).

The term *Atheromatous* was applied to tumors containing a thicker material than the contents of the melicerous tumors, and was bestowed upon them on account of their consistence, resembling that of pap; the derivation being the Greek word ἀθήραε, signifying pap.

Then, again, there are other encysted tumors, to which the term *Pilous* is applied, from the fact of their containing hair. How the hair gets into this position may be conceived when it is remembered that these encysted tumors are often due to the obstruction of the duct of the sebaceous gland, and that the sebaceous glands are closely connected with the hair follicles, the latter often opening into them. It can therefore be easily understood that when a hair follicle becomes so involved as to get within the cavity of such a tumor, the hair may continue to grow, perhaps more rapidly than normally, on account of the hypertrophied condition of the parts, until a considerable amount of it will have accumulated. There is another class of pilous tumors sometimes found externally, although more frequently in connection with the ovary, which consist of the remains of a degenerated and disorganized foetus. Such tumors frequently contain not only hair, but also bones and teeth.

Treatment.—When it is intended to extirpate encysted tumors, a bistoury should be run through both the skin and the tumor, so as to slit them open; after which one-half of the sac should be seized with one pair of forceps, whilst the skin of the corresponding flap of the wound should be held by another, when the sac can be drawn out. If any little portion remain it should also be removed or cauterized freely, lest it continue to secrete, and thus reproduce the tumor. This plan of evulsion is a much simpler and expeditious mode than thoroughly dissecting out the sac without rupturing it, and there is less danger of hemorrhage, because the little vessels supplying it with blood are lacerated and not cut.

SECTION VI.

CHONDROID TUMORS.

Another variety of tumors are those to which the name of *chondroid* or *enchondromata* has been applied, on account of their resemblance to the general characters of cartilage. These tumors are often found in connection with the bones, with the joints, and with certain glands, as the testicle, mammary, sub-lingual, and the parotid glands, whilst many other forms of tumors will often take on this chondroid character. The enchondromata or chondroid tumors are composed of a mass of cartilage-like material, or of numerous masses, held together by condensed fibrous tissue. They are hard, especially to the touch, when they have a bony base, and, when cut into, act precisely like gristle or cartilage. In their chemical characters they are identical with foetal cartilage, containing, like them, large quantities of that peculiar modification of gelatin which is known as chondrin. Like the tumors already described, these can only be removed by extirpation. Under the microscope, chondroid tumors present a great diversity of structures, which Mr. Paget¹ describes as follows: A basis or intercellular substance, variable in quantity, the cells or nuclei lying wide apart (Fig. 63); in some closely crowded, and varying in con-

Fig. 63.

Fig. 64.



Fig. 63. A microscopic view of a thin section of an Enchondroma from the Pelvis. (After Bennett.)

Fig. 64. A microscopic view of the Corpuscles from the softened part of the same Tumor. (After Bennett.)

¹ Lect. Surg. Pathol., p. 423, Phil. edit.

sistence with all possible grades. Sometimes they are composed of a fasciculated tissue, in which cartilage cells lie elongated and imbedded. (Fig. 64.) Some present the typical form of healthy preparatory cartilage cells.

Osseous tumors will be treated of hereafter when we come to speak of the diseases of the bones.

SECTION VII.

TUBERCULOUS OR LYMPHATIC TUMORS.

Tubercular or *scrofulous* tumors are those which are the result of the deposit of tuberculous matter in certain structures, as the lymphatic glands, particularly those of the neck and axilla. They are usually of moderate bulk, though they may attain considerable size, especially when several lymphatic glands are involved at the same time. They are very apt to be indolent in their character, but their natural tendency is to inflammation and suppuration.

Treatment.—In their treatment they may not unfrequently be dispersed. Locally they do mischief by pressure and by exciting inflammation in the subjacent structures. As a general rule they will be benefited by the constitutional treatment proper to scrofula, as tonics, good diet, iodine, &c. &c. When chronically enlarged, indolent, refusing to be discussed, and of sufficient bulk to cause serious inconvenience, they may sometimes require extirpation.

SECTION VIII.

GENERAL RULES FOR TREATMENT OF TUMORS.

In the extirpation of the above, or indeed of any other tumors, the following general rules ought to be observed: 1. Make the external excision sufficiently large to give free room to work, there being no greater mistake than to refrain from making the primary incisions sufficiently free. 2. Select such a shape for the incision as will best give a free opening, and yet unite neatly. If the tumor is a small one, a simple V-shaped incision will suffice, the incision being commenced a little beyond the circumference of the tumor,

and drawing towards the centre for the first cut, and the reverse for the second. Larger tumors, particularly those that are pedunculated or pendulous in their character, may be removed by making two simple semicircular, semilunar or elliptical incisions. Two incisions formed in the shape of an L or a T, will give very free openings, but the freest will be obtained by making a simple crucial incision and turning back the four flaps. As a general rule all these incisions should be made from the circumference towards the centre of the tumor.

There are certain other rules which deserve to be remembered, a very excellent one being that laid down by Dr. Alexander Stephens, of New York, in a valuable paper written by him some time since upon this subject, to wit, to make the first or second cut of the knife pass down on to the tumor itself, this always being thoroughly done before commencing to dissect it out. If this rule is not followed, the surgeon may wander off from the tumor into the surrounding healthy tissues.

Another rule is in regard to the manner of using the knife, which should be held like a pen, and drawn with long sweeps; for if the surgeon holds it so that the point can be used, and pricks at the bottom of the wound with short cuts, he may open a large artery, wound a nerve, or do some other mischief, which attention to this rule would have avoided.

The *entire* tumor should be removed, and none left if possible, as the patient will then be much less liable to a return of the complaint.

In order to control the tumor, it is a good practice to pass through it, at the commencement of the operation, a large needle, armed with a strong ligature, which, after the needle is removed, should be tied in a loop, so as to give the surgeon perfect hold of the mass to be removed.

When large vessels or nerves are in the neighborhood of tumors, they should be protected from the edge of the knife by holding them out of the way by a blunt-hook.

It is also a good rule, as suggested by Langenbeck, to use the knife, and especially its point, as little as possible in the neighborhood of large vessels; the tumor being separated rather by traction with the fingers, or by the knife-handle. After the tumor is removed, the wound should be carefully examined, to see that the

work is thoroughly done, any little portions that may have been left being then removed.

In operations upon the neck, in which the large veins are involved, great care should be taken to prevent the entrance of air into them.

In the after-treatment, the surgeon should be careful not to allow the wound to unite superficially before the deeper parts have adhered. Another good rule is to keep a little piece of lint in one corner of the wound of the skin, so as to prevent its healing till the deeper parts have thoroughly united.¹

A very few words may be said in this place with regard to the microscope as a means of diagnosis, this being a point upon which there has been much discussion, and on which there is yet much diversity of sentiment. The general opinion of surgeons at present appears to be as follows: that, as a means of diagnosis, the microscope is certainly of great utility, though it must be employed with care, and seldom can be used until after the tumor has been removed, when it will materially aid in deciding finally the question of diagnosis, and confirm or relieve the fears of the surgeon and patients as to the malignant character of the disease. It should, however, be chiefly regarded as an adjuvant to the knowledge of the general characters of tumors furnished by clinical experience. When a diagnosis formed upon a thorough investigation at the bedside is confirmed by the discovery with the microscope, after an operation, of the characteristic details of certain growths, the prognosis of the result of the treatment will be rendered much more certain. The two together (microscopic and clinical observation) are as nearly perfect in their conclusions as our finite senses can make any observation; but either, alone, is liable to mislead the observer, and establish incorrect results.

¹ For further details on the removal of tumors, see the volumes on Operative Surgery by the Author.

PART IV.

OF INJURIES OF THE SOFT TISSUES.

AFTER the consideration of the varied action created in the soft tissues by the modification of their nutritive powers, as seen in inflammation and in the development of malignant and benignant tumors, the process of repair after injuries, and the formation of new tissue, is naturally the next subject that should be presented to the student's attention.

Process of Repair in the Soft Tissues.—The changes seen in the repair of injuries in the soft tissues of the body, may be briefly stated as follows: In the first place, inflammatory action being developed by the injury, lymph or plasma is effused, becomes organized, and finally approximates in its character to the general appearances of that tissue which has been destroyed, as was mentioned under the section on the effusion of lymph (page 83). That the presence of the nuclei in the adjacent tissues exercises a marked influence upon the peculiar character of the new cells formed in the plasma, seems to be probable, from the fact that lymph formed by or on the periosteum ultimately results in the development of bone, whilst that from tendons, muscles, and skin approaches more nearly to the character of these tissues. The reparative process seems also to be modified, to some extent, according as the newly effused material is exposed to the direct action of atmospheric air, or so situated as to be protected from its influence. The effect of the atmosphere on the repair of injuries of the soft tissues appears to have been early noticed by surgeons, and to have attracted the especial attention of Mr. John Hunter, who laid down the general principle that those injuries which do not communicate with the external air seldom inflame; whilst those to which it has access usually take on a degree of inflammation that is very apt to result in the establishment of

suppuration. In the first case, the repair is prompt and certain; whilst in the second it is tedious, and liable to failure. Various instances might be cited in corroboration of the correctness of this principle, such as the rapid healing of the tendo-Achillis, when divided in the treatment of club-foot by the subcutaneous section, the tendon being firmly united in this case in forty-eight hours; whilst in its division by an open wound it would be many days before the reparative process would be completed. The same thing is noted also in injuries of the hard tissues, where the process of union is much more rapid in a simple fracture than it is in a compound one, or one that has a wound in the integuments that permits the entrance of the atmosphere to the seat of injury. As the details of the reparative process in the soft tissues are usually studied under one general class of injuries, the subject of wounds may now be presented.

CHAPTER I.

GENERAL CHARACTERS OF WOUNDS.

A WOUND is usually defined as "a solution of continuity in the soft tissues, produced by violence, and communicating externally." When created, the injury results in hemorrhage, &c., as will be presently stated.

SECTION I.

OF THE HEALING OF WOUNDS.

There are three principal methods in which wounds may be closed by nature.

The first is that by "immediate union;" or the first intention of McCartney.

The second, "union by adhesive inflammation."

The third, "union by the second intention," or by granulation.

To this some writers add another under the head of "the scabbing process."

Union by the first intention of McCartney, that by adhesive inflammation and that by granulation having been already explained, the scabbing, or that process in which a wound heals under the protection of a scab or crust, becomes the first object of attention. Healing of wounds by the scabbing process has lately attracted notice, and is supposed by some to be an extremely desirable mode of union, so much so that they direct, in cases of certain wounds, and especially those which communicate with closed cavities, the creation of an artificial scab, or one made by dusting some dry powder over the wound, applying dry lint, or covering it with the white of egg or collodion and permitting it to dry. This scabbing process may, in some instances, prove useful; yet in many it is objectionable. If the scab is sufficiently complete to exclude the air, which is one benefit supposed to be derived from its use, and the wound is of any size, the discharges will be retained—be liable to burrow—to become acrid, and to retard the process of granulation; and if it is not complete enough to produce this effect it admits the atmosphere, and the benefits claimed as peculiar to it cannot possibly be obtained.

In very superficial wounds, the scabbing process answers very well, but in those of considerable depth it is objectionable. Another mode by which wounds heal is by that which is designated as the "Modelling Process of McCartney." This process being the result of the effusion of plasma, is really only a modification of the ordinary union by granulation, and although it has been much discussed, does not appear to be deserving separate consideration.

With regard to the comparative value of the two processes of healing in wounds, that is, "union by adhesion" or "union by granulation," there is a diversity of sentiment. Generally it is sound practice to seek for union by the first intention, or by adhesive inflammation in every wound, as it is the safest and most rapid mode of cure, whilst if it fails, it does not in any way retard the subsequent union by granulation.

As the production of wounds was attended by hemorrhage, the question soon arose among surgeons whether effused blood was employed by nature as a bond of union, or whether it did not retard the cure. As all wounds give rise to an effusion of blood, and this was considered in fact as "the life of the creature," the earlier surgeons believed that the blood was useful, and never removed a clot from the wound, but rather encouraged its forma-

tion in all instances. Even as late as the time of Mr. Hunter this opinion was generally maintained, and was subsequently supported by the experiments of Sir Everard Home, Carswell and McCartney, who supposed the clot to be useful because they knew it contained fibrin, which they believed capable of organization, because they had succeeded in injecting a clot.

Subsequent examination confirmed the fact that a blood-clot "might become organized and even assume the character of a tissue, coalesce with adjacent parts and become vascular,"¹ as was shown in 1845 by the experiments of Dr. Zwicky. In 1848 Mr. Paget also had an opportunity of confirming Zwicky's account of this organization in a clot obtained from the arachnoid of an insane person, where a thin layer of a pale ruddy membrane lined the whole internal surface of the dura mater, and adhered to it, whilst its color, &c., satisfactorily proved that it had been a thin clot of blood effused in apoplexy. "Numerous small vessels could be seen passing from the dura mater into this clot membrane, and while they were still full of blood, Mr. Paget made the sketch shown in Fig. 65.

"The minute structure of this clot is shown in Fig. 66, and bears

Fig. 65.



A microscopical sketch of the Vessels of a Blood-clot as made by Mr. Paget. (After Paget.)

Fig. 66.



A microscopic view of the Structure of the Injected Blood-clot. (After Paget.)

a strong resemblance in its general structure to the characters seen in the material formed for the repair of subcutaneous injuries, as in

¹ Paget's Lectures, Phil. edit., p. 120.

the substance of what appeared like a filamentous clot of fibrin sprinkled over with minute molecules, the addition of acetic acid brought into view corpuscles like nuclei or cytoblasts, very elongated, attenuated, and, in some instances, like short strips of flat fibres."¹ Notwithstanding these appearances, so analogous to the reparative process in fibrin, Mr. Paget became satisfied "that extravasated blood had usually *no share* in the repair of wounds; as the smallest portion of blood was effused in cases where the largest amount of reparative material was produced in the shortest time, and that therefore extravasated blood was not necessary for union by the first intention, though the lymph around it became organized."²

After showing how the blood-clot was removed from a wound by ejection, and how it is absorbed as unnecessary, he states the following as his conclusions, in which every experienced surgeon will doubtless coincide.

"1. Blood is neither necessary nor advantageous to any mode of healing.

"2. A large clot, if at all exposed to the air, irritates the part and is ejected.

"3. In more favorable conditions, the effused blood becomes inclosed in the accumulating plasma, and, while this is organizing, the blood is absorbed.

"4. It is probable that the blood may be organized and form part of the reparative material; but even in this case it probably retards the healing of the injury."³

As the blood-clot thus retards the healing of wounds, it might be deemed advantageous to keep the wound open until all hemorrhage had ceased, and the clots could be ejected; but this is not so, it being sound practice to close it as soon as possible and thus prevent the further flow of blood by direct contact of the sides of the wound by gentle pressure.

To illustrate the importance of promptly closing wounds in which adhesion is desired as well as the occurrence of union under most unfavorable circumstances, the following cases are cited from the work of Mr. Thompson:—⁴

When Pharavant, a surgeon of the 16th century, was in Africa, "there happened," says he, "a very strange affair; a certain gentle-

¹ Op. citat., p. 121.

² Ibid., p. 122.

³ Op. citat., p. 124.

⁴ Thompson on Inflammation.

man, a Spaniard, called Gutiers, of the age of 29 years, upon a time walked in the field and fell at words with a soldier, and began to draw; the soldier seeing that, struck him with the left hand and cut off his nose, and there it fell down in the sand. I then happening to stand by, took it up and pissed thereon to wash away the sand, and dressed it with our balsamico artificiato, and bound it up, and so left it to remain eight or ten days, thinking that it would have come to matter. Nevertheless, when I did unbind it I found it fast conglutinated, and then I dressed it only once more, and he was perfectly whole, so that all Naples did wonder thereat, as is well known, for the said Signor Andreas doth live, and can mention the same."

Bleigny also mentions a case in which, after the nose had been cut off for some time, it was applied and perfect union resulted; and Balfour records one in which a finger, being chopped off in a carpenter's shop, in cold weather, fell down among the shavings and remained some time; yet afterwards, being taken up, washed in warm wine and reapplied, perfect union occurred.

Duhamel and Hunter also performed numerous experiments on this subject, by successfully transplanting the spur of a cock to his comb, and the teeth of one individual into the mouth of another, &c. &c.

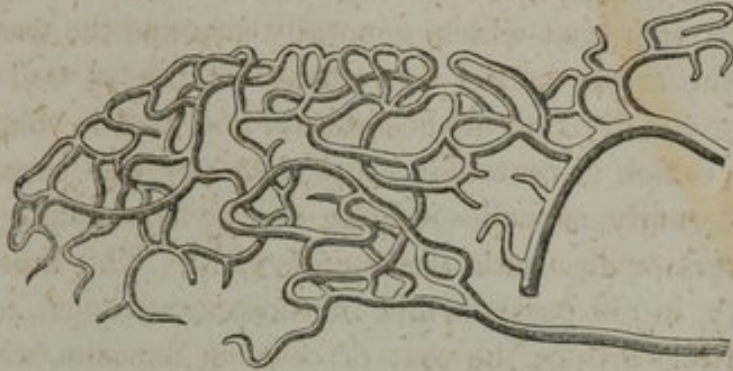
In the latter cases, though union doubtless occurred, yet it was not the result of a true adhesive process, but rather due to the effusion of lymph around the transplanted bodies and the prolongation of bloodvessels through it from the healthy tissues.

These facts, however, certainly show, that even when the separation of divided parts has existed for some time, the surgeon should attempt in case of the lopping off of small portions of the body to replace them, particularly if they are such that great deformity or inconvenience would result from the loss. The experiment may often fail, but it will also sometimes succeed, and the result justifies a trial.

The process of union in wounds by means of granulation and cicatrization yet requires a few words in addition to what has been already mentioned. When wounds heal by these processes, the coagulable lymph which is effused as the product of the inflammatory action consequent on the creation of the wound passes through the changes of the formation of granules, nuclei, and cells, and soon becomes organized by the fusiform enlargement of vessels, these

vessels soon creating granulations, and giving rise to the secretion of pus. Such vessels in a suppurating wound are usually arranged as seen in the figure.

Fig. 67.



A representation of the general arrangement of the Vessels on the surface of a Suppurating Wound, or one healing by the second intention. (After Paget.)

In the healing of wounds of such a character and extent as prevents the approximation of their sides, the lymph is simply effused on the cut surface; becomes vascular, as seen above; connects the two surfaces by the formation of numerous granulations; "forms on their surface, near the edges of the wound in the skin, a thin layer of cellular tissue, on which a very delicate layer of cuticle is soon developed, and a cicatrix commences to form; the smooth shining surface of this new cuticle giving the peculiar character to the recent scar, which is so constantly seen after the healing of all wounds."¹

The time required for these changes varies according to the amount of new material that is required; the whole process being dependent on the preservation in the part of such a degree of heat and moisture as will favor the organization of the granulations.

SECTION II.

OF HEMORRHAGE FROM WOUNDS.

An important point for study in connection with the treatment of wounds is the various means at our disposal for the arrest of hemorrhage, and in order that the student may more readily un-

¹ Paget on Repair of Tissues.

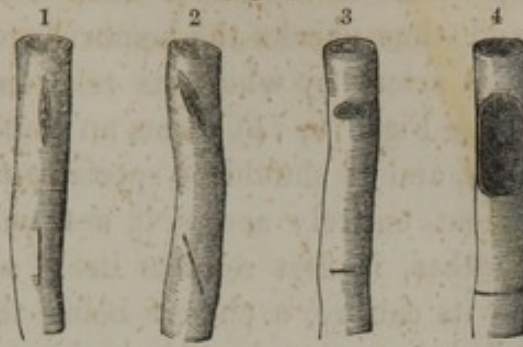
derstand this subject, a brief description of the coats of the arteries must be given, their vital action being essential to this process.

Coats of the Arteries.—The coats of the arteries are three in number: 1. The external or fibrous coat, in which Henlè has detected genuine elastic tissue, and which gives the chief strength to the vessel. It is this coat which generally sustains the traction practised upon the artery in the movements of life as well as by the ligature after the division of the internal and middle coats. 2. The middle coat, which is muscular in its character, and presents circular fibres internally, as well—judging chiefly from analogy—as longitudinal fibres or an elastic tissue externally. This muscular coat is frequently, in old persons, and in those accustomed to the free use of alcoholic drinks, the seat of osseous deposits, which make the artery so brittle that it will break off in tying it, whilst the calcareous matter keeps its orifice as patulous as a pipe-stem when the vessel is divided. 3. The lining membrane of the artery, or, as it is commonly called, its serous coat, is thin and delicate in its structure, lines the heart and arteries throughout their extent, and, like all serous membranes, readily takes on inflammatory action, the tendency of which is to adhesion rather than suppuration; a very important point to be remembered in connection with the subject of the ligation of arteries.

Besides studying the anatomical structure of the arteries, it is important to understand the physiological effects produced upon them by such wounds as divide their coats, as well as to examine the steps by which nature closes them.

Effects of Wounds on the Arteries.—After an artery has been wounded, certain changes occur which vary in accordance with the line of the incision; these changes being chiefly due to the contraction of its muscular coat. Thus, a simple perpendicular cut through the coat of an artery, becomes, in consequence of this contraction, a gaping wound. (Fig. 68, 1.) An oblique cut (2) gives a wound like that seen at the upper part of the same figure, the wound being dilated by these same contractions of the muscular coat. It follows, therefore, that a partial division or puncture of an artery, will give a more patulous orifice, and one more likely to bleed, than a wound which completely divides the vessel, because, if the artery is cut entirely across, the fibres which in a partial division dilate the wound by drawing it to each side, will, by their circular contraction, close the orifice, and thus prevent hemorrhage.

Fig. 68.



A DIAGRAM TO SHOW THE EFFECTS OF WOUNDS OF AN ARTERY AND THE ACTION OF THE MUSCULAR COAT UPON THE SIZE OF THE ORIFICE IN THE VESSEL.—1. A simple longitudinal incision, near the bottom of the figure, which is represented as gaping at the upper end, under the action of the circular fibres of the muscular coat. 2. An oblique incision, with its consequent enlargement by the action of the muscular coat. 3. A transverse, but smaller wound, which gaps much more in proportion to its length than either of the others. 4. A transverse incision of the same length as those represented in 1 and 2, but causing a very wide gap by the action of the elastic coat of the artery. (After Liston.)

Hæmorrhage resulting from the division of an artery may be arrested either by natural or by artificial means, such means being designated as hæmostatics (*αἷμα, blood, στασις, stagnation*).

§ 1.—OF NATURAL HÆMOSTATICS.

The means by which nature checks hæmorrhage are to be found, first, in the arrest of the local circulation, and the formation of a coagulum, or clot, which takes a certain position, and plugs up the vessel and wound, so as to check its further flow. If the artery is simply punctured, the blood will escape from it, in consequence of its gaping, and be effused into the surrounding tissues so as to form a clot in them, while, owing to the retraction of the coats of the vessel, the wound in the artery will no longer correspond with that in the skin. The blood that continues to escape will, therefore, also form a plug

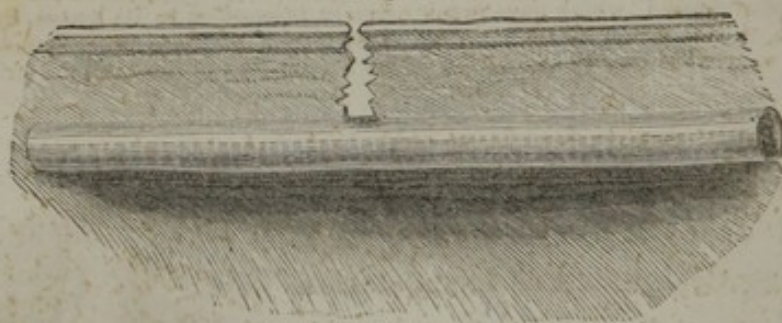
Fig. 69.



A PLAN OF THE NATURAL ARREST OF BLOOD IN A WOUNDED ARTERY.—*a*. Shows the divided end of the artery, which has assumed a conical shape by the contraction of the circular fibres of its muscular coat. *b*. The sheath of the artery left vacant by the retraction of the artery through the contraction of its elastic tissue; the sheath is seen as occupied by a clot. *c*. The clot or coagulum of blood projecting from the orifice of the sheath. (After Jones.)

in the surrounding sheath of the vessel until it closes the wound by a firm mass, and thus checks the hemorrhage. (See Fig. 69.) The retraction of the artery by which its relation to the external wound is changed (see Figs. 70, 71), forms an important fact in the study of hæmostatics, and it should be specially remembered, that when an artery is cut entirely across, it not only contracts, but also retracts; or rather, it first retracts itself within its sheath, and then contracts its calibre, a change being thus made in the relative position of the opening in the vessel and in that of its sheath (see Fig. 71); the contractile and retractile force both act-

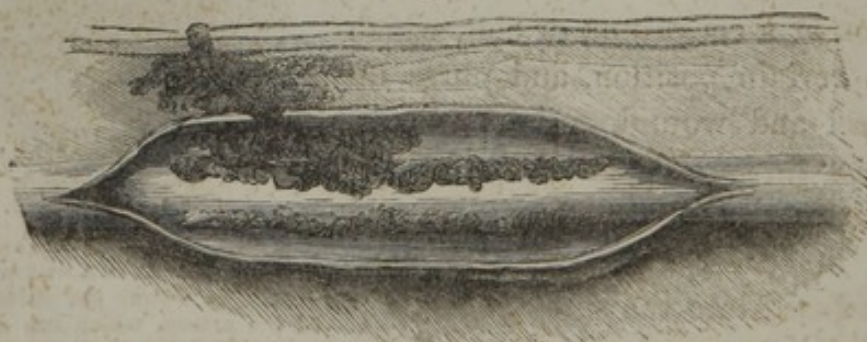
Fig. 70.



Plan of a Punctured Wound of an Artery immediately after its production; the wound in the integuments and the vessel being uniform and continuous, and thus favoring hemorrhage. (After Miller.)

ing to draw the artery within its sheath, and cause it to assume a conical shape. (Fig. 72.) By this action the connection of the clot

Fig. 71.



A Punctured Artery, showing the change in the openings in the integuments and in the vessel, with the infiltration of blood and the formation of clots both within and without the vessel; that within becoming adherent to its coats, and thus firmly fixed. (After Miller.)

which forms in the vessel and adheres to its sides is facilitated, the latter being also supported from without by the external clot.

A few minutes, therefore, after the entire division of an artery, its orifice no longer corresponds with the cut end of the sheath, but must be drawn out with the forceps or with the tenaculum before it can be tied with advantage.

The natural means of arresting hemorrhage owe much of their success to the fact that loss of blood produces syncope, and a diminution of the force of the heart in consequence of the want of action in the brain, resulting from a diminution of its usual supply of blood. During syncope the hemorrhage ceases, because the blood being no longer actively driven forward by the heart, clots are more readily formed, and when formed are not so readily thrown off from their attachments. Faintness is therefore a condition favorable to the arrest of hemorrhage; a fact which should be remembered, because, though wounds may not bleed while the patient is in a state of syncope, yet will they frequently do so when he revives, the heart's renewed action driving out the partly formed clots. Caution is also requisite, after surgical operations, in watching for the renewal of the circulation before closing the wound lest hemorrhage should occur subsequently from vessels whose points were at the time not apparent. But in the majority of accidents and operations, the natural hæmostatic effort should not be relied on, as it is often uncertain, and often only temporary. More permanent measures must therefore be employed, all of which have for their object the production of such a change in the condition of the artery as will lead to the formation of a permanent obstruction within the vessel, by creating a sufficient amount of adhesive inflammation to glue its walls together, and induce an entire modification of its whole structure. The arrest of hemorrhage by these means is generally described as due to artificial hæmostatics, and is essentially the same whether accomplished by the application of styptics, the ligature, cautery, pressure, or any other means.

Fig. 72.



PLAN TO SHOW THE RELATIVE CONNECTIONS BETWEEN THE INTERIOR AND EXTERIOR CLOT OF BLOOD IN THE PROCESS OF ARRESTING HEMORRHAGE BY NATURAL HÆMOSTATICS. — *a*. The external clot, or that in the wound, incorporated with the coagulum as found in the sheath at *b*. *c*. The length of the internal coagulum, which generally rises as high as the point where the first collateral or anastomosing branch is given off. (After Jones.)

§ 2.—ARTIFICIAL HÆMOSTATICS.

Action of the Ligature.—When a ligature is applied to an artery and firmly tied, it produces the division of its internal and middle coats, but does not divide the external coat or the sheath of the vessel. This division of the internal and middle coat results in inflammation of the adhesive character, in consequence of which an effusion of fibrinous lymph occurs, and the blood-corpuscles coming in contact with it adhere and form the clot which blocks up the vessel. By and by this lymph contracts, the more liquid portions of the clot are squeezed out, the lymph becomes organized by the adhesion of the clot to the sides of the internal coat, and thus glues the sides of the artery together (see Fig. 73); when it continues to contract until finally the artery becomes merely a round fibrous cord. This obliteration of the caliber of a vessel takes place as high up as the first anastomosing branch, through which, as well as by the other anastomosing branches, the blood circulates to re-join its own channel a few inches below the point at which a ligature has been applied. (See Fig. 74.) At the same time another change progresses; ulceration being established in the external coat of the artery, which, it must be remembered, was not divided by the ligature. As this ulceration soon destroys the external coat, the ligature comes away, not by any destruction or change in its own substance, as is proved by its coming off in the form of a loop, but by the vital process of ulceration which divides the coats of the artery, and thus sets the ligature free.

The older surgeons not being acquainted with this process, and supposing that the ligature came away only when its own texture yielded, paid much attention to the selection of the material of which their ligatures were composed, and wrote many treatises upon the subject. Hence buckskin, the tendon of the deer, and other animal substances which speedily decomposed when brought in contact with the discharges of a granulating surface, were once highly recommended, and even at the present day are lauded by some as affording very superior materials for this purpose.

Experience has, however, shown that any ligature that is strong enough, and that is properly applied, answers equally well.

As a fine thread cuts through a vessel sooner than one that is broader, the thickness of the ligature should be made in reference

to the size of the artery, and the length of time that it is desirable it should remain on the vessel. For small arteries a single strand of good round saddler's silk is sufficiently thick, but for the femoral

Fig. 73.



Fig. 74.



Fig. 73. A VIEW OF THE CAROTID ARTERY OF A DOG, 48 HOURS AFTER THE APPLICATION OF A LIGATURE, SHOWING ITS EFFECTS.—*a*. The internal and middle coats as divided by the ligature. The external as yet being sound, ulcerative action not being fully established. The plasma is seen in the inside of the vessel around the seat of the ligature, and a clot is represented as forming on each side of the vessel, so as to close the ends and prevent hemorrhage when the ligature ulcerates through the external coat. (After Miller.)

Fig. 74. A VIEW OF ANOTHER CAROTID ARTERY OF A DOG, six days after it was tied, showing the ulceration of the external coat, the removal of the ligature, the formation and shape of the coagulum in each end. The sheath of the vessel is shown as pinned out with external vessel as at *a*, coursing onwards to occupy the interior. (After Miller.)

or carotid arteries it is better to twist two or three strands together, having them well waxed whilst being twisted. A ligature about twelve inches long is of a convenient length for ready application.

In ligating the end of a divided artery, as in an amputation or in

a wound, it is requisite that the vessel should be separated from the adjacent nerves before it is tied, and that as little as possible of the surrounding tissues should be included in the loop of the ligature. In order, therefore, to apply the ligature, the end of the artery should be transfixed with the point of a tenaculum or seized with a pair of forceps, and drawn out of the tissues, and whilst thus held should be tied by a firm double knot, after which one end of the ligature should be cut off within a line or two of the vessel. Formerly much stress was laid upon the form of the knot, and peculiar ties were directed under the name of the "surgeon's knot," or the "sailor's knot," &c., but a simple firm double tie, drawn with sufficient firmness to cut through the internal and middle coats of the vessel, suffices, and is quite as secure as the more complicated knots.

Instead of the ligature, *Torsion* may be employed to arrest hemorrhage, the vessel being made to contract by twisting its coats in the grasp of a pair of forceps, which are usually designated as "Torsion forceps." In employing them, seize the end of the artery, hold it firmly in the grasp of the instrument, and, rotating it two or three times in the fingers, twist the vessel until its middle and internal coats yield, which they do very readily. Torsion, by lacerating these coats without at the same time tearing the external coat—owing to its greater toughness—causes the contraction and retraction of the muscular coat, and in the case of numerous and small arteries, has an advantage over the ligature, as it checks hemorrhage without delaying the healing of the parts by the presence of the ends of numerous ligatures. It is not, however, so certain in its effects as the ligature, and should not be relied on in bleeding from the larger vessels, lest it give rise to secondary hemorrhage by a subsequent relaxation of the muscular fibres.

Pressure as a means of arresting hemorrhage may be employed in two ways: 1st. By its direct application on the spot from which the blood issues; and 2d. By its application above the wound, upon the main trunk of the artery which supplies the part.

When pressure is made at the wounded point, it may be accomplished simply by placing the point of a finger on the artery, as in operations where it sometimes prevents the delay which results from the application of ligatures; or it may be made by means of a graduated compress (see Fig. 75), which should be retained on the

wounded point by a bandage. When pressure, as is most frequently the case, is required on the main trunk of the artery, it may be applied by pressing the thumb upon the artery whilst the

Fig. 75.



PLAN OF THE ACTION OF A GRADUATED COMPRESS AS APPLIED TO A DEEP-SEATED PUNCTURED WOUND OF AN ARTERY.—*a*. The wounded artery. *b, b*. The graduated compress so arranged that its apex is in immediate contact with the orifice of the artery, whilst its base occupies the wound and reaches a little above the level of the integuments. (After Miller.)

fingers embrace the limb, or by means of the padded end of a key, or some similar substance, though when such pressure is desired, it is a safer plan to employ the Tourniquet of Petit.

This consists of two plates of metal made to separate from each other by means of a screw, the plates being fastened on the limb by a good strong piece of webbing and a buckle, which is thus made to constrict the entire limb. Previous to its application, form a compress by folding three or four turns of a bandage, lay it over the course of the artery, and retain it in this position by making one or two circular turns of the bandage around the limb at this point. Then placing the tourniquet with its plates closely adjusted to each other, directly over the compress which is on the artery, carry the strap of webbing around the limb, in the course of the turns of the bandage just applied, and buckle it tightly. On turning the screw of the tourniquet the plates will then be separated, and the lower one made to act directly on the compress, and through it on the artery. In the selection of a tourniquet it is important to obtain good webbing and a buckle which is strong, and the teeth of which are not too sharp, lest it break off when on the strain, or tear through the webbing. The application of the compress and turns of a bandage to the limb prior to the application of the tourniquet tends to make the pressure more directly on the artery, whilst it also protects the skin from being chafed by the strap or by the plates of the instrument. The tourniquet of Petit checks the circulation not only in the artery, but also in the veins, as it encircles the limb. Of course, it cannot be borne for any length of time—

say over one hour—without exposing the patient to the risks of mortification.

In cases, therefore, in which it is necessary to arrest the hemorrhage by pressing upon the main artery, whilst it is desirable that the circulation through the veins should remain unchecked, recourse may be had to the Ring Tourniquet, or to Bellingham's Compressor (see *Aneurism*), which are well calculated to make firm pressure, and yet allow the circulation to go on in the rest of the limb. Another tourniquet is that which is designated as the "Field Tourniquet," from the fact that it is easily carried in the pocket, taken out upon the spur of the moment, and placed by the patient around his own limb. It consists of a single pad, and a strap which hooks on to the plate, and is promptly tightened as desired. It is a useful instrument in the case of soldiers about to go into battle. When none of these instruments are at hand, resort may be had, in an emergency, to the "Spanish Windlass," which is prepared as follows: Fold a common handkerchief into the shape of a cravat, roll it into a narrow cord, and, tying a knot in its middle portion, carry the cravat around the limb so that the knot shall come over the artery; then tying the two ends loosely together, insert a short stick into the loop, and twist it up until the compression of the artery by the knot, and the constriction of the limb, arrest the circulation.¹

Cold may sometimes be employed advantageously as a hæmostatic agent. When thus used, it creates a diminution of the capillary circulation, and is followed by a contraction of the bloodvessels. Its application should, therefore, not be carried further than the production of this result, or the usual depressing effects of cold will occur, and gangrene be induced, a point which should be constantly remembered in the treatment of hemorrhage by this agent. Various methods may be employed in its application, as by the use of a bladder, partially filled with pounded ice, and laid upon the part; or by means of lint saturated with cold water. But the use of cold water as a hæmostatic agent is objectionable in many cases of wounds, because the constant flow of the water over the part washes away the effused fibrin, and thus prevents the successful efforts of nature to form that clot which is the natural check to

¹ For many other points connected with the arrest of hemorrhage, see the *Operative Surgery*, 2d ed., vol. i. p. 215.

all hemorrhages. Moreover, in wounds of arteries of any size, cold will either fail totally, or produce merely temporary effects; and hence it may be stated to be quite unreliable, except in cases of capillary oozing.

Styptics are also frequently employed for the arrest of hemorrhage, and of these there is a great variety, as we have at our disposal all the astringents of the materia medica, and many of those substances which at the same time are more or less stimulating or tonic in their character. The *Tinctura Ferri Chloridi* of the Pharmacopœia is a very admirable styptic in many cases, and may be applied by laying a piece of lint soaked in it upon the parts; or it may be dropped into the wound, taking care that it does not come in contact with any part of such a delicate texture that it could be seriously injured by the acid which it contains. This article is very stimulating in its character, and, if it be recklessly employed, may develop such inflammatory action as will cause the wound to slough.

Tannic acid, powdered acetate of lead, sulphate of zinc, alum, kino, matico, &c. &c., in fact the whole class of astringents, have been employed, and act both by diminishing the caliber of the vessel, and promoting the formation of a clot. Like cold, styptics are adapted only to cases of capillary oozing, and are of little value where vessels of any size are involved.

The *actual cautery* is a more potent agent, and one formerly extensively employed. The instruments used for this purpose are made of iron, and of various shapes; thus, the cauterizing iron is sometimes pear-shaped, a form which is especially applicable to the cases of deep wounds in which it is desirable to cauterize a single point, as, a small artery so situated that it cannot be tied.

The cautery of such a shape as to make a linear burn may also be similarly employed, though this form is not used so much for controlling hemorrhage as for other purposes. A short cylinder, a bullet-shape, etc., have also been recommended.

Cauteries may be occasionally required by the surgeon in cases of secondary hemorrhage. When required for use they should be heated to a red heat and applied lightly on the parts, but the instrument must not be allowed to remain any time in contact with the tissues, else the eschar will be deeper than is necessary, the vessels will become adherent to the iron, and the eschar thus be dragged away. The heat thus applied checks hemorrhage by producing the contraction of tissue ordinarily seen in a burn, and

leaves a dry stiff coating over the surface which covers it and prevents the escape of blood. But this mode of arresting hemorrhage is liable, in the majority of cases, to serious objections: thus, there is always risk of troublesome secondary bleeding when the slough created by the cautery is thrown off; and this happens the more readily, because the attachments of the vessel to the stiff unyielding eschar prevent that contraction and retraction of its coats which alone are to be relied upon for the permanent suppression of the flow of blood.

Secondary hemorrhage, or that which occurs some days after the injury, may result from other causes than the removal of a slough; but although the simple slipping of a ligature may create it, or it may follow the throwing off of an eschar made by the actual cautery, yet most frequently its occurrence is indicative of diseased action, such as the contused state of the edges of the vessel, as is found in the case of gunshot and contused wounds.

Constitutional Effects of Hemorrhage.—If hemorrhage, whether primary or secondary, be not duly arrested, it produces serious constitutional disturbance. This is shown first in the state of the pulse which becomes quick, irritable, and thread-like. The pulse is not only quick, but it is frequent, counting 120, 140, or even 150 beats per minute. From the removal of the blood-corpuscles, moreover, the blood is impoverished, and there result all the symptoms of anemia, with the pallor of skin and general bloodless aspect seen in this condition from any other cause.

Constitutional Treatment of Hemorrhage.—In the constitutional treatment of hemorrhage it has been recommended to administer astringents internally. These may sometimes prove useful in cases of hemorrhage where it is impossible to get at the bleeding surface, as in the case of uterine hemorrhages, &c.; but, as a general rule, this treatment is not applicable to surgical cases. Opiates, also, by diminishing the heart's action and allaying irritation, sometimes proves useful, but the chief security in the arrest of surgical hemorrhage is to be found in a reliance on local measures. Venesection is sometimes demanded for the purpose of assisting in the control of hemorrhage, as in the case of wounds of the chest where, from excessive vascular action, the hemorrhage is troublesome, but it is only required in special cases.

Occasionally patients are seen who bleed profusely upon the most trifling injury, the prick of a needle or the scratch of a pin pro-

ducing a hemorrhage which is difficult to control. Such patients are said to possess the *hemorrhagic diathesis*, and every wound therefore to which they are exposed should be carefully watched.

§ 3.—OF THE USE AND PREPARATION OF SPONGE FOR THE
TREATMENT OF WOUNDS.

As it is often necessary to cleanse a wound in order to arrest the hemorrhage, a few words may be said in regard to the use and preparation of sponge in the treatment of wounds. When required for surgical use, sponge should be specially prepared. As found in the shops it is filled with broken fragments of coral, and if used in this condition would produce pain whenever it touched the surface; and here it may be remarked that, as a general rule, a sponge should not be allowed to touch the surface in cleansing a wound, but should be held over it filled with water whilst it is gently squeezed so as to allow the water to run down upon the wound. But if in cleaning the blood from a wound during an operation, it is necessary to wipe the surface in order to show clearly the divided ends of the vessels, it should be done by pressing the sponge lightly against it, and then allowing the sponge to expand quickly till it has imbibed as much blood as it will contain.

Preparation of Surgical Sponge.—Hammer it well whilst it is dry, and shake out as much of the sand and dust as possible; then soak it in muriatic acid, diluted with sixteen parts of water to one of the acid. This treatment will cause the sand to be decomposed with the evolution of carbonic acid. The sponge should then be washed in a solution of one ounce of carbonate of soda in a quart of water to free it from any excess of acid that may remain, and then allowed to remain for fifteen minutes in running water so as to wash away the soda, after which it will be ready for use.

SECTION III.

UNION OF WOUNDS.

After having arrested the hemorrhage by any of these means, attention must next be given to the wound from which it proceeds.

It will usually be noticed upon inspecting this that it gaps, this gaping, if the skin alone is involved, being due to the simple contraction of this tissue; but if the wound has penetrated deeper the contraction of the muscular fibre will produce the same effect on a larger scale. The surgeon will therefore be obliged to resort to various contrivances for bringing the edges of a wound into apposition; such as uniting bandages, strips of adhesive plaster, collodion, and sutures. The latter are of various kinds, consisting of the interrupted, the continued, the twisted or harelip, the dry, and the clamp suture; in the selection of which he must be chiefly guided by the position, size, depth, and character of the wound.

The *continued suture* is seldom employed in the treatment of wounds, being used generally for sewing up dead bodies in the dissecting rooms, or in post-mortem examinations.

The *interrupted suture*, so called because the stitches are made separately, is formed by passing a needle armed with a ligature from one side of a wound to the other. Having put in a sufficient number of stitches, tie them so that the knots will fall on one side of the flap, taking special care to avoid making them over the course of the wound, as they would then create irritation and retard union. In angular wounds the first stitch should be placed at its angle, and tied, the others being subsequently placed as required. The stitches of this suture should never be closer to each other than 3 or 4 lines, and seldom so close; strips of adhesive plaster, when necessary, being applied between them so as to support the parts, and take the strain off the thread.

The *twisted suture*, or, as it is more commonly called the harelip suture, on account of its employment in the operation for that deformity, was introduced by Heister, of England, who says that it was suggested to him by seeing tailors wrap their threads around the needle in their sleeves when about to lay aside their work. For this suture a pin is required, which may either be the ordinary silver-plated pin of the toilet table, or the harelip pin, with a movable point, as made by the cutler, though the latter is liable to the objection of leaving the point fast in the flesh if the pin is withdrawn before being passed through the flaps. In the application of this suture, pass the pin through the edges of the wound so as to transfix them, placing the first pin lowest down if in an angular wound such as that in harelip, in order to secure the more perfect apposition of the angles. Then wrap the ligature around

the two ends of the pin in a series of figure of 8 turns and tie them in a knot as in Fig. 76. Having made as many such stitches as the nature of the case demands, cut off the ends of the pins with a pair of bone nippers; or if the silver pin of the cutler has been employed, remove its point. Subsequently, when this suture is to be removed, make slight traction upon the pin with gentle rotation, and it will be easily withdrawn without disturbing the parts; when the ligature, which is usually glued to the flesh by the dried blood and other discharges from the wound, should be left to aid in retaining the parts for a few days, the wound being also covered and approximated by adhesive plaster until the union is firm.

The *dry suture* is made by means of strips of adhesive plaster, or bandages, fastened firmly on each side of the wound, and afterwards approximated by stitches, so as to draw its edges together (see Fig. 77). It is applicable to cases where the irritation of the stitches in the skin is likely to do mischief, as where erysipelas, or sloughing of the wound is apprehended. Another mode of closing wounds, which has been lauded very highly of late, especially in France, is by the use of the *serres-fines* of Vidal. These consist of a little clamp of wire made sometimes plain and sometimes with teeth to give a firmer grasp, and hold the parts together simply by the elasticity of the wire. They may be employed in superficial wounds. Although the inventor claims for them the advantage of not producing as much irritation as stitches, it will be found that they create more or less ulceration at the points where they are in contact with the skin.

The *quilled suture* is one of great antiquity, and is analogous in its action to the more modern "clamp suture," being especially

Fig. 76.



A representation of the Harelip, or twisted or figure of 8 Suture, as applied to the union of a Vertical Wound. (After Miller.)

Fig. 77.



A representation of the application of the Dry Suture to a Transverse Wound of the Leg. (After Nature.)

applicable to wounds in which direct union of the deep-seated as well as of the superficial parts is desired. It is made by cutting two bougies, pieces of wood, or of quill of a sufficient length to extend throughout the entire length of the wound, and arming three or four needles with double ligatures, so that a loop of each ligature will be on one side of each needle. In its formation, pass the needles through both lips of the wound, in such a manner, that all the loops shall be on one side, and all the free ends of the ligature upon the other; insert one quill through all the loops, and tie the ends of the ligatures over the other quill with sufficient firmness to approximate the parts as closely as necessary (see Fig. 78).

Fig. 78.



Fig. 79.



Fig. 78. A view of the Quilled Suture as applied to the union of deep Longitudinal Wounds.

Fig. 79. A representation of the best mode of cutting Adhesive Strips from the sheet, without breaking off the plaster. (After Velpeau.)

The *clamp suture* of Dr. Simms, of New York, will be found fully described in the *Operative Surgery*, in connection with the subject of vesico-vaginal fistula.¹

¹ See vol. ii. p. 300, 2d ed.

In closing wounds by *adhesive plaster*, the plaster should be cut into strips of proper width as follows: Give one end of the sheet of plaster to an assistant to hold, bidding him keep it tense, then make a slight cut into it in the direction of the fibres of the muslin, and holding the scissors partly closed, push them forward. The material will thus be divided with an even edge instead of being hacked, as would be the case if it is cut in the ordinary manner. The strips thus prepared should be about one-eighth or one-fourth of an inch wide, and of a length proportioned to the wound. In order to soften the plaster for use, hold the back of each strip against a bottle, or tin can filled with boiling water (see Fig. 79); after which apply one end to the most dependent edge of the wound, and bringing it across so as to approximate the edges accurately, cause the strip to adhere by pressing it on the other side of the wound. In removing these strips seize both ends and carefully raise them to the line of the wound on each side (see Fig. 80), as this avoids the danger of reopening the wound incurred by using traction upon but one end of the strip.

Fig. 80.



A representation of the proper Method of removing an Adhesive Strip from a Wound, so as not to interfere with the union of its sides. (After Velpeau.)

Collodion, or the solution of gun cotton in ether, is an article recently introduced into notice, and particularly useful in superficial wounds, and in cases where it is desired to protect the surface from the atmosphere. It may be applied by means of a camel's-hair pencil, and is at first somewhat painful on account of the ether it contains; though the pain is but temporary. It forms also an admirable dressing to any slight abrasions that may exist upon the

hands of the surgeon, when they are to be exposed to contact with the dead body, or to the irritating discharges of sores. If the wound

Fig. 81.



A view of the application of the Uniting Bandage to a deep Wound of the Muscles of the Forearm. (After Nature.)

is more extensive, it may also be used, by painting it on the surface of the skin on each side, and then applying a narrow strip of band-

Fig. 82.



The Uniting Bandage, as made with a Handkerchief, and applied to a Longitudinal Wound of the Leg. (After Mayor.)

age, which, as soon as it adheres, can readily be made to act in the same manner as the strip of adhesive plaster.

Uniting bandages present a very useful mode of closing wounds, and may be applied either by surrounding the part with a roller so slit as to permit one portion of the bandage to pass through the other (Fig. 81), which is specially applicable to the treatment, or by fastening it with a handkerchief so cut as to enable one end to slip through the opposite portion (Fig. 82).

In transverse wounds, strips of the bandage should first be fastened on each side of the wound by circular turns, and then the strips being slit as in Fig. 83, they may be drawn together so as to close the wound.

Fig. 83.



A view of the application of the Uniting Bandage to a Transverse Wound of the Thigh, the two strips being fastened on each side of the wound by the circular turns of the rollers, and then slipped through each other, as shown in the cut. (After Velpeau.)

CHAPTER II.

OF SPECIAL WOUNDS.

WOUNDS having been defined as recent solutions of continuity in the soft tissues created by violence, considerable variety is to be found in their general characters. Surgical writers have, therefore, classified them for the purposes of methodical study, under two general heads: First, in accordance with the character of the cause which created them, and second, from the region or portion of the body on which they are situated. Of the first, we have the Incised, Lacerated, Contused, Punctured, Poisoned, Gunshot, and Railroad—the latter being peculiar to modern surgery, and embracing most

of the preceding varieties—whilst the second includes all parts of the body, as wounds of the Head, Neck, Abdomen, &c.

An Incised wound is one made by a clean, sharp-cutting instrument, whilst a Lacerated wound is one that is torn by a blunt or dull agent.

The Contused wound is a division of the soft parts that is the result of a blow, which, at the same time creates more or less of a contusion or bruise.

A Punctured wound is one made by a pointed instrument, which, when it passes to any depth, is sometimes spoken of as a "Penetrating wound."

A Poisoned wound is one in which virus of some kind is introduced, and Gunshot wounds include all those which are the result of the explosion of gunpowder—whether caused by a ball, a splinter, or a blast of rocks.

All wounds of any extent, unless promptly followed by death, are liable to create general constitutional disturbance, as well as local evidences of derangement—as hemorrhage, suppuration, &c., already alluded to. Most of the constitutional symptoms are, also, those which have been previously mentioned in connection with the subject of Inflammatory Fever, Suppuration, and Mortification. These results require, therefore, no special mention at present, further than to call attention to the liability of many wounds to be followed, in many instances, by hectic fever or erysipelas. When either of these affections complicate wounds, the symptoms and appropriate treatment will be such as have been given in the Chapters which relate to them.

SECTION I.

OF INCISED WOUNDS.

The incised wound, being defined as that which is made by a sharp, clean-cutting instrument, this class includes not only such as are the result of accident, but also those made by the surgeon himself in the removal of tumors and in various surgical operations.

Characters.—The edges of the incised wound are smooth, clean, and disposed to unite by the first intention, or by adhesive inflammation; and the hemorrhage is brisk, particularly if arteries of any

size have been divided; peculiarities which are quite sufficient to enable any one to form a correct diagnosis.

Prognosis.—The prognosis of this class of wounds will generally be favorable after the arrest of the hemorrhage.

Treatment.—The indications for their treatment are: 1. To arrest the hemorrhage; which may be accomplished by some of the various means previously described under the head of Hæmostatics. 2. To remove from the wound all large clots of blood, and foreign matter of every description, such as bits of clothing, etc. 3. To coaptate the edges accurately, and retain them in position by some one of the sutures or other means already described.

4. To prevent too great a degree of vascular action; for which purpose the water-dressing may be employed when necessary.

In these wounds, especially when they are long and of some depth, sutures are preferable as uniting media to adhesive plaster, except in wounds of the scalp, where sutures are generally injurious.

Rest is of great importance in the treatment of such wounds, if of any extent, as it is impossible that they should unite, while the muscles which are involved are constantly contracting. *Position* has also an influence upon the success of the union in many cases, and it consequently becomes an important element in the treatment. As union by the first intention should generally be attempted in incised wounds, the general principles laid down when alluding to adhesion and to the organization of lymph as the result of inflammatory action will suffice for their proper treatment. When an incised wound fails to unite by adhesion, it should be treated like the healthy ulcer and made to heal by granulation and cicatrization.

SECTION II.

OF LACERATED WOUNDS.

A *lacerated wound* is one in which the injury is caused by a rough or dull-edged instrument, as a dull knife, a saw, splinters of wood, as from ships, railroad cars, &c., or from machinery in all its varied forms, especially reaping and thrashing machines, and mills in which bands are connected with drums, rollers, &c.

Characters.—Lacerated wounds present ragged, uneven, irregular

edges, which are very different from those of the incised wound. They also differ from the latter in the character of the hemorrhage, which is less free in the lacerated than in the incised wound, because the arteries are stimulated to contraction and retraction by the violence of the laceration.

They also differ from the incised wound in their mode of union, healing almost invariably by granulation, because as the injury impairs the vitality of the edges they are more or less disposed to slough. It is, therefore, generally useless to attempt to unite such wounds by means of sutures or adhesive strips.

Prognosis.—The prognosis of the lacerated is less favorable than that of incised wounds; a much longer time being required for their cure.

Treatment.—The indications for the treatment of lacerated wounds are, in many respects, the same as those just given for incised wounds, as the arrest of hemorrhage, removal of foreign bodies, and, so far as it is possible, the coaptation of the edges; but as the latter are more apt to slough in lacerated than the incised wounds, their accurate apposition is not so essential to their cure. The warm water dressing is particularly applicable to this class of wounds, the sedative influence of the warmth and moisture allaying irritation and preventing the subsequent inflammation and sloughing.

SECTION III.

OF CONTUSED WOUNDS.

Contused wounds are those produced by any cause that inflicts a bruise at the same time that it creates a solution of continuity in the tissues. With the appearance produced by a simple contusion every one is familiar, a black eye presenting a very good example of it. A black eye, accompanied with a cut upon the cheek, will therefore present a simple illustration of the condition of the parts in a contused wound.

Contused wounds being generally accompanied by more or less contusion, a slight reference to the character of the latter injury is essential.

Contusions may create four degrees of injury. In the first there is a rupture of the small superficial vessels and a consequent infil-

tration of blood into the tissues. In the second there is a rupture of the larger vessel, and an augmented effusion of blood. In the third, in addition to the hemorrhage, there is more or less alteration and destruction of structure as a result of the violence employed; and, in the fourth degree, the injury results in gangrene.

Under the head of contused wounds are properly grouped all the large class of gunshot wounds, but these will be reserved for separate consideration.

When the changes created by a simple contusion result in a destruction of tissue it creates an ulcer, not a wound, though the difference between the two is sometimes overlooked. As contused wounds and contusions are nearly inseparable, the consideration of their treatment is usually taken up under one head.

Treatment.—After closing the wound, the indications for the treatment of a contusion of the first degree are to prevent further effusion of blood and promote the absorption of that which has already escaped into the adjacent structures. Cold is, therefore, among the most valuable of our agents, the common application of a piece of raw beef, or a raw potato, or cold knife, &c., so often recommended in cases of black eye, acting simply by presenting cold to the injured parts. If cold appears insufficient, astringents may be resorted to, and cloths wetted with lead or alum water, &c., may be laid upon the part until the swelling is checked. With the changes of color, from the primary livid purple or black, to blue, and then to yellow or green, through which an ecchymosis ordinarily passes during the absorption of the effused blood, all are familiar.

In the second class, where much blood is effused, means must be employed to favor its absorption. To do this the action of the neighboring vessels must be stimulated, and particularly that of the veins, which are the most active agents in this process. Stimulating applications of various sorts may, therefore, be resorted to, as the tincture of arnica, spirits of camphor, and laudanum, all which stimulate whilst they create cold by the evaporation of their alcohol. They are also useful by their anodyne effects on the local circulation.

If the effusion of blood in a contused wound is of such a bulk that it produces great irritation, and seems likely to result in supuration, a puncture should be made, the clots pressed out, any pus that may have collected be evacuated, and the case afterwards treated as one of abscess.

In the third class, where there is destruction of structure after the hemorrhage has been arrested (and it is generally slight), the wound should be cleansed from all foreign matters, and the warm or tepid water-dressing resorted to, in order to preserve a proper circulation in parts which have had their vitality weakened by the blow.

If constitutional treatment is necessary, it should be carried out according to the principles already laid down; thus, if suppuration is established, and runs on to any extent, the strength of the patient must be supported, the principle being the same whether the suppuration is caused by a wound or by some other agent. The treatment to be adopted, should secondary hemorrhage come on, will be detailed under the head of Gunshot Wounds.

SECTION IV.

OF PUNCTURED WOUNDS.

Punctured wounds are those made by a pointed instrument. They have also been called penetrating wounds, but this is a very loose phraseology, for an incised wound may also be penetrating, as in those created by small-swords, &c. The wound in the skin in these cases may be either incised or lacerated according to the nature of the point of the instrument. More or less contusion, however, is usually present in all punctured wounds, particularly if the point inflicting the wound be blunt. In these wounds the first danger is from the injury that may be done to important organs, in consequence of which punctured wounds are generally more serious than those resulting from any other class of weapons. Thus if an artery be wounded it will bleed more profusely, and if a nerve be punctured the consequent irritation will be greater in a punctured than in any other variety of wounds; hence tetanus is more frequently met with in this class of injuries. The second danger is from inflammation leading to suppuration beneath fasciæ, and resulting, if the pus be not evacuated, at the proper period, in extensive infiltration of the tissues.

The third danger is that resulting from the presence of foreign bodies in the wound, for it may happen that the whole or a part of the instrument making the wound will remain in it, as in the case of splinters or arrow-heads. A bayonet or boarding-pike, broken off

in the body by contact with a bone, or any other substance, will, of course, add to the dangers to be apprehended.

Treatment.—The indications for the treatment of punctured wounds are, 1st, to arrest the hemorrhage, and, 2d, to allay irritation. The latter indication is, in some cases, the more important of the two, and may demand the earliest attention, as where the instrument has been left in the wound.

In the attempt to arrest hemorrhage it may be necessary to dilate the wound in order to tie the bleeding vessel, as not unfrequently a vessel which bleeds profusely from a puncture will contract and retract upon being entirely divided, to such an extent, that the bleeding will cease. Where the hemorrhage, though free, is not sufficiently so to justify the surgeon in boldly cutting down and securing the bleeding vessel, the tampon may be employed, or a piece of patent lint, charpie, sponge, or agaric, be thrust into the wound and kept there till a clot is formed.

An important point in the treatment of punctured wounds is to prevent the healing of the skin before the deeper points are thoroughly united, so as to insure a free vent for the pus, as the skin heals more readily than other tissue. Should the skin unite while suppuration is yet going on below, a large abscess would be formed, the pus from which, by infiltrating the cellular tissue, invading muscles, and other deep-seated structures, might do much mischief; but when, notwithstanding every precaution, matter yet forms beneath fascia, the parts should be incised freely to give it ample opportunities of escape.

SECTION V.

OF POISONED WOUNDS.

Poisoned wounds are those in which, in addition to the wound, there is a certain amount of noxious matter introduced into the part. These poisonous substances are varied, and do mischief in two ways: 1, by entering the circulation; 2, by their influence on the nervous system. The virus from poisoned wounds may enter the circulation in consequence of a direct puncture of one of the vessels, or from having been placed in the cellular tissue and taken up by the lymphatics of the part. When it is introduced through

the lymphatics, inflammation of those vessels or "angioleucitis" is the result, of which a familiar example among medical men is to be found in the case of a dissecting wound. The effects from the introduction of poison into the system by a wound of a lymphatic are not, however, so rapid as when the poison is introduced directly into the circulation by a wound of a bloodvessel, as it is then brought more promptly in contact with the brain and spinal marrow, and acts directly upon them in the production of depression and the whole train of typhoid symptoms which characterize these wounds. The condition of the blood, resulting from such poisoning, has been called "Zymosis," from the supposition that there was a kind of ferment at work, which changed the character of the blood, diminished its disposition to coagulate, and so altered it that it did not properly nourish or stimulate the nervous system. The class of affections attributed to blood-poisoning, from this as well as from other sources, are also often designated as "zymotic diseases." The local effects of the introduction of a poison are various, but they are generally such as show the presence of irritating matters. Thus, there may be a violent inflammation developed, which will assume an unhealthy character; pus will be formed, and this pus will also present an unhealthy character, being ichorous, and accompanied by an ulceration or sloughing which spreads with rapidity.

Poisoned wounds may be classified, according to the character of the poison introduced; as those arising from the stings of insects, from the bites of serpents, of rabid animals, &c.

§ 1.—POISONED WOUNDS FROM THE STING OF INSECTS.

The sting of insects produces a poisoned wound of the simplest class; the wound being a mere puncture, and the irritation created by the poison not very violent. They generally give rise to no constitutional symptoms, unless the number of the bites or punctures is very great, as in the case of bees, which, when swarming, have been known to cause the death of the person stung.

In the bite of the *Mosquito* or *Bedbug* there is a slight amount of irritation produced by the saliva of the insect, which is effused into the wound during the process of mastication, the wound being made in the act of feeding. These insects are, as is well known, grami-

nivorous, and only carnivorous in their habits when animal life is presented to them.

Treatment.—The salivary matters being generally acrid or acid in character, the external application of alkalies, as aqua ammonia, liquor potassæ, salt and water, &c. &c., nearly always suffices to remove the irritation.

The sting of the bee or wasp presents also the same general facts; though in these insects there is a wound made as the result of an attack, the puncture and the introduction of certain acid irritating matters secreted by a gland, and contained in a little sac at the base of the sting, being resorted to as a weapon of offence and defence. The wound made by the sting of the bee, wasp, or hornet is usually very small, but is soon surrounded by a certain amount of inflammation, as is indicated by more or less redness, pain, heat, and swelling, the latter being generally of an oedematous character. Sometimes the sting remains in the wound, and may be recognized as a fine black point like a needle. As it would prove a source of irritation if allowed to remain, it is necessary to withdraw it, and this may be done by seizing it cautiously with fine forceps; after which the application of the various alkalies will prove useful by neutralizing more or less the poison introduced.

When the bites of wasps, hornets, or bees are very numerous, the multiplication of irritation will sometimes produce constitutional disturbance, the amount of injury necessary for this purpose being much less in persons of intemperate than in those who are of temperate habits. Indeed, in persons whose constitutions have been rendered irritable by intemperance, the most trifling injuries will sometimes prove fatal; thus, there are cases on record where the individual has died from the bite of the common spider.

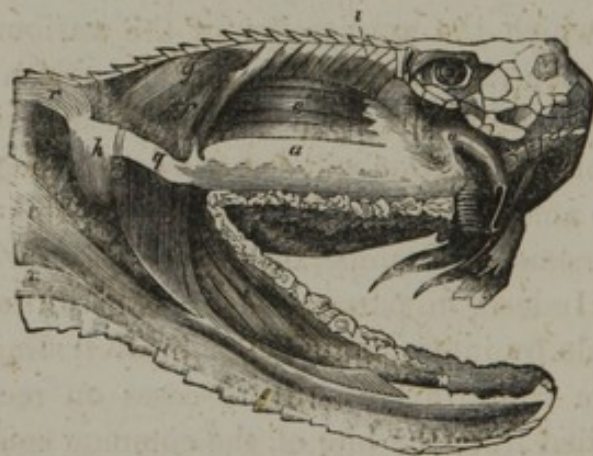
There is one case, however, in which the sting of a single bee or wasp may prove seriously injurious, and that is where it is inflicted in the fauces, as may happen when the insect is taken into the mouth in a piece of honeycomb, when the swelling of the fauces may rapidly prove fatal by creating oedema of the glottis, and preventing the entrance of air into the trachea. In such a case, cooling or detergent gargles would be the proper class of local applications; or punctures of the glottis or tracheotomy might become requisite if positive strangulation and oedema of the glottis supervened.

§ 2.—OF THE BITES OF SERPENTS.

There is a large number of serpents, capable of causing serious danger to life by their bite. It is not necessary, however, to enter into all the details of these; the Cobra di Capello and other Asiatic snakes being not likely to come under the observation of American surgeons. The Copperhead, and other venomous snakes of the United States, cause by their bite a series of symptoms which are embraced with but little variation in the following details of the bite of the Rattlesnake.

The Rattlesnake, it is said, seldom bites man except in self-defence, and generally gives warning of his presence by means of the little apparatus in his tail, from which he derives his name. In making the wound, the poison is introduced through a puncture made by a long sharp tooth in the upper jaw (see Fig. 84) correspond-

Fig. 84.



VIEW OF THE HEAD OF THE RATTLESNAKE, SHOWING THE POSITION OF THE POISON GLAND AND ITS EXCRETORY DUCT.—*a, a*. Poison gland, and its duct; the latter being cut open at its extremity. The other letters of reference relate to the muscles and ligaments of the jaw, and have no special connection with the subject surgically. (After Cyclop. of Anat. and Physiol.)

ing in position with the canine tooth in the dog. This tooth is not firmly attached to the jaw, but is movable, being acted upon by certain muscles. It is also hollow, and contains at its base a little sac, which communicates by means of a duct with the poison gland. When the snake strikes, it raises itself in a coil, throws its head back, and then strikes downward, the tooth making a wound from

above downwards; the contraction of the muscles in erecting the tooth acting upon the sac at its base, and the poison being forced out by the side of the tooth into the wound. (See Fig. 85.) The poison thus introduced may prove rapidly fatal, particularly if the wound has been made directly upon the skin, and not through clothing. Death follows most rapidly if a small vein or artery is punctured, occurring in certain of the lower animals in as short a time as nine minutes; but when the poison is simply introduced into the cellular tissue of the parts the symptoms are less imminent, and are as follows.

Symptoms.—Shortly after the puncture of the bite, a pain of a burning, tingling character is felt, which is particularly violent, and sometimes creates a brief spasm if one of the cutaneous nerves has been wounded. The part then swells rapidly, an arm that has been bitten becoming double its natural size three or four hours after the injury. This swelling is not like that of healthy inflammation, but rather resembles the oedematous swelling, with the fetid, ichorous infiltration of the cellular tissue seen in gangrene. Sometimes it goes to such an extent that the skin gives way, and the liquid products of diseased action are effused. This condition of the cellular tissue is sometimes designated as "cellulitis gangrænosa," of which I have one fine specimen in my cabinet. Should the lymphatics be the medium by which the poison is absorbed, inflammation will be noticed in their course, and enlargement of the lymphatic glands be observed; but generally the swelling is so great as to prevent this from being seen. Sometimes the wound and the adjacent parts become truly gangrenous, and large sloughs come away. Sometimes, on the other hand, it ceases to be apparent, and the course of the affection can only be ascertained by the history of the case.

The constitutional symptoms which are developed at various periods after the injury, are those of depression, which sometimes come on very rapidly, the patient dropping suddenly as if struck dead. Sometimes, and most commonly, the progress of the case is more deliberate; there are nausea, vomiting, high febrile action, de-

Fig. 85.



A MAGNIFIED VIEW
OF THE POISON FANG.
—p, p. The cavity of
the tooth. v, v. The
canal along which the
poison flows on the
outside of the tooth.
(From the same work.)

lirium, a sense of constriction in various parts of the body, typhoid symptoms, and death preceded by coma or by convulsions.

The activity of the poison and the rapidity of its action seem to depend upon the condition of the serpent; thus, one which has just bitten several other animals, will not prove so venomous as one which has not bitten anything for some time. The experiments of Dr. Barton, formerly Professor of Materia Medica in the University of Pennsylvania, and of Captain Hall, in the early part of this century, as reported in the *American Philosophical Transactions*, are very interesting in this connection. They found, upon making a serpent bite five or six chickens, or other small animals, that those last bitten did not die so soon as those first wounded. So also certain seasons seem to have their influence upon the venom of the snake, bites inflicted in August being more apt to prove fatal than those received in colder months.

Treatment.—The indications for the treatment of the bites of serpents are two: 1. To check or prevent the absorption of the virus. 2. To prevent the depression from proceeding to such a point as to prove fatal.

These indications are to be fulfilled by both local and constitutional means. The local means to be employed in fulfilling the first indication are such as attempt the removal of the poison. If the patient be in the woods at the time of the accident, and without other means, he may, without hesitation, suck the wound with the view of extracting the venom, for it has been found that when applied to mucous surfaces upon which no abrasions exist, the poison is innoxious. The wound should also be lacerated freely with some sharp instrument, to provoke hemorrhage in hopes of washing out the noxious matter. If the patient is so situated that a cupping-glass can be obtained, it should be placed over the wound, as recommended by Sir David Barry, in order to prevent absorption. Teamsters on prairies when bitten, are, I have been informed, in the habit of surrounding the limb with a tight ligature; but this can only act temporarily, and when the ligature is removed, permits absorption to go on with even greater rapidity. It has also been recommended to wash the wound with liq. ammon., or liq. potassæ, with the view of neutralizing the acid of the poison. The use of caustic has also been advised, but as it is liable to prevent hemorrhage, it may tend to promote the absorption of the virus, though its subsequent application, for the purpose of excit-

ing healthy inflammatory action in the wound, may prove useful. When the cellular tissue sloughs, and the integuments are distended by liquid effusions, as in gangrene, they should be evacuated by free incisions, and the parts covered by stimulating washes, or poultices. The constitutional treatment will vary with the stage; in some cases it may be advisable to commence by vomiting the patient and purging him freely, in order to equalize the portal circulation, irregularities in which are said to be among the first effects of the poison. But the chief indication is to counteract the depression by stimulants, such as ammonia and alcohol. Opiates have also been suggested, and may prove useful by allaying irritation, but they should not be carried so far as to add to the depression.

In regard to the alcoholic treatment of these snake wounds, it is very popular; indeed, whenever alcoholic drinks are recommended as remedial agents, *the people* are apt to be pleased with the prescription. In this case, there is a general idea that if a person bitten by a rattlesnake is able to get drunk, he will not die. It is, therefore, by no means uncommon for persons, when thus bitten, to procure a quart of whiskey and drink to extreme intoxication. I have frequently been told, by army officers and others, that such is a very common practice among the teamsters and soldiers who have come under their observation. But although this treatment has been successful in many cases, and the strength of constitution of others has enabled them to escape the ill effects of both the bite of the snake and of the alcohol, yet, if alcohol be so given that its depressing effects come on simultaneously with the depressing effects of the serpent's venom, a delicate patient would certainly succumb. A more scientific plan, and one more likely to prove generally successful, is to wait till the depressing effects of the bite begin to appear, and then to combat them with alcoholic stimulants, just as if the same symptoms came on from any other cause.

§ 3.—OF THE BITE OF RABID ANIMALS.

In the case of the bite of a rabid animal, the danger proceeds from the introduction into the wound of a modified secretion of saliva, which, under certain circumstances, becomes a real poison—at least, such is one view of its origin; whilst another ascribes its

source to the development of poison sacs, &c. The first view is certainly the most rational.

When the poisoning proceeds from the bite of a dog, it has received the name of "Rabies Canina;" though the same class of symptoms may be caused by the bite of a wolf, of a cat, and it is said also of a jackal or badger. The most common cause, however, is the bite of a dog.

A dog infected with Rabies, either from a bite or from any other cause, shows (first, according to Youatt, to whom all are largely indebted for his investigations of the subject, and from whose description I have eliminated most of this account), a change of disposition; and there is no question of this modification of disposition being due to a change in the condition of the nervous system of the animal. It is characterized by the dog first exhibiting restlessness; then becoming cross, and disposed to growl and bark at everything; then, as the disease progresses, he shows a greater or less amount of ferocity, runs wildly about, biting at every one, and even at those to whom he has been most attached. From the nervous excitement, and its effects upon the laryngeal muscles, as well as the mucous lining of the larynx and trachea, as in croup, there is a change in his voice, and he barks in a peculiar manner. The tongue is hot and the mouth dry, the animal running with his tongue hanging out, whilst he licks stones or any cold substance that comes in his way, in the vain attempt to cool his fevered jaws. Next he shows disorder in the digestive organs, as if the disease, travelling down the spinal marrow, excited first derangement in the centres presiding over the mouth and throat, and then in those regulating the digestive apparatus. The appetite now becomes morbid; he eats straw, dirt, stones, rags, anything that presents itself, and a *post-mortem* has not unfrequently shown large quantities of these substances in his stomach and bowels.

It has been established by Mr. Youatt that the popular idea that a mad dog shuns water is erroneous. There are cases on record in which the dog has given the fatal wound when in the very act of drinking; and one case occurred in England, in which a man was bitten by a dog which he took from a canal, in which the dog was playing, fearing lest he should be drowned, was seized by hydrophobia and died. Rabid dogs have also been found dipping their heads into water up to the eyes, to relieve the parched condition of the mouth and tongue.

By the bite of a rabid dog, the saliva may be introduced either by the tooth, or it may adhere to the paw, as it is thick and viscid, and the dog, after scraping it from his mouth, may scratch some one with the paw, and thus inoculate him; or a dog may lick the hand or face of his master, and thus bring the saliva in contact with some previously existing abrasion.

These facts show how the disease may originate in those cases which are occasionally reported, in which the patient is said, and perhaps truly, never to have been bitten by a dog, as the existence of Idiopathic hydrophobia in man seems highly improbable.

The inoculation having been effected, the disease may be divided into several stages for the purposes of study:—

1. The period of incubation varies widely in point of time, sometimes lasting forty days, sometimes three or six months; and cases are on record in which six or even twelve years have elapsed between the date of the wound and the appearance of the disease.

The condition of the wound also varies; generally it heals readily; sometimes, however, at the time of the commencement of the disease it suddenly becomes livid and inflamed, with the cicatrix elevated above the surrounding skin, and causes acute pain.

2. After a period of incubation of greater or less duration, the patient begins to complain of some uneasiness, and a slight irritation may or may not call his attention to the wound; his disposition is changed, he becomes irritable, and peevish or gloomy, and despondent; slight chills, followed by fever, occur perhaps several times through the day, and there are headache, loss of appetite, and general signs of nervous derangement. Stiffness of the neck and soreness of the pharynx are noticed, and perhaps pain in the epiglottis. The tongue is dry and feverish, but in the attempt to swallow a little water for relief, violent spasms in the throat are induced, because the muscles of deglutition will not carry the fluid down into the stomach. As this spasm passes off it leaves the patient in a condition of great mental distress, because he now recognizes the nature of his complaint.

A second or third effort at deglutition—for strong willed patients will sometimes persist in making the attempt, as if they could thus prolong life—produces effects which are truly deplorable, terrible spasms of the pharyngeal muscles being induced, whilst the patient, half choked, struggles for air. The eyeballs stare wildly, and become prominent, and cold perspiration stands out over the features,

which are frightfully distorted. In time the nervous irritation becomes such that the most trifling cause will bring on a renewal of the spasms; the slightest noise, the closing of a door suddenly, the air from an open window, the breath from the mouth of a friend, produce spasms of the most terrific order. Now, also, appear that dislike and terror of fluids which have given its name to the disease, the patient associating the idea of fluids with his spasms, because it was during swallowing that they first appeared. He, therefore, dreads their approach, and the mere sight of them will often be sufficient to throw him into uncontrollable convulsions.

From nervous excitement and derangement of the innervation of the laryngeal muscles, there is now also alteration in the character of the voice, which becomes hoarse and peculiar, so that the patient is often popularly said to bark like a dog.

As the disease progresses, the thick viscid saliva accumulates and impedes respiration, and the patient, to get rid of it, hawks and spits violently in all directions. This occasionally gives rise to great fears among his friends, lest they should be inoculated, but there is no danger of such a result, unless the matter should come in contact with an abrasion or wound, a fact which should be impressed upon the minds of the friends, or fear will sometimes interfere with the dictates of humanity.

Maniacal excitement now comes on; the patient rushes wildly about, and attempts to destroy himself, or to injure those who surround him. In this he should be restrained by a couple of stout assistants, and not by the straight-jacket, if it can be avoided, for while the latter secures the friends it does harm to the patient.

This state of things, however, cannot last long, and the patient dies, asphyxiated, exhausted, or in convulsions.

A post-mortem examination shows that the symptoms must have been due chiefly to nervous derangement, as there is usually congestion of the great nervous centres, the brain and spinal marrow being more or less tinged, whilst there is also an inflamed condition of the mucous membrane of the fauces and stomach.

Some time ago, in the post-mortem examination of dogs dying from hydrophobia, little yellow follicles were found under the mucous membrane of the tongue, and these were supposed to be the efficient cause of the disease; but further examination has shown them to be merely the result of follicular inflammation, and

that the appearances in question are only the mucous follicles of the tongue distended with pus in consequence of inflammation.

Certain authors have gone so far as to deny that hydrophobia has any real existence, and the fact of its extreme rarity has aided them in this supposition, they having ascribed all the phenomena just detailed to tetanic spasms. But this opinion cannot be maintained, as the disease has been observed too frequently and too carefully for us to doubt its existence. I have personally seen one case, and fortunately but one, for I shall never forget the horrors of the death of the man in whom it occurred. Those familiar with the signs of tetanus, moreover, will at once perceive that the symptoms just described are very diverse in their characters. In tetanus the mind is generally clear to the last, and the patient quite rational and without any of those maniacal symptoms which have been described. In tetanus the spasms involve the whole frame: there is opisthotonos, emprosthotonos, or pleurothotonos. In hydrophobia the muscles of the throat only are involved, so that I consider disbelief in the existence of the disease entirely gratuitous, and the confounding of it with tetanus an error.

Treatment.—The *treatment* may be divided into two stages:—

1. That proper immediately after the bite, or the prophylactic.
2. That proper after the disease has fairly set in. I cannot call it the curative, for it is doubtful whether any patients affected with true hydrophobia have recovered.

Immediately after receiving a bite from an animal known to be rabid, the parts containing the wound should be cut out, and the actual cautery or caustic potash applied. If the patient dreads the pain of the operation he may be etherized; *this is a certain preventive if it be properly done*, even if practised several days subsequently.

Mr. Youatt was bitten, or permitted himself to be bitten over and over again, and by pursuing this treatment never suffered any inconvenience, but has lived to write many excellent works, and to that on the dog we are largely indebted for our knowledge of hydrophobia.

After the disease has fairly set in, various plans of treatment have been suggested; it has been advised to bleed *ad deliquium animi*, and to keep the patient immersed in a warm-bath. Magendie thought a cure could be effected by the injection of warm liquids into the blood. Blisters to the spine have their advocates, and so has ice to the throat. The introduction of the woorari poison into the system

so as to produce asphyxia has also been suggested in the hopes that as the patient recovered from the effects of this potent agent he would be found to have escaped from the disease.

Chloroform and ether have been given with a view of producing anæsthesia. Tracheotomy, as suggested by Dr. Physick, of Philadelphia, has been performed under the idea that constriction of the larynx producing suffocation was the cause of death, but the patient has died even when the operation has been performed early in the disease. All these various remedies will doubtless fail when applied to a well-marked case; and there is, in fact, no successful treatment known, after the disease is thoroughly developed. All, then, that can be reasonably expected to be done is to add as much as possible to the comfort of the patient until death closes the scene. But the hopelessness of this treatment should only stimulate both patient and surgeon to the most thorough cauterization of every wound made even by a *suspected* animal.

§ 4.—OF DISSECTING WOUNDS.

Dissecting wounds are poisoned wounds which arise from the irritation produced upon the hand or arm by wounds from instruments used in making dissections or post-mortem examinations, or from scratches with spiculæ of bone, or from absorption, by the long-continued immersion of the hands in the fluids of the bodies of patients who have died of certain diseases, as peritonitis and erysipelas. The accounts of this subject in most of the books have reference rather to the complaint as it exists in Europe, than as it is observed in this country, and to the results of post-mortem examinations, than of wounds created by medical students during a course of dissections.

As a general rule these wounds, when troublesome, are produced by a puncture; injurious consequences seldom resulting from an incised wound, probably because of the more free flow of blood washing out the virus.

When serious symptoms result, the promptness with which they are produced, and their severity, appear to be dependent rather upon the constitution of the individual wounded than upon the character of the dead body from which he has been inoculated, a simple punctured wound unconnected with any poisonous matter

having been known to produce all the symptoms of angioleucitis or inflammation of the lymphatics usually observed in this class of wounds. Thus, the slight pricking of the finger with a needle or pin, in persons whose constitutions have been impaired by any cause, as by confinement in the wards of badly-ventilated hospitals, has been known to produce a train of symptoms closely simulating those of the dissecting wound. Wounds received during post-mortem examinations act much more frequently as an exciting cause than dissecting wounds, because the various solutions, such as the chloride of zinc or the salt mixture now usually employed for the preservation of the dead body, so modify the putrefactive processes as to render the wounds received quite innoxious in the great majority of cases. Wounds which result from injuries received in the dissection of subjects thus injected, have, therefore, rather the character of irritated than of poisoned wounds. The treatment is in consequence simpler, the recovery more rapid, and it is one great recommendation of these antiseptics in practical anatomy, that, whilst preventing odor and keeping the atmosphere pure, they also protect the constitution of the student, and modify the consequences of the wounds which sometimes follow its careless prosecution.

In post-mortem examinations, however, where the patient has died from such disease as erysipelas, typhus fever, smallpox, &c., where the fluids are more or less changed in their character, there is certainly danger of bad consequences; and if these fluids should be of an extremely irritating character, as in those dead of peritonitis, it is not even necessary that the surgeon should wound himself or have the slightest abrasion upon the hands in order to have serious effects induced. On account of this danger, the hands should always be well oiled before commencing such a post-mortem examination. In dissections and post-mortem examinations, most wounds can, however, be avoided by taking care to saw the bones smoothly so as to leave no spiculæ to hurt the hands, or by a little care in the use of the double hooks or of the tenacula.

Symptoms.—Whenever inflammatory action is developed in a wound made during a dissection or a post-mortem examination, the following symptoms may ensue. The patient experiences first a greater or less amount of smarting or irritation in the part, or there may exist in it a certain degree of pain for a few hours, after which he will begin to suffer some constitutional disturbance, as a general feeling of languor, loss of appetite, indisposition to take

exercise, with very frequently more or less diarrhoea. Diarrhoea, indeed, is by no means uncommon among anatomical students, even when not wounded, especially those coming from the country, and dissecting for the first time. After these symptoms, inflammation is observed along the line of the lymphatics, which become red and swollen, the cuticle is elevated at the original wound and presents patches of vesication; the limb begins to swell; in fact, we have all the symptoms of angeioleucitis, accompanied by erysipelatous or unhealthy inflammation, as produced by any other cause. In order that every case of inflammation of the lymphatics shall not be regarded as evidence of poison, it may be stated that these symptoms have been known to be produced by so trifling a matter as paring a corn too closely. I have also seen buboes produced by simply stumping the toe, whilst inflammation of the lymphatics of the arm and suppuration of the glands of the axilla supervened in one case on a trifling fall, which simply abraded the skin of the hand, and rubbed a little dirt into the abrasion.

As the disease progresses it generally takes on an erysipelatous character, and travels up the arm, and if the glands of the axilla become involved, they may run on to suppuration, with all the results of the formation of pus in the loose cellular tissue of the axilla. With this inflammatory condition of the parts there is usually combined great nervous disturbance, which is shown in anxiety, despondency, restlessness, and inability to sleep, the latter being so marked that four hundred drops of laudanum have been given every two hours without producing narcotism or inducing the slightest anodyne effects; there are also often fever, headache, and great prostration. As the disease progresses, the ordinary evidences of blood poisoning appear, and the symptoms assume a typhoid character.

Treatment.—The treatment is divided into three stages: 1, the prophylactic; 2, the abortive; 3, the curative.

The prophylactic treatment of dissecting wounds consists in avoiding exposure to irritation by keeping the hands carefully out of the way of sharp spiculæ of bone, and avoiding punctures with the double hooks, the needles and tenacula, as well as by covering any little abrasions or wounds which may exist with collodion, before placing the hands in the fluids of the body. But if, notwithstanding all caution, effective inoculation takes place, the abortive treatment must be resorted to.

2. The abortive treatment is as follows: So soon as the wound is observed, if the patient is not very fastidious, he may at once place it to his mouth and suck it, spitting out his saliva afterwards; then if it is so situated as to permit it, a cupping-glass should be applied and suction produced, as recommended by Sir David Barry in the case of poisoned wounds, when, should inflammation follow, it is to be combated on general principles, by means of the warm water dressing or warm poultices. Should the inflammation continue to extend up the arm, and the lymphatics be involved, a strip of blistering plaster, or some stimulating ointment may be applied two inches above the inflamed part in the course of the lymphatics so as to induce healthy inflammatory action, and this will often arrest the progress of the disease towards the deep-seated glands.

The constitutional treatment of these wounds is all important, and it is generally well to begin by administering an emetic and a purge with the view of clearing out the alimentary canal, following it by large doses of opium frequently repeated. The opium here serves the double purpose of quieting the nervous irritation and vascular action, and of securing rest and freedom from pain. As a general rule, the antiphlogistic treatment of inflammation is badly borne on account of the previous debility and constitutional derangement which so often exist. Local bloodletting, at some little distance from the wound, will sometimes, however, prove useful, but leeches should never be applied near the wound itself, or their bites will exaggerate its already irritable condition.

A practice which has been highly lauded and often practised, is to cauterize the wound freely with nitrate of silver so as to produce an eschar. Experience has, however, shown me many cases in which this treatment has increased the symptoms, and I believe it does so in the majority of cases by adding to the inflammation and irritation of the wound, and by forming a slough, which, by preventing the escape of the noxious fluids, favors their absorption. I therefore advise the student to abstain from the use of the nitrate of silver in the early period of this affection.

§ 5.—WOUNDS FROM DISEASED ANIMALS.

The next class of wounds are those from diseased animals; and under this head may be considered the complaint designated as Glan-

ders or Equinia. Glanders results from an inoculation of matter from diseased animals of the horse tribe. The disease in the horse or ass, which generally produces the complaint in man, is an affection of the glands of the mucous membrane of the nose, or of those of the skin. When developed, the unhealthy pus from the abscesses, or from the mucous membrane of the nose, will readily inoculate man if applied to an abrasion in the skin, or to a mucous surface.

When the glands of the neck and throat of the horse are affected by this disease, and abscesses form under the skin in various places, numerous soft doughy tumors appear, and the disease is designated as "*Farcy*," the inflamed glands from which it results being called "*farcy buds*." When the nasal membrane is the seat of the disease, it receives the name of "*Glanders*." *Farcy* may result in glanders, but it most generally succeeds it.

The inoculation of glanders, which is a rare disorder in the United States, may be accomplished in many ways: Thus the groom may dust the horse's face with a handkerchief and afterwards use it to blow his own nose, or he may use a sponge upon the mouth and nostrils of the animal and afterwards wash his own hands and face in the bucket into which it has been thrown. So that a man will frequently be inoculated in countries where the disease is common among horses, without knowing it, and therefore when cases present the symptoms now to be described, the previous history and acts of the patient should be closely investigated.

Symptoms.—Inoculation having occurred, the patient first complains of a general feeling of uneasiness and indisposition, low spirits, wandering pains, feverishness, a feeling of oppression in the chest, and all the symptoms of blood poisoning. Soon, however, the case becomes more characteristic; diarrhoea appears, the fever rises in grade, whilst in about eight or ten days a tumor of the face is observed, and a viscid discharge of a yellowish or brownish color, often stained with blood, and offensive in smell, flows from the nostril. The swelling gradually increases in size, the discharge is augmented in its odor, difficulty in deglutition comes on, delirium follows, and the patient dies.

The discharge from the nostril is contagious and capable of reproducing the disease. Cloths moistened with it, therefore, should not be handled, and all contact with the dressings should be avoided on the part of the surgeon or nurse.

Pathology.—The pathology of the disease is no doubt that of

blood poisoning. When post-mortem examinations have been made, no structures are found changed, except those immediately involved in the local affection, such as the mucous membrane of the nose, which is inflamed, and presents sometimes patches of ulceration, the latter involving the cartilages and even the bone itself. Metastatic abscesses in the kidneys, in the liver, and other glands have also been found.

Treatment.—The treatment of glanders in man is as follows: Evacuate the abscesses that form at an early period, and treat them like ordinary abscesses. Astringent injections into the nostril are also generally demanded, and especially those which are at once astringent and antiseptic, the latter being serviceable in correcting the fetid smell. Solutions of creasote and of the mild chlorides may likewise be used with this object. At the same time from 20 to 30 grains of quinine may be given daily, with 6 or 8 of Vallet's mass, the diet consisting of a bottle of porter, and a beefsteak. Though such a plan is perhaps the best mode of treating the disease, it must be admitted that it frequently fails to effect a cure.

§ 6.—MALIGNANT PUSTULE.

Another form of poisoned wound, in which the poison is obtained from diseased animals, is that known by European writers as malignant pustule, or the Charbon of the French. In this case the mischief is the result of inoculation with fluids or other matters from the bodies of animals which have died from certain causes, as from being over-driven, or from being kept in close stables and improperly fed, as has happened in the cow stables of the suburbs of some of our large cities.

In these cases, the individual who skins the animal may wound himself; or, without any wound, when immersing his hands in the fluids of the animal, or thrusting them under its skin, become conscious of an itching, burning, or tingling in one of his fingers, or in some part of the hand. A few hours afterwards he notices a vesication at the spot where the sense of tingling was experienced, and by-and-by the vesicle rupturing a small amount of brown or bloody serum is effused. Then follows the thickening of the part and a hard carbunculous tumor results which soon begins to slough, presenting the appearances of an ordinary moist slough, or the

blackish and dried characters of an eschar, though the latter is less frequent than the moist form.

Treatment.—The treatment is based upon the ordinary principles laid down in the case of carbuncle; to wit, attend to the general health, and cauterize the parts freely with a stick of caustic potash well rubbed in, or the actual cautery at a white heat may be employed, the object being to produce such a destruction of tissue that when the slough comes away it will leave a fresh and, probably, a healthy granulating surface.

CHAPTER III.

GUNSHOT WOUNDS.

UNDER the general head of Gunshot Wounds is placed all such injuries as are directly or indirectly created by the impulsive force of gunpowder. This class of wounds may, therefore, present either the characteristics of contused or lacerated wounds, and both of these will occasionally be found combined with the symptoms of burns in consequence of the combustion attendant on the explosion of the powder. More or less sloughing of the edges of these wounds may, therefore, be expected, but the hemorrhage will at first be slight unless some of the larger arteries be cut through by the course of the ball. These wounds are, however, especially liable to secondary hemorrhage when sloughing begins.

For the purpose of aiding the memory, the general characters of gunshot wounds may be stated under the following heads: 1. These wounds have a tendency to heal by granulation and not by adhesive inflammation. 2. The hemorrhage is generally slight unless some large vessel is cut. 3. Secondary hemorrhage is very apt to ensue, and forms the chief danger in the great majority of cases.

One of the peculiarities of these wounds is the fact, that in persons wounded under the same circumstances, and apparently in precisely the same manner, the result of the wound is very apt to be entirely different; of which many cases are to be found in the works of Baron Larrey, of Boyer, and others.

Larrey mentions one case in which two soldiers were wounded in the bladder in the Austrian campaign, the ball passing completely through the body and coming out at the buttock; in one, the urine came through the wound in the back for the first twenty-four hours, after which it came through the natural channel. In the other, with a precisely similar wound, the urine did not pass by its natural channel for twenty-one days, and a general infiltration of urine into the parts about the posterior orifice of the wound led to a troublesome sloughing, which confined him for several weeks afterwards. He also relates the case of a grenadier who was struck in the thigh with a five pound shot, which remained in the thigh covered by the muscles, its presence being recognized as he handled the limb, simply from its weight. This limb being amputated, the man recovered without a bad symptom. At the same time that the accident occurred to this man, his Captain, standing near him, was struck with a similar shot from the same battery, the limb being entirely severed, though the injury did not extend so far up the limb as in the other case. This thigh was also amputated, but the patient died.

Many cases illustrative of similar facts will be found detailed in almost all the works on military surgery. The prognosis should, therefore, be very guarded, it being set down as a general rule that a gunshot wound is *always* serious.

The severity of gunshot wounds depends less upon the character and size of the projectile than upon its velocity. It is, hence, of importance in this connection to study the general laws of projectiles as well as the effects they produce upon contact with the body. The following general rules are those which have been laid down by the most experienced military surgeons, and are generally received by the profession as correct.

1. The greater the velocity of the ball, the greater will be the danger to life.

2. The swifter the ball, the more direct will be its course through the part. Hence the greater danger of wounds of important viscera from balls received at close quarters.

3. The slower the ball the more apt it will be to splinter a bone which it has struck; a swift ball being much more apt to cut a bone clearly.

4. Free hemorrhage is more frequent from wounds made by swift balls than from those made by slow ones.

5. If a slow ball strikes a bone without sufficient force to splinter it, it is apt to flatten upon it; whilst a swift ball striking against a sharp angle of a bone will often be split into two fragments, each of which will pursue a separate course.

6. The *wind* of a ball does no harm, the contusions said to be caused by this being due to spent balls, or those which have lost much of their original velocity, or which graze the patient in the revolutions on their axis, made by all balls whilst in motion.

In studying the effects of projectiles, we may now examine the results of their action upon the soft parts. A ball which penetrates the soft parts always produces a contused wound, and this result follows irrespective of its velocity, because when a ball passes from the air into the flesh, it passes from a rarer to a denser medium, and experiences resistance at the point of entrance: hence the contusion of gunshot injuries is always more marked at the point of entrance than at that of the exit of the ball.

This difference of character between the wound made by a ball in entering, and that left by it in quitting the body, is not unfrequently of importance in a legal point of view, and its distinguishing characters are, therefore, of some interest.

The opening made by the entrance of a ball is contused upon the edges, and the orifice is small, often smaller indeed than the ball itself, in consequence of the contraction of the surrounding structures, which are, also, sometimes more or less depressed from without inwards. The edges of the wound are, also, bluish or livid in their color.

When a ball escapes from the soft parts, it passes from a denser into a rarer medium; the skin, therefore, is stretched on its exit from within outwards, and the parts are more or less lacerated, but they are not so much disposed to slough. This orifice is large, often larger than the ball itself.

Balls may enter the body, and after travelling for some distance come out again from the opening by which they entered. And when a ball passes through the body it does not always do so in a straight line.

A case of the former sort is cited by Hennen, in which a ball struck upon the *pomum Adami* of a soldier, passed entirely around the neck, and came out where it entered.

Sometimes two openings are made by but one ball, a result

which may mislead the surgeon if he does not use care in his examinations.

The slough in gunshot wounds is usually quite marked throughout a great portion of the track of the ball, and is thrown off by the natural action of the part as explained under the head of Mortification. It seldom separates before the 6th day, and may not come away before the 12th or 14th day, or even later. As the slough separates the risk of secondary hemorrhage comes on.

In searching for a ball, it is important to place the patient as much as possible in the same position as he was when struck: thus, if he received a ball in the shoulder while in the act of firing his piece with the arms up, the arms should be raised to a similar posture in searching for the ball. So, also, if struck in the thigh while on horseback, the leg and thigh should be placed as nearly as possible in a similar attitude, when the ball is sought. Various cases may be cited to show how devious the course of a ball will sometimes be. Thus in one case a man in the act of mounting a scaling-ladder was struck by a ball in the head, and it came out at the shoulder. In another the ball struck on the calf of the leg, and came out at the popliteal space.

Similar instances are occasionally seen in private life: thus an individual being a little love-sick made an attempt to commit suicide, by placing a pistol against his heart; but the ball passed along the course of a rib to the spine, down which it went to the pelvis, and I took it out at his buttock. So also the case of a blacksmith who put a gun-barrel which he did not know to be loaded, into a fire to heat it, when the piece went off and the ball which it contained struck upon his leather apron, over the belly, penetrated the apron, the clothes, and the skin, followed round the course of the external oblique muscles of his abdomen, and was taken out by me beneath his scapula.

These facts show that when a ball enters the body on one side, and makes its exit on the other, it by no means follows that it has passed directly through it in a straight line.

Balls left imbedded in the bone, or covered by the soft parts, not unfrequently work their way to the surface and thus escape, yet they are not always thus thrown off. Lead acts very kindly upon the tissues, seeming to produce an amount of local sedation which counteracts the inflammatory effect of the injury, and a small quantity of lymph being thrown out and organized, the ball

may remain encysted, or continue buried in the bone without producing any violent symptoms. Several specimens of this result are in my cabinet, in which after penetrating, or even shattering a bone, a ball has lain quietly imbedded for a length of time without producing any apparent irritation.

This fact gives an important rule in the treatment of gunshot wounds, viz: that if the ball cannot readily be extracted without increasing the risk of hemorrhage, or doing injury to the bone, as denuding it of periosteum, &c., it is better to allow it to remain. The same rule holds good in regard to the soft parts; if the ball cannot be gotten at without risk of opening arteries, wounding nerves, or doing other serious injury, it is better to let it alone. An instance of the length of time in which a ball may remain imbedded without creating marked inconvenience, was presented to me some years ago in a person wounded in the war of 1812, and who carried a ball imbedded in his sternum until 1843, when, being engaged upon a railroad, and striking his breast rather violently against a locomotive which was stationary at the time, a little tumefaction was produced which suppurated, and when the abscess was evacuated, the ball was thrown off with the pus. There are various other instances in the records of surgery, and in almost every section of the country, individuals can be found who have carried balls received in various ways for a longer or shorter period.

Symptoms.—The symptoms of gunshot wounds are both local and constitutional, the latter being the most marked. Among the most conspicuous of these is that change in the nervous system produced by being shot, which is designated as the "shock." When an individual is shot, no matter how great may be his self-possession, or even if unconscious of the wound at the moment, he is very apt shortly afterwards, to display symptoms which might be mistaken for cowardice, but which really are due to disorder of the nervous system; thus the patient is often pale, trembles, and presents coldness of the surface, cold perspiration, and stiffness of the muscles; seems unable to move in some cases, and appears to be completely prostrated in mind and body; and in many instances these symptoms have been increased by the fact that his mind had been acted upon previous to his receiving the wound.

In illustration of this we have a well known case from Guthrie. During the war in Portugal, an English soldier suddenly met an

adversary coming up over the other side of an embankment; being close to each other, each presented his musket, and fired together. The Englishman fell, thinking he must certainly be killed; but feeling, by and by, that he still possessed sensation, he rose, and going to the other side of the embankment, found his adversary dead. When met by Mr. Guthrie, a little after the accident, this soldier was pale, trembling, and described himself as much hurt, although the only wound he had received was a trifling one upon the ulna, which had been grazed by the ball.¹

In many instances, therefore, the symptoms due to moral impressions must be taken into consideration, and it may be laid down as generally correct, that except hemorrhage the shock will be the first symptom that requires attention.

As this shock may generally be relieved by very simple measures, and more may be done by "acting upon the morale than upon the physique," the patient should be encouraged as much as possible, and every means employed calculated to raise the spirits. A moderate amount of diffusible stimuli should also be administered, and for this, whiskey and water will answer very well; the symptoms of shock thus being speedily relieved in the majority of cases.

Individuals shot under feelings of excitement, however, are not unfrequently unconscious of the wound; or, if they feel the blow, are conscious simply of a slight benumbing pain, such as that felt from the blow of a rattan or stick. In some cases, it is true, the pain is more severe, especially if one of the sentient nerves is torn or lacerated. Unless the hemorrhage is very marked, the local symptoms will not generally attract attention. Subsequently, however, as inflammation is developed, the wound will begin to make itself felt and will become a serious source of inconvenience, and sometimes of danger. As inflammation is developed, the ordinary signs of this affection present themselves; thus there is swelling produced by effusion into the part, and redness, but complicated in its color by the contusion present. Subsequently, other signs are developed, suppuration comes on, and sloughs, consisting of the parts which were contused sufficiently to destroy their vitality, commence to separate. As the inflammation progresses, constitutional symptoms appear, constituting irritative or inflammatory fever; or even hectic fever, if the suppuration is sufficiently free.

¹ Guthrie on Gunshot Wounds.

The swelling, which appears in from twenty-four to forty-eight hours after the wound, diminishes the caliber of the passage made by the ball, and hence the wound should be examined with a view to the extraction of the ball as speedily as possible. In this examination, instruments may be used, probes of various kinds having been invented for the purpose; but the best probe possible is one always at hand, and that is the finger; wherever the surgeon can introduce this it should be done as soon as possible after the injury, in order to ascertain the true position of the ball.

Sometimes, however, a ball penetrates to such a depth that it cannot be touched by the finger, and then a probe is absolutely necessary. Occasionally, evidences of the course of a ball which has passed by a superficial route, can be found upon the skin, its track being marked by a dusky redness, which is elevated in the manner of a wheal or welt such as that caused by the blow of a cowhide; this change in color being due to the congestion of the superficial capillaries caused by the contusion produced by the ball.

Sometimes air is introduced through the wound into the cellular tissue of the part, rendering it emphysematous, and the course of a ball which has passed superficially, can then be traced by the crackling of the skin beneath the finger.

Patients exposed to large projectiles, such as cannon-balls, &c., sometimes give evidences of serious injury, although it is impossible to find any external wound; and these injuries were anciently supposed to be due to the wind of the ball. As science progressed and electricity began to attract attention, it was considered for a time that they were due to an electrical change in the parts, produced by the near approach of a large moving metallic body, which it was conjectured drew off the electricity from the part. At present, however, both these opinions are rejected as impossible, and the symptoms in question are generally attributed to the contact of spent balls, or more frequently to the lateral concussion produced by the revolution of the ball on its own axis, as it glances rapidly by the person who is injured.

Baron Larrey, whose great experience makes him the highest authority upon gunshot wounds, explains the matter in this way: A ball shot from a gun is acted upon by two forces, the force of the powder propelling it forward, and the power of gravitation drawing it toward the earth. In consequence of the double action

of these two forces the ball does not move in a right line, but in a parabolic curve, and acquires a rotatory motion upon its own axis; and having nearly lost its original propelling force, and rotating in the manner described, produces injury to the part touched in the same manner as the wheel of a heavy vehicle.

Splinters of wood or stone struck off by balls or fragments of shell, produce a class of wounds that come rather under the head of lacerated than of contused wounds, as they present the torn edge, absence of hemorrhage, and difficulty of union of the former class of wounds. Should the fragments of stone or shell present sharp cutting edges, ordinary incised wounds may be produced. Many of the terrible wounds produced by shells thrown at close quarters at Sevastopol, disembowelling patients and tearing off limbs, were reported as being of this class, the wounds resembling those made by a sharp cutting instrument, and producing rapid and fatal hemorrhage.

Prognosis.—The prognosis in all cases of gunshot wounds is serious until after suppuration is established, for, in the most trifling wound, erysipelas may be developed at any moment, or hectic or inflammatory fever set in, and carry off the patient during the suppuration of the wound. The surgeon should, therefore, be guarded in expressing an opinion respecting the duration or result of such cases.

Complications.—The various *complications* of gunshot wounds require consideration.

1. The first and most common of these is that resulting from the presence of foreign bodies, which may consist of any substance driven in by the ball, or broken off by it in the wound, as small pieces of clothing, buttons, bits of the leaves of books carried in the pocket, and fragments of bone near the wound.

2. The second complication arises from inflammation, and this, in a wound doing otherwise well, may arise from the most trifling excesses in diet, drink, exercise, or venereal indulgence, cases being on record in which officers and others who, after having very nearly recovered from severe wounds or amputation, have died nevertheless from hemorrhage brought on by want of caution in these particulars. Changes of temperature alone may produce serious complications, and heat, dampness, or cold may cause trouble by modifying the inflammatory action. Free suppuration frequently complicates these wounds, the pus travelling among the muscles producing

finally a disposition to adhesions, which results in stiffness of the limb, or ankylosis if joints are involved in the injury.

3. The third complication is secondary hemorrhage, which may ensue upon a gunshot wound, first from excessive arterial action, however excited; second, from sloughing; third, from a want of proper tone in the granulations; and in all such nothing but an arrest of the hemorrhage will save the patient.

4. Tetanus, which will be treated in full hereafter.

Treatment.—The indications for the treatment are: 1. To examine the wound carefully and promptly; carefully, so as to make sure of the removal of all foreign bodies, and promptly, lest the swelling which supervenes on the action of the injured tissues should interfere with the accuracy of the examination. 2. To remove the ball, and all foreign matters, such as clothing, splinters, &c. 3. To moderate the inflammatory action. 4. To facilitate the escape of pus by every means, such as position, &c. 5. To favor the separation of the slough. 6. To guard against secondary hemorrhage.

The means of fulfilling these indications are as follows:—

1. In the examination of the wound the finger should be used, if possible, or a probe if it be necessary. The probe should be a flexible silver probe of sufficient length to reach fifteen inches. This, for convenience of carrying, may be made of two pieces, arranged so as to screw together. If the wound is very shallow, and straight in its course, the ordinary probe may sometimes answer.

2. The ball being found, the next indication is to remove it, which may be accomplished in various ways. If the ball, after having penetrated some distance, is lodged immediately beneath the skin, the simplest manner of removing it is to make an incision through the skin upon the ball, which may thus be extracted. While making this incision the ball should, however, be fixed with two fingers, and any little filaments of fascia which may remain should be clipped off with the scissors rather than the knife, lest the rotundity of the ball should cause the edge to slip and other parts to be wounded. In some cases it may be desirable to make an opening counter to that in which the ball entered, or one on the opposite side, in order to extract the ball; as in case the femoral, or some other large artery would be involved by cutting down upon the ball from the side on which it entered.

To remove the ball by extraction through the opening made by itself, various instruments have been contrived. Such are the Tierballe, which consists of a rod of steel, with a screw at one end, which is screwed into the soft lead of the ball, and traction then made on it. This instrument is particularly useful in extracting balls embedded in bone. At the opposite end of the instrument is a scoop (curette), by means of which, and with the aid of the finger, a ball may be removed. A pair of small forceps, resembling the polypus forceps of the dressing-cases, with small fenestra, are useful in cases where the ball has not penetrated too deeply, or for the extraction of shot; and the long gunshot forceps, made after the pattern of Percy's forceps, so that they can be dilated without dilating the orifice of the wound, are much used.

An instrument is also made in which the two blades of the forceps fit into each other like a single scoop, and so enter the wound; when, a proper depth having been reached, one blade is made to rotate upon the other, thus converting the instrument into a pair of forceps which seizes the ball.

An instrument has also been used similar to that employed by Civiale (litholabe or three-pronged clasp) for crushing stones in the bladder. Having reached the ball with this, a screw in the handle expands the blades and separates the soft parts, when the reverse action of the screw enables the prongs to grasp the ball, which, being firmly seized, may then be extracted. An instrument has also been used similar to Leroy d'Etiolles' scoop, for extracting fragments of stone lodged in the urethra. This instrument is passed down past the ball, when the action of a screw in the handle bends a joint at the end of the instrument, at right angles behind the ball, which is thus readily extracted by traction upon the instrument.

3. In all attempts at moderating inflammatory action general principles must be observed, as already laid down under the subject of *Inflammation*. It may, however, be here stated, that in all gunshot wounds great relief will be obtained, and inflammatory action checked, from the use of the warm water dressing.

4. The modes by which it will be best to attempt to favor the escape of pus depend much upon the nature of the wound. Sometimes free incisions will be necessary, so as to lay open fascia beneath which the pus is collecting; and sometimes all that is required can be accomplished by position.

5. The separation of the slough may be favored by stimulating the natural processes of nature. Stimulating poultices and washes may be employed for this purpose, as directed in the treatment of gangrene. As the parts of the slough loosen, they may be clipped off with the scissors; but traction upon a slough should never be made, on account of the risk of hemorrhage.

6. The last indication is with reference to the secondary hemorrhage. This can generally be arrested by compression, except where large vessels are involved. In case such vessels are pouring forth blood, it will be necessary to cut down upon the sound portion of the main trunk of the vessel and tie it. But the hemorrhage which usually gives the most trouble is the oozing from the surface, or that which escapes from vessels that cannot be seen, and which pressure often fails to arrest, probably, in some cases, from want of attention to its proper application, as the following plan has often checked it: Interrupt partially the course of the general circulation near the wound by means of the ring tourniquet, or Bellingham's compressor, or some such means; then, having sponged the wound clean, and turned out any clots that have collected there, introduce into it portions of patent lint, of charpie, or of agaric, and pack them neatly and closely together. Then, covering the whole with a graduated compress, make pressure upon the wound and the compresses by means of a bandage, accurately applied, and extending some distance above the wound.

Sometimes, in wounds received at close quarters, from weapons loaded with shot, the entire load enters into the wound without scattering to any extent, or the charge, wrapped in its wad, remains in the wound, so that the whole may be extracted together. Such instances not unfrequently occur in the case of sportsmen shot by the accidental discharge of their fowling-pieces while in the act of leaping a fence, &c., and more than one such has thus come under my observation.

Amputation.—With regard to the question of amputation in gunshot wounds, the rules of civil and of military surgery differ, it being proper to amputate limbs in military service which a surgeon in civil practice would attempt to save; primary amputations, or those within thirty-six hours after the injury, being also preferred in military practice, whilst in civil surgery those performed at a later period seem to do best. In military service, primary operations are often most beneficial because performed on the field, the pa-

tient being then in fair health, and thus saved the irritation that would ensue upon the transportation of a broken bone, &c., to a distant hospital.¹

CHAPTER IV.

TETANUS.

TETANUS (from *τετνω*, to stretch) is a nervous disorder characterized by spasm (from *spasmo*, I draw). It is recognized by the fact that it presents tonic rather than clonic contractions of the muscles, and it has already been alluded to as one of the most serious complications of gunshot wounds.

Tetanus is called Idiopathic where it is dependent upon constitutional causes, such as exposure to cold, the presence of irritating ingesta, &c. &c. It is called Traumatic where it arises from wounds.

Symptoms.—The symptoms of traumatic tetanus are as follows: There is first a soreness in the muscles of the jaw, which feel as if the patient had been eating something hard and was tired. This stiffness soon spreads to the muscles of the neck, producing the sensations of stiff neck, or such as is caused by a draught of cold air, and often described in this way by the patient. A peculiar expression of countenance is then soon observable, which may be characterized as a painful smile, and is due to the fixed contraction of the zygomatic muscles. At the same time the eyes have a peculiar look; they stare, and are gathered at the corners by contraction of the orbicularis palpebrarum. The affection of the muscles of mastication soon becoming more marked, the masseter contracts so powerfully that the jaws cannot be opened, while the saliva or liquid, &c., cannot be swallowed on account of the muscles of deglutition being involved. A pain in the stomach now comes on, as if an attack of colic were about to begin, and the diaphragm is soon affected, the patient suffering from difficulty of breathing and a spasmodic pain along the insertion of the diaphragm. The abdomen next becomes hard and knotted, presenting the appearance of

¹ For the further consideration of this question, see *Op. Surgery*, vol. ii. p. 408, 2d edit.

a tumor, from contraction of the recti muscles, while from spasm of the muscular coat of the bowels and bladder there are constipation and difficulty of micturition.

Meanwhile the intellect of the sufferer continues clear, and the pulse natural, or by no means so much excited as might be expected from the symptoms. If the paroxysms continue, they become more violent, and the patient dies in a period varying from two to fourteen days, the shorter period being rarely seen.

Tetanus receives certain designations according to the muscles which are chiefly involved in the spasm; thus, when those of mastication are principally affected, it is called *Trismus*. When the patient is bent backward into the shape of an arch by the contraction of the spinal muscles and the flexors of the legs, it is called *Opisthotonos*; when he is bent forward, *Emprosthotonos*; when sideways, *Pleurosthotonos*.

Tetanus shows itself under various circumstances, and often after very slight wounds, when conditions favoring its development exist, atmospheric changes, and other causes which are not well known, seeming to act as predisposing causes.

The wounds most likely to produce tetanus are wounds of nerves, wounds of tendons, of fascia, &c.; lacerated and punctured wounds being more apt to result in it than the other class. Very slight *punctured* wounds, indeed, may produce it. In one instance in my experience it was excited by the slight puncture made by taking a top, with a very sharp plug, into the hand while it was spinning; and in another instance, a waiter at a hotel had tetanus induced by pricking his finger with a fork while setting the table.

Diagnosis.—Hydrophobia might be confounded with this complaint, which it resembles in the difficulty of swallowing, and the increase in the violence of the spasm from very slight causes, such as the opening of a door, a breath of air, &c. It may be remarked, however, that the spasm in tetanus is continuous (tonic); in hydrophobia it is intermittent (clonic). In tetanus, the mind is clear; but in hydrophobia, a delirium, which is of a maniacal character, is present at least in its latter stages.

The diagnosis from myelitis or inflammation of the spinal marrow and its membranes is to be found first in the fact that in myelitis the patient complains of a constant burning pain in the back, and has high fever and often paraplegia, neither of which are found in tetanus, except in cases complicated with myelitis.

Prognosis.—The *prognosis* of tetanus is very unfavorable, and although I do not indorse the French aphorism, “tants des cas tants des morts” (so many cases so many deaths), yet it is very rare for a patient to recover from tetanus when it is once thoroughly developed.

Pathology.—The *pathological condition* of the organs of the body in tetanus is doubtless a disordered condition of the spinal cord, brain, and ganglionic system, but only involving the lower portion of the brain, and this chiefly towards the close of the disease. This disordered condition of the brain is not inflammatory in its character, nor is it very well understood, but may be described as being in the great majority of instances rather functional than organic, though sometimes vascular congestion is marked.

Treatment.—The treatment of tetanus may be divided into (1) the prophylactic and (2) the palliative measures.

1. The prophylactic treatment consists in such means as will avoid or remove the source of irritation. When tetanus is feared, nerves merely pricked should be entirely divided, ill-conditioned sores be freely cauterized, &c. &c. But, when the disease is once developed, it is worse than useless to amputate the affected limb, as this operation does not check the disease, and has in some cases proved to be an additional source of irritation.

2. The palliative treatment is as follows: A purge should be given, if it can be swallowed, to clear out the primæ viæ; but this is frequently impossible, on account of the trismus, the latter being one reason why patients die, as it is difficult to administer remedies or food to them in sufficient quantities to obtain their prompt action. The difficulty of nourishing them is also increased by the fact that the muscular coat of the alimentary canal does not propel the food through it, owing to the continuous spasm which characterizes the disorder.

Opium may follow purges when it can be readily administered, but it should be remembered that though immense doses of this drug will be borne without producing sedation, we should not be induced by this fact to give it in such quantities as to risk a complication of the disease by producing congestion of the brain. Anæsthesia has also been recommended, and is, doubtless, useful as a means of rendering death easy, but it has as yet produced no curative results. Perhaps the most useful, as it is certainly the most plausible plan of treatment, is counter-irritation to the spine,

as recommended by the late Dr. Hartshorne, senior, of Philadelphia. His plan of treatment, which resulted in a few cures, consisted in making a free cauterization along the course of the spine with caustic potash, or the actual cautery, or in the formation of a large issue.

The extract of the *Cannabis Indica* has been highly recommended of late, and among others by Mr. Miller, of England, but though fairly tried in three cases it has not given the same results in my experience.

CHAPTER V.

WOUNDS OF THE REGIONS OF THE BODY.

UNDER the head of wounds of the regions of the body we may now study the effects produced upon certain parts, in consequence of the presence of the various organs which they contain, rather than from the character of the wound itself, the peculiarities of each variety of wound, as previously described, being very much the same in all regions.

The prognosis of all regional wounds is very much modified by the peculiar character of the adjacent organs, inflammation of these structures often adding the specific signs of such disorders to those due to the wound. It is in the treatment of such injuries that it is impossible to separate the practice of medicine from that of surgery, and, unless the surgeon is also a good physician—as he must necessarily be if properly qualified for his duties—the patient may sink from the effects of what is usually regarded as an internal or medical complaint, and therefore without the limits assigned to surgery. Such a series of circumstances frequently supervenes on wounds of the head and chest, the first creating Meningitis, and the latter Pneumonia or Pleurisy, all of which disorders are usually regarded as belonging to the Practice of Medicine. The student of surgery must see, therefore, in these results, the importance of studying all the disorders and physiological actions of the human system, if he desires to treat scientifically and successfully any of those which, for the advantages of methodical investigation and the simplifying of the subject of wounds, are usually assigned

to the practice of surgery. Besides the chances of the development of inflammation of the adjacent organs, the prognosis of regional wounds will likewise be materially affected by—1, the variety of the wound. 2. Its extent. 3. The age of the patient; and 4, the character of his general health and habits.

In the consideration of regional wounds, they will be presented in the natural order of arrangement of the parts of the body, commencing at the head and passing thence to the trunk and extremities.

SECTION I.

OF WOUNDS OF THE HEAD.

Wounds of the Head may be of any of the varieties previously described; that is, incised, lacerated, punctured, or gunshot; but, most frequently, the wounds of this region are either incised or lacerated; poisoned and punctured wounds of the head being seldom seen, though they are possible. In order to understand correctly the effects produced by wounds in this region, its general structure should be borne in mind, as the character of the scalp and the numerous branches of the temporal artery ramifying beneath it; the thickness of the cranium, and the character of its two tables, with the intermediate diploë. The ramifications of the middle artery of the dura mater, just within the bone, and the size and position of the sinuses, as well as the characters of the membranes and of the enclosed brain, with the proneness of both to take on inflammatory action, should also be noted.

Complications.—The chief complications of wounds affecting the scalp, is erysipelas, and the sloughing consequent upon it; of those affecting the cranium, meningitis or inflammation of the membranes of the brain, and cerebritis, or inflammation of the substance of the brain itself; besides which there may be in either case the dangers arising from compression and concussion of the brain.

§ 1.—WOUNDS OF THE SCALP AND ERYSIPELAS.

Erysipelas of the scalp presents us with the ordinary symptoms of erysipelas before detailed, although it is not accompanied by so much swelling as in portions of the body where more cellular tissue

is present. When erysipelas of the scalp involves a considerable portion of this integument it will be very apt also to involve the membranes of the brain, and produce meningitis, owing to the vascular connections between these two tissues. The symptoms and treatment of meningitis belong to the practice of medicine.

Inconsiderate traction upon the hairs in dressing a wounded scalp, the presence of sutures, the slightest causes will often suffice for the production of erysipelas of this region.

Treatment.—The treatment of erysipelas of the scalp, when established, does not vary materially from that required for its cure elsewhere. The prophylactic measures consist in treating all wounds of the scalp so as to favor their rapid healing and prevent suppuration. If the wound be of the incised variety, the scalp should be carefully shaved in order to avoid the irritation from the hair, and to prevent it from getting into the wound and acting as a foreign body; after which, the hemorrhage should be arrested.

Fig. 86.



A VIEW OF THE RECURRENT BANDAGE, AS APPLIED TO THE HEAD.—In its application make one or two circular turns of the forehead and occiput, with a two inch wide roller, reverting it backwards and forwards till the head is covered, and then fastening the ends of the recurrent turns by one or two additional circular turns. (After Nature.)

This is sometimes a matter of difficulty, for the scalp is so firm, dense, and adherent a tissue, that it is almost impossible to draw out the arteries and tie them, without including part of the dense surrounding cellular structure in the ligature, in consequence of which, in three or four hours, the knot will probably slip and hemorrhage ensue. The best mode of checking hemorrhage in this situation is by pressure made by applying a graduated compress upon the course of the temporal or of any other artery that may supply the wounded spot, subsequently retaining it and the dressing upon the head by means of the turns of a "recurrent bandage" (Fig. 86).

The wound should also be closed by adhesive plaster and not by sutures, the latter having, in many instances, proved dangerous from their creating irritation by the punctured wound made by the needle as well as by the presence of the threads, which act as

foreign bodies and give rise at times to suppuration and abscess. It may, therefore, be laid down as a general rule, to which there are but few exceptions, that it is better not to employ sutures in closing wounds of the scalp. As the skin in these wounds has a tendency to heal rapidly, and will sometimes do so before the sides of the wound are united in its deeper portions, abscesses are sometimes created, and proceed to such an extent as to require the scalp to be freely opened. It is better, therefore, in bad cases to keep some portion of the wound open and not to let it close entirely until all the deeper parts are fairly united. When it is necessary to retain a poultice or the warm water dressing on the head, it may be readily accomplished by the application of a handkerchief in the manner shown in Fig. 87.

In arresting the hemorrhage from wounds of the scalp, particularly before the parts are shaved, it should be remembered that the hair sometimes becomes the nidus of a clot, which will then present a long capillary appearance not unlike the projection of an artery.

Occasionally contusions of the scalp produce a bloody tumor, which is soft and fluctuating, and it may become a question whether it should be evacuated or not.

Practice has, however, proved that it is better, generally, not to open it when the collection of blood is exterior to the pericranium, as can be easily ascertained by the touch, the collection beneath the pericranium being much harder than when it is exterior to this membrane. These bloody tumors should generally, instead of being evacuated, be treated with cold water or other means calculated to prevent further effusion, and favor the absorption of the blood, as the tumor will generally do well and give but little trouble when it is not incised; whereas, if opened so that the air can enter its cavity, we will generally have troublesome suppuration, or, perhaps, sloughing of the integuments over it.

There is a tumor, however, sometimes seen in infants and in midwifery, which has been designated as *cephalæmatoma*, or the bloody tumor of the scalp, which is due to an effusion of blood between

Fig. 87.



A VIEW OF THE HANDKERCHIEF CAP OF THE HEAD.—The handkerchief being folded into the shape of a triangle, carry its summit over the head and fasten it by a circular turn of the two angles, pinning the ends together on the forehead. (After Nature.)

the pericranium and the bone. This is a circumscribed tumor, hard and elevated upon the edges, but soft at the centre, and has sometimes been mistaken for depressed fracture of the skull, the feeling of which it closely resembles. The hardness upon the edges of this tumor is due to the attachment of the pericranium to the bone and to some effusion of lymph, whilst the softness in the centre arises from the liquid blood.

When, by the history of the case and the age of the patient, it is satisfactorily ascertained that one of these bloody tumors is present, the proper plan of treatment, if called at an early period, is to attempt to check its development by cold, &c.; but if the swelling continues to increase in spite of this treatment, or has already existed several days, the best treatment is to incise it freely, turn out the clots, enable the pericranium to come again in contact with the bone, and thus diminish as much as possible the danger of caries or of exfoliation of the external table, which is apt to supervene when the pericranium is separated from the bone by the effusion.

Occasionally a blow upon the head, particularly if the course of a nerve has been involved, gives rise to neuralgic symptoms in the scalp. If this neuralgia is exceedingly violent, and resists the ordinary treatment of neuralgia from other causes, it may become necessary to make an incision upon the main track of the nerve and divide it so as to temporarily paralyze the part, though union of the nerve will generally occur, with a return of sensation, without a recurrence of the neuralgic symptoms.

Lacerated wounds of the scalp are to be treated upon the general principles which apply to lacerated wounds elsewhere. Of course it would be perfectly useless in these wounds to attempt union by the first intention, as the edges almost invariably slough to some extent. The lacerated scalp should therefore be accurately replaced after it has been cleansed from foreign matter, and only supported in its proper position, without uniting its edges.

In gunshot wounds of the head, it must be borne in mind that the cranium presents a convex surface, and that this will often cause a deviation in the course of the ball. It should also be recollected that the cranium consists of two tables, and that a ball may, therefore, penetrate the outer table without involving the inner one. So also a ball may be driven into the frontal sinus and there embedded and remain without involving the brain or even the inner table of

the bone. Depressed fractures of these parts, as from sabre cuts, axes, &c., may also exist without involving the encephalon.

Sabre cuts, wounds from circular saws, or from axes, &c. &c., are generally dangerous in proportion to their depth, which sometimes is very slight, and sometimes most serious. Wounds made by the circular saw are generally the most dangerous of all wounds of the head. Still, patients constantly recover from severe wounds of this kind, considerable portions of the cranium having been, in my experience, shaved off without involving the dura mater; the patients recovering without a bad symptom.

When a ball has entered the cavity of the cranium, the danger to be feared from probing is nearly as great as any that is likely to result from the presence of the ball. The probe should, therefore, never be used, nor any attempts made to remove balls imbedded in the substance of the brain lest it add to this irritation, the finding of a ball once introduced into the brain being always problematical, and death certain.

§ 2.—INJURIES OF THE BRAIN.

Sometimes blows and other forces applied directly or indirectly to the head, and altogether independently of the production of any external injury, produce an effect on the brain that is designated as "concussion of the brain," or, as it is ordinarily called, stunning. They may also create *compression* of the brain by causing the rupture of bloodvessels and effusion of blood within the cavity of the cranium.

1. CONCUSSION OF THE BRAIN, from a blow or fall, produces a train of symptoms which are much influenced in their character by the nervous connections between the brain and other parts of the body. Thus a sympathy exists between the brain and the stomach, and that so great that it has been said that a man has two brains, one in his abdomen (the solar plexus), and the other in his head, in consequence of which, if a man receives an injury to his head he is very apt to vomit, whilst a violent blow upon the stomach will often destroy consciousness by impairing the action of the brain.

Concussion of the brain is a marked interruption of its function, that is sometimes unaccompanied by any visible injury, and may be caused by any force that shakes or jars this structure. It

may be produced by falls, either upon the head or upon the feet, as well as by blows, and similar causes.

Symptoms.—The symptoms of concussion of the brain have been arranged by Mr. Abernethy into three stages.

In the first stage the condition is that of collapse, and this is the state in which the surgeon, if he has been promptly called, will generally find the patient. The second stage presents the symptoms of reaction, and the third those of inflammation.

In the first stage the patient will be found lying motionless, unconscious, insensible, and unable to answer questions. The skin is cold, and the pulse feeble, while the pupil is usually contracted or irregularly dilated. If the injury is not a very severe one, the patient may be roused by shaking him and shouting in his ears, so far as to enable him to answer questions imperfectly, after which he is apt to relapse into his comatose condition. This state may continue for a varied period of time, as from half an hour to four or five hours, after which evidences of reaction appear. The pulse now becomes fuller, the skin warmer; there will be a slight return of color to the lips; and the patient will become restless and pitch himself about like a person in a troubled dream, muttering, and, perhaps, speaking in a language which he had long forgotten, or which his friends had not supposed him to know. Whatever he may say is, however, generally very incoherent and disconnected in its character.

After this he begins to vomit, and after vomiting is often much relieved, and from this period will often begin to improve, his consciousness gradually returning, though he continues for some time feeble, and recovers perfect consciousness very gradually. In more severe injuries, however, he remains unconscious, the surface continues cold, the features pallid, the pulse quick, particularly when he is roused, it sometimes rising under a little excitement from 90 to 130 or 140 beats per minute, or even so fast that it is impossible to count it. Sometimes, however, the pulse is more full and regular. The respiration is also varied; it being sometimes very feeble or followed by a deep sigh, and then by an almost total absence of breathing for a few seconds, so that one is tempted sometimes to apply a glass to the lips to see if it is actually going on; auscultation hardly giving a sound. This state of things may last for some time, the patient being still able to swallow although unconscious, until finally the case terminates in recovery or in death.

In these cases many phenomena—which fully deserve the name

of eccentric that has been applied to them—will be observed at times; thus patients will begin to answer a question and not complete the sentence, or they will begin a sentence in one language and complete it in another, &c.

Diagnosis.—The diagnosis of concussion of the brain is highly important, and will be treated of fully under the head of compression; this being the condition with which it is most liable to be confounded.

A *post-mortem* examination in concussion of the brain shows various appearances; thus there may be congestion of part or of the whole brain, or effusion of blood, but the latter is seldom to any extent if the symptoms have not been complicated with those of compression. Most frequently there is no structural change whatever to account for the symptoms, thus indicating that the disorder of the brain in this injury is merely functional.

Prognosis.—The prognosis of concussion should always be guarded. The disease is not only dangerous in itself, but also on account of the congestion and inflammation of the brain which may supervene.

Treatment.—The *treatment* of concussion will depend upon the stage at which the patient is first seen. If seen in the state of collapse, the attempt must be made to excite action in the surface by frictions, mustard poultices, and stimulating injections into the rectum, such as salt and water, the turpentine injection, &c.

A very common mistake made by an inexperienced surgeon in these cases is to yield to the popular desire, or the wishes of friends, and extract blood. But it should be recollected that if blood is taken at this stage the collapse will be increased, and none should, therefore, be drawn before reaction comes on. If, however, the reaction threatens to become violent, blood may be taken to such an extent as would be proper under the same condition proceeding from any other cause.

After reaction is fully established and inflammation begins to be developed, the symptoms of meningitis may appear. Thus mania may present itself, during which the patient may shriek out or scream violently, and it is because this shrieking indicates the presence of meningitis that it has been spoken of as one of the fatal symptoms in cases of concussion. But although meningitis in these cases frequently proves fatal, the patient may yet recover under the ordinary treatment of meningitis proceeding from any other cause; thus, the stomach and bowels should be evacuated, and counter-

irritants and mercurials employed, for in these cases it is said that if we can succeed in salivating the patient he will generally recover. Opiates should never be administered in cases of concussion, no matter how restless the patient may be, as they are apt to add to the congestion which may already exist in the brain; and thus eventually increase the symptoms.

2. COMPRESSION OF THE BRAIN.—Instead of the simple disturbance of the functions of the brain just described, an interruption of its action by some mechanical cause acting directly upon it and producing compression of its structure, sometimes occurs. This cause may be force applied to the walls of the cranium so as to drive them in, or there may be an effusion of blood upon the membranes of the brain, that is, between them and the cranium, or in the substance and cavities of the brain itself, or between the brain and its membranes.

Symptoms.—If the compression is great enough, complete insensibility results from this condition, precisely as is seen in apoplexy.

Besides general insensibility a case of compression of the brain presents a slow, full pulse and a dilated pupil, with stertorous breathing, the latter being due to the paralysis of the muscles of the soft palate. The respiration is also exceedingly slow, being often not more than five or six times in a minute, and the breath escapes with a peculiar whiff or puff from the corners of the mouth, in consequence of the imperfect action of the buccal muscles. If the patient recovers a little from this condition, headache and torpor of the intellectual faculties will be observed, or symptoms similar to those detailed under compression, though generally he either recovers entire consciousness or dies with the evidences of apoplexy.

Diagnosis.—Compression of the brain, whether due to a blow or to a depressed fracture, may be told from concussion by the fact that in concussion there is feeble respiration; in compression it is stertorous; in concussion the pupil is generally dilated; in compression it is contracted; in concussion we have a quick, feeble pulse; in compression it is slow, labored, and full, counting often only 30 or 40 in a minute; in concussion the patient may be partially roused, but in marked compression he is totally insensible.

Compression of the brain may be told from drunkenness by a close examination of the circumstances of the case, though it will be much aided by discovering the odor of liquor upon the patient's breath. Still, the two affections may exist together, and the pre-

sence of compression or concussion in a case of drunkenness can often be positively ascertained only by time.

Prognosis.—The Prognosis in compression of the brain depends upon the amount and character of the injury. If it is due to a clot of blood, and the stupor increases, whilst the other symptoms grow more and more marked, the danger of death is imminent; but if the symptoms remain stationary, or materially improve, there is greater probability of the patient's recovery. If the compression is due to a depressed fracture, and this can be raised, the prospect of recovery is usually fair, unless meningitis supervenes.

Treatment.—The treatment of compression must depend upon circumstances. If the symptoms are evidently due to a depressed fracture of the cranium, recourse should be at once had to the operation of trephining; but if there is no such fracture, and the symptoms of compression steadily increase, as after the receipt of a blow, we may fairly conclude that the compressing cause is an effusion of blood. In this case it would be useless to trephine with a view to the evacuation of the blood which has been effused, for there can never be any certainty as to its situation. Yet if there is such a fracture of the skull that the surgeon can see through the cranium to the dura mater, and perceive beneath it a large and increasing effusion of blood, it may become a question whether this blood should be evacuated or not, and this question may be answered by laying down the rule that if the symptoms are such as show that the immediate dangers from compression are so great as to overbalance those arising from the meningitis which the puncture may induce, the operation should be performed. Still, even after the clot is evacuated, there is no certainty that the hemorrhage will be arrested, and we must, therefore, strike a balance between the dangers in such cases. Hemorrhage from the middle artery of the dura mater may be checked by compression, and by plugging up with a bit of wood the little channel made in the bone for the artery, when it was accessible through a fracture.

§ 3.—FUNGUS CEREBRI AND FUNGUS OF THE DURA MATER.

Fungus cerebri and fungus of the dura mater are two fungoid growths which differ materially in their characters, though appearing in the same region of the body. *Fungus of the dura mater*

presents simply the structure and appearance of exuberant granulations, its formation being due to lymph having been effused and become organized. As this growth progresses, it produces absorption of the inner table of the cranium, and then by pressure stimulates an increased development of the structure of the diploë and external table, so as to create the various bony structures which coalesce and constitute what was formerly known as spina ventosa. This tumor may even go so far as to encroach upon the cavity of the orbit by causing absorption of its bony plate, and then push the eye forward.

Fungus Cerebri, on the other hand, is created by an expanding of the proper substance of the brain which is protruded through

Fig. 88.



A representation of a true *Fungus Cerebri* consequent on a fracture of the skull which was trephined. (After a cast from Nature.)

some wound or opening in the skull (Fig. 88), by pressure from within, such as that made by the collection of pus in abscess of the brain, &c. This complaint occurs sometimes after the operation of trephining. The fungus expanding in this instance pushes through the orifice made by the trephine, and shows itself outside in the shape of a mushroom-like projection. It grows by degrees larger and larger, till finally the neck being constricted the mass may slough off; the neck then begins to develop itself anew, and thus the complaint goes on. Generally, these complaints are incurable, particularly fungus of the dura mater.

In fungus cerebri we may give the patient some chance of recovery by removing the fungus, but generally it is reproduced.

When, after trephining, or wounds of the head, there is reason to anticipate the formation of a fungus, a moderate amount of pressure should be cautiously employed, in order to prevent the escape of any of the contents of the cranium. If a fungus has formed, it will sometimes be desirable to remove it by applying a ligature, and tightening it with the greatest caution, from day to day, till the whole has sloughed off. After which, a compress wet

with lime-water may be applied to the part, as was first recommended by Sir Astley Cooper; or the tumor may be shaved off by the scalpel, and the lime-water applied to the cut surface. The disease is very apt to return; but it is worse than useless to attempt to prevent this by the use of caustics.

After a wound penetrating the cavity of the cranium, it may happen that instead of a true fungus, we will have simply a protrusion of the brain substance, constituting *hernia cerebri*, or *encephalocele*. Sometimes the part thus protruded breaks off, and a portion of the brain is lost, and yet the patient recovers.

Hernia cerebri, it is said, may also be dependent upon abscess in the substance of the brain; but this would produce the condition already described as *fungus cerebri*, and not a true hernia. The treatment of hernia of the brain is that of hernia everywhere;

Fig. 89.



A view of the single T Bandage as applied to retain a light dressing after the operation of trephining, the vertical strip being carried over the wound, and retained by the horizontal piece. (After Nature.)

that is, carefully to replace the protruded parts if possible, and retain them in their position by means of a light bandage, applied as shown in Fig. 89.

SECTION II.

WOUNDS OF THE FACE.

Wounds of the face may involve any part of this region, and although they may produce very great deformity, are not generally

dangerous to life. Still, they are not unfrequently very serious. Thus, for instance, in a gunshot wound, in which the ball passes through the base of the nose, there is not only the deformity, but risk of injury to the parts connected with the nose, such as the lachrymal sac or the ethmoidal cells, through which the force of the concussion may be transmitted to the brain itself. Such a wound will of course require the whole antiphlogistic system. If the *lachrymal sac* is injured, the proper treatment for this complication (as will be detailed under the head of *fistula lachrymalis*) must be adopted. So, also, there may be wounds of the eye, of the cheek, of the antrum, of the mouth, &c. &c., and in all these cases, there may be trouble from the character of the structures which are involved. In wounds of the cheek, perhaps the most troublesome injury is the formation of *salivary fistula*, which is to be treated by means of the punch, as described in the operative surgery.¹ Another in-

Fig. 90.



A VIEW OF THE MASK OF MAYOR.—Fold a handkerchief into a triangle; cut holes for the eyes, nose, and mouth, and apply as shown in the figure. (After Nature.)

convenience is paralysis of the muscles of the face from section of the *portio dura*. When this occurs, all that can be done is to promote the healing of the wound, then stimulate the nerve to the fulfilment of its function by blisters over its exit from the head at the mastoid foramen. Sometimes there is troublesome hemorrhage from the facial artery, and here we must ligate the artery, or use pressure to check the hemorrhage. Occasionally, severe wounds of the face, accompanied by burns, are produced by the premature explosion of a blast of rocks. In such cases a handkerchief, applied as in Fig. 90, is an excellent mode of retaining a dressing.

Sometimes it will happen that the wound will involve the soft structures merely. Thus the *nose* may be cut with a sabre or a knife, or it may be bitten in a fight. In this case, whether the cartilages are involved or not, the treatment is the same, the wound being closed as soon as possible by sutures or adhesive plaster, whichever seems most applicable. If sutures are used, they should only involve the integuments, as a suture passed through the cartilages would develop such an action in the parts as would prevent the healing of the wound.

¹ See Operative Surg., vol. i. p. 363, 2d edit., 1855.

Occasionally, it has happened that a ball has gone through into the *antrum Highmorianum*; and not having been extracted has developed inflammation, which has resulted in the formation of an abscess of the antrum. In such an event, we must treat the abscess as if it had resulted from any other cause, as by drawing out a tooth, puncturing the cavity of the antrum through the alveolar process, evacuating the pus, washing the antrum out with a syringe, and afterwards extract the ball by such means as may seem most judicious—as by trephining, &c. When the lip is cut, the sides of the wound should be united by the harelip suture, or if this is not at hand, by means of a handkerchief folded into a cravat, and applied as shown in Fig. 91.

Sometimes it happens that wounds are inflicted within the *mouth*, knocking out teeth, and involving the tongue, the gum, the alveolar process, the palate, &c. I have several times seen wounds of this sort made in marble yards, by the end of an iron crowbar flying up and striking the patient in the mouth. Under these circumstances, the treatment consists in moulding the parts into a proper position, and then keeping down inflammatory action by cold and detergent applications.

The *tongue* may be bitten by the patient himself, as in convulsions; or it may be wounded by balls, especially those passing into it from under the lower jaw. In these cases, if the deeper seated portions of the organ are wounded, the hemorrhage will be troublesome, and when such is the case the ligature should be employed to arrest it, a suture being resorted to if the wound is large, for the purpose of closing it. In order to apply a ligature to the artery in this case, some means of controlling the organ is required, and it would be useless to attempt to do so by holding it between the fingers, or even with a towel. The best plan is to hook it with a tenaculum and draw it out from the mouth, when the ligature and the suture may be applied and their ends cut close off, after which the tenaculum being removed the tongue may be returned into the mouth. It has been recommended to pass a needle and ligature through the end of the tongue for the purpose of controlling it, but

Fig. 91.



A view of the Uniting Handkerchief of Mayor as applied to a wound of the upper lip, the two ends of the handkerchief being crossed on the lip over compresses placed on each side of the wound. (After Nature.)

the tenaculum is quite as efficient, and not so painful. Neglect, of decided measures, from a mistaken tenderness in these cases, has been the cause of much of the trouble that has sometimes arisen in cases of wounds of the tongue.

If, after the tongue is returned to the mouth, it should swell much, or should inflammation come on, cold applications and anti-phlogistic measures must be resorted to.

SECTION III.

WOUNDS OF THE NECK.

Wounds of the neck, as already stated, vary materially; there may be a simple incised wound, and this again be modified in its result by its position. In the case of persons who have attempted to commit suicide, the wound is generally made between the os hyoides and the top of the larynx, producing little danger to life. Such a wound requires that it should be closed by suture, yet closed so as to leave a free exit for the pus lest it burrow under the superficial fascia of the neck. If the individual is maniacal, and attempts to tear out the stitches after the wound is dressed, as is not unfrequently the case, he must be controlled by means of a strait-jacket or by stout assistants.

A stiff stock of leather has been recommended in these cases, with a view of preventing the overlapping of the edges of the wound, but it does not control the motions of the head except to a limited degree, and is not equal for this purpose to the handkerchief bandage of Mayor, as applied with the view of keeping the head stationary. (Fig. 92.)

Sometimes wounds are made upon the side of the neck, so as to involve the external or internal jugular vein or the carotid artery, and thus cause serious or fatal hemorrhage. Or the laryngeal or other vessels may bleed from being partially divided, until the patient faints, and then the bleeding be arrested. I remember tying up several branches of the laryngeal in a case of this sort, and then leaving the patient, telling the friends that he would probably be dead in a few hours; but the next day I found him much better, and he finally recovered. I mention this case as bearing upon the prognosis of all wounds; as the surgeon should never give a

patient up, or desert him while life remains. In suicidal attempts patients will sometimes commit very trifling injuries upon the neck, which yet will be followed by serious consequences.

Fig. 92.



THE UNITING HANDKERCHIEF OF MAYOR, AS APPLIED TO WOUNDS OF THE NECK.—In its application carry a cravat circularly around the chest beneath the axilla, and then depressing the patient's head upon his chest, to the proper degree, apply another broad cravat to the head, and fasten it as in the figure. (After Mayor.)

Wounds and blows upon the back of the head and neck produce sometimes a remarkable train of symptoms, as when the cerebellum is involved the patient will frequently lose entirely his virile power. As illustrative of this, Henen relates the case of a dragoon, famous for his amorous propensities, who, in consequence of an injury of this description, suffered a wasting of the testicles, and never afterwards experienced the slightest venereal desire. The treatment in such cases should be such as is calculated to remove the deposit of lymph or the congestion which is generally the source of the mischief, and for this purpose a resort must be had to counter-irritants, the free use of mercurials, &c.

SECTION IV.

WOUNDS OF THE CHEST.

In *wounds of the chest* we have a train of symptoms modified by the depth to which the wound has penetrated. Thus there may be a simple wound of the muscular parietes giving rise to hemorrhage from a branch of the external mammary artery, which, being

arrested, the wound may be readily closed by sutures, or by strips of adhesive plaster.

If a wound of the chest is complicated with an injury of the lung, there may be an escape of air externally, or into the cellular tissue surrounding the chest so as to produce emphysema; and this may proceed to such an extraordinary degree, as to swell up the whole body; or the tissues may be similarly engorged with blood, a condition which is much more serious. Effusion of blood in these cases may show itself externally, internally, or both. If it shows itself internally, the individual will cough up blood, owing to its escape into the bronchial passages. Occasionally in wounds involving the pleura, pleurisy will ensue.

Sometimes foreign bodies are driven into these wounds and create violent inflammation; the latter commencing at the seat of the wound.

When a ball enters the chest it is useless to search for it, as most frequently it will work its way downward and be found upon the diaphragm. Fragments of rib, bits of clothing, and other foreign bodies, will sometimes share the same fate. Injuries of this kind generally run on to suppuration, and as the surface of the pleura is a continuous one, the suppuration which results may be very extensive, the cavity of the chest becoming filled with liquid and distended to a very considerable degree, constituting *empyema*.

Treatment.—The treatment of wounds of the chest will depend entirely upon the character of the attending circumstances. The treatment in mere flesh wounds is the same as in wounds of other parts of the body, whilst wounds breaking a rib and opening the intercostal artery will require that this vessel should be secured. This may be done by drawing it out with a tenaculum, and ligating it in the ordinary manner, as has frequently been done. Occasionally, when a rib is broken there may be some little difficulty in ligating it, but the hemorrhage can be arrested by passing a needle armed with a ligature—to which is fastened a little compress—behind the rib so as to bring the compress over the artery, and then tying the ligature externally, the artery will be secured by the pressure.

If the wound penetrates a little deeper and pleurisy results, it must be treated in the same manner as pleurisy arising from any other cause. When emphysema ensues from a puncture of the air-cells of the lungs, it should be treated precisely as emphysema

resulting from wounds of other portions, that is, by the application of a firm bandage around the part.

If foreign bodies have been introduced and empyema has ensued, paracentesis may be resorted to, a puncture being made at some convenient point, as between the fifth and sixth ribs,¹ and the foreign bodies removed if they can be reached, the pus present evacuated, and the chest washed out with warm milk and water, the patient having been previously placed in a convenient position for that purpose.

Where there is internal hemorrhage from the lung, as shown by the expectoration of blood, it is generally essential to bleed very freely, and repeat it, if the activity of the heart's action is not diminished, after which the whole antiphlogistic system becomes applicable, as antimony, mercury, digitalis, aconite, &c. &c., carried to their utmost limits, owing to the great vascularity of the lung.

If portions of the lung protrude, they should be replaced, if possible, by dilating the wound freely for that purpose if necessary; but if the prolapsed portion is strangulated and its vitality partially or completely lost, it should be surrounded with a ligature which should be cautiously tightened from time to time till the protruded part sloughs off.

Fig. 93.



A representation of the Handkerchief Bandage for retaining a dressing to the Axilla, Shoulder, or upper part of the Chest. (After Nature.)

¹ See Op. Surg., vol. ii. p. 55, 2d edit.

As a general rule, in all wounds of the chest involving the thoracic viscera, the wound should be closed as speedily as possible, and a tight bandage applied so as to compel the patient to breathe by his diaphragm, and thus prevent all motion of the ribs.

A wound of the *axilla* or shoulder should have its dressings retained to the part by a handkerchief folded as a cravat, and applied as in Fig. 93.

SECTION V.

WOUNDS OF THE ABDOMEN.

The danger in *wounds of the abdomen* arises chiefly from their liability to produce peritonitis, and the prognosis, therefore, is always serious. The treatment will be modified by the character and contents of the viscera involved.

Thus, wounds of the *liver* give rise to very troublesome hemorrhage; but a formidable danger is that resulting from the hepatitis which may be set up. It should be treated upon the same principles as hepatitis uncomplicated by wounds. Should abscesses form, they should be evacuated, but before this is done adhesion should be brought about between the peritoneum covering the liver and that lining the abdominal walls by proper means, such as by cutting down nearly to the peritoneum, and applying nitrate of silver and caustic potash.¹ When the surgeon is sure that adhesion has taken place, the pus may be evacuated without danger of its escaping into the peritoneal sac.

In wounds of the *stomach*, there will be hemorrhage depending for its violence upon the position of the wound. Thus, wounds of the greater and lesser curvatures of the stomach will be likely to produce greater hemorrhage than wounds in other parts of its parietes. Wounds of the stomach, when it is full, as after eating, will also be likely to result in the escape of its contents into the cavity of the abdomen.

In view of these dangers it might be supposed that these wounds would be necessarily fatal, but, on the contrary, patients very often recover from them, and there is a well known case on record, in which a man having had such a wound inflicted upon him, a cobbler who

¹ See Operative Surgery, vol. ii. p. 65.

was in the neighborhood went to work with his awl and waxed ends, and deliberately sewed the whole wound together, making the viscus fast to the abdominal walls, and yet the patient recovered. And this course is far from being irrational treatment, as stitching the wounded stomach to the abdominal parietes will diminish the dangers of the escape of gastric juice or other matters into the peritoneal sac. Of course, the patient should be kept upon the lowest possible diet, and be informed of the risks of his wound.¹

SECTION VI.

WOUNDS OF THE INTESTINES.

Wounds of the intestines may also give rise to trouble by allowing their contents to escape into the peritoneal cavity.

In closing wounds of the intestine various sutures have been recommended, the details of which belong to operative surgery, and are given with plates in the work alluded to.² In transverse wounds Lembert's suture will be found desirable. In its formation, a needle is to be introduced about an inch and a half beyond the wound, and brought out half an inch from it; entered again about half an inch the other side of the wound, and again brought out an inch and a half beyond the wound. Then traction being practised upon the ligatures thus placed, the two peritoneal coats—that of the intestine and that of the abdominal parietes—are brought in contact, and adhesive inflammation taking place, the wound will be firmly closed.

Jobert's suture is made by passing a needle from without in, about half an inch from the wound, and then from within out half an inch from the edge of the opposite flesh; finally from within out in the first flap at the same distance; after which the ligature is to be tightened and tied, as shown in the *Operative Surgery*, vol. ii.

Palfyn's loop suture is made by passing a ligature through a piece of wood in such a manner that when each end is passed through a flap of the wound, and the ends tied, the wood will draw the intestine firmly forward against the abdominal wall.

Pellier's suture is the ordinary continued suture, so arranged that

¹ See Op. Surg., vol. ii. p. 78, 2d edit., for other cases.

² See Op. Surg., vol. ii. p. 79, 2d edit.

by drawing upon each end it may be tightened to such an extent as may be necessary.

Ledran's suture, which is particularly applicable to longitudinal wounds of some extent, is made by passing in four, five, and six stitches, or as many as may be necessary, of the interrupted suture. The ends are then brought together with the thumb and finger, and, by rotating them, are firmly twisted into a cord, thus approximating the edges as closely as may be deemed desirable.

Fig. 94.



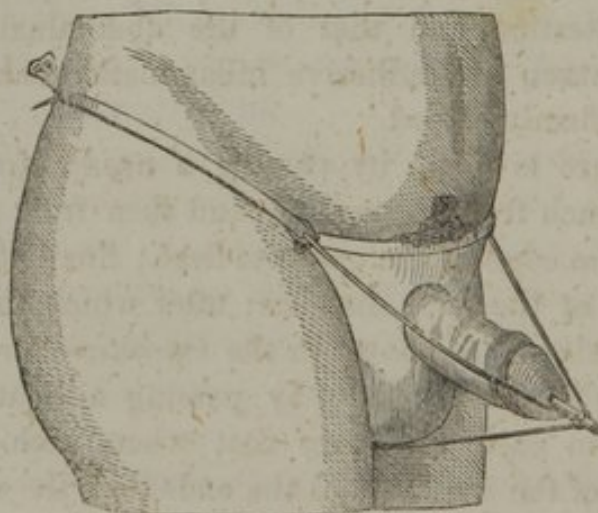
A representation of the Glover's Suture, as applied to a Longitudinal Wound of the Intestine. (After Miller.)

The Glover's suture is sometimes employed in these wounds, as shown in Fig. 94.

Of course, the selection of any one of these sutures will depend upon the nature of the wound and the accompanying circumstances. Thus, sometimes we have wounds of the intestines which will be best treated by simply surrounding the whole wound with a single ligature,

such, for example, as wounds accidentally made in operations for hernia, or such as result from a mortified spot in an intestine that has been strangulated.

Fig. 95.



A REPRESENTATION OF A SIMPLE METHOD OF RETAINING A CATHETER IN THE BLADDER IN THE TREATMENT OF WOUNDS OF THIS VISCUS, OR IN CASES OF STRICTURE OF THE URETHRA.—A square piece of muslin, with a tape to each corner, and a hole for the penis, is to be applied and fastened around the pubes, the two tapes from the perineum being tied to those which go over the groins. Then the four ends of two ligatures tied around the catheter are to be tied as shown in the figure. (After Velpeau.)

In *wounds of the kidney*, inflammatory action is the principal danger to be feared; this, of course, should be combated by appropriate means, but such wounds are generally fatal.

In *wounds of the bladder*, a catheter should be introduced, and retained in position, as shown in Fig. 95, till the urine passes readily by the natural channel.

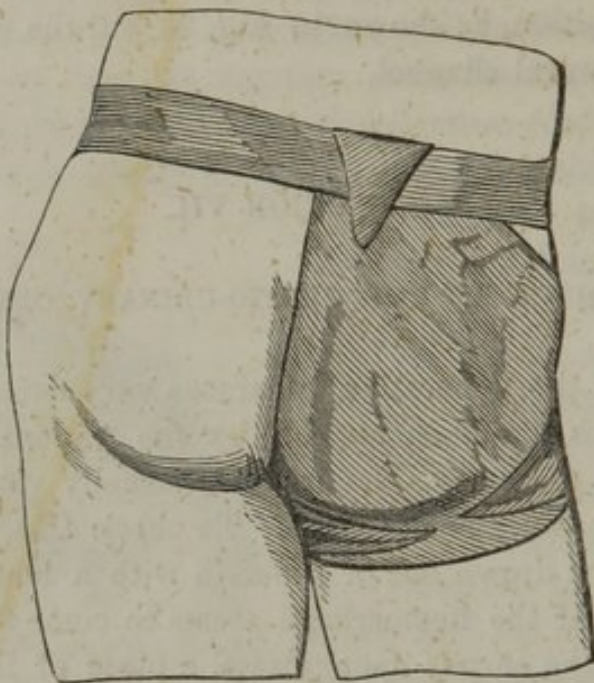
SECTION VII.

WOUNDS OF THE GENITO-URINARY ORGANS.

Wounds of the generative apparatus vary considerably; sometimes the *penis* has been cut off by the patient himself, or by others, and in these cases the organ is usually violently retracted, and there is profuse hemorrhage. To check this, the body of the penis should be drawn out of the skin with a tenaculum, and the arteries tied. If the hemorrhage seems to come from the corpora cavernosa, or the corpus spongiosum, a piece of lint wet with tr. ferri chloridi, or some other astringent, may be applied. Sometimes individuals have cut off their *testicles* while laboring under maniacal excitement; and I have known cases where persons confined in prisons, and others, have attempted this with the edge of a broken bottle, &c. Fortunately for these unhappy patients, the means by which they attempt to effect their object are generally such that there is very little hemorrhage, owing to the lacerated character of the wound. If, however, free hemorrhage should occur, it may be arrested by ligating the vessels of the cord, the wound being treated upon general principles. Wounds of the *female* generative apparatus may occur, very extensive lacerations of these parts having been produced by falling astride of the stopper of a bath tub, &c.; In such cases, usually, the chief danger is from the inflammation which will ensue, and this should be combated upon general principles. Wounds of the *buttock* and *perineum* are also sometimes created by falls, or, as once occurred, by the breaking of a chamber-pot under the weight of a heavy man. Under these circumstances the wound should be freed from all particles of foreign matter, and the parts covered by a poultice, &c., as directed in lacerated wounds. The best means of retaining a dressing to this part of the body is by means of the handkerchief bandage of Mayor—one

handkerchief in the form of a cravat being tied around the pelvis, and the other, in the shape of a triangle, being applied by its base

Fig. 96.



A representation of the Handkerchief Bandage of the Buttock, as applied by Mayor.
(After Mayor.)

around the thigh, whilst its summit is pinned to the cravat, as shown in Fig. 96.

PART IV.

INJURIES AND DISEASES OF THE BONES AND JOINTS.

THE Bones, like the soft tissues, are liable to certain changes, which not unfrequently eventuate in a marked modification of their normal condition; thus they may inflame, suppurate, ulcerate, slough, mortify, and be thrown off from the system, whilst the void thus left will granulate and reproduce a new bony structure by very much the same steps as were noted in similar affections of the soft tissues. In fact, in nearly all the injuries and diseases of the bones, but little difference will be seen between them and the same affections of the soft tissues, except such as are due to the difference in their chemical composition and density, lime predominating in the bones, whilst the protein compounds form the chief ingredients of the soft structures. A brief allusion to the structure of the bones will facilitate the comprehension of their diseases, and point out the modifications between their injuries and the same condition in the soft tissues.

General Structure of Bones.—Bones present two varieties of structure, an outer or compact tissue, which predominates in their diaphysis, as well as in their circumference, and an inner, reticulated, or cancellated structure, which is found in the medullary canal or in the interior of the bones, as well as in their epiphyses and extremities. In the long bones these two structures—the compact and cancellated—are so distributed that the portion nearest the joints, or their articulating extremities, is chiefly composed of cancellated tissue, whilst the shaft, which is more solid, is formed of the compact matter. But in the short or thick bones the cancellated tissue forms the great bulk of the bone, the compact structure being only a thin shell spread over their surfaces. The bones are also covered externally by a strong, tough, fibrous tissue, which, in adult life, can

only be separated from them with difficulty, though less firmly attached in the young bones; whilst internally in the medullary canal, and throughout most of the cells of the cancellated structure, they are lined by a more vascular and delicate membrane. These two membranes are generally designated as the external and internal periosteum, the latter being also known as the medullary membrane, in consequence of its connection with the soft pulpy medulla which it contains, and which is popularly known as the marrow. To these two membranes the bones are chiefly indebted for their nourishment, most of the processes of repair in either disease or accident being due to the healthy action of these tissues. The supply of blood from other sources than through the vessels of the external periosteum is comparatively limited, the chief point of supply being the nutritious foramen of the bone, through which the main artery enters in its course to supply the internal membrane. As this nutritious foramen is a fixed point in all bones, it is easy for a surgeon to recognize the influence of the position of certain fractures upon it, and to use additional care in the treatment of any case in which the nutritious supply might be checked by the fracture, or to explain to his patient beforehand that the result of such an injury will probably be more serious than it would otherwise have been.

Seat of Diseases in the Bones.—The injuries and diseases of the bones may either affect the shaft or their continuity, or its extremities, and the contiguous portions; the latter including all the injuries and diseases of the ligaments and joints, as well as the articulating surfaces of the bones. In the methodical arrangement of the affections of the bony tissues and their appendages I shall include under the first variety, or the affections of the bony tissues, fractures, periostitis, osteitis, caries, necrosis, exostosis, and tumors of various kinds, together with such diseases as are due to a deficiency or redundancy of certain of their component elements, as *mollities* and *fragilitas ossium*.

In the second variety, or the affections of the contiguous structures, may be placed luxations, sprains, synovitis, hydro articuli, &c., all of which must be separately studied; and, as fractures are the injuries most frequently met with, they should first receive a careful investigation.

CHAPTER I.

OF FRACTURES IN GENERAL.

THE subject of fractures, or the solutions of continuity in the bony fibres, caused either by mechanical violence or muscular action, is one that demands the most careful attention of the student, not only in order to prevent deformity of the limbs and the imperfect locomotion which result from the improper treatment of such injuries, but also to protect the reputation of the surgeon, and insure the proper performance of his duties. Nor is this subject less important to every medical man, whether professing surgery or limiting himself to the practice of medicine, as all practitioners are liable to be called on to render assistance in the emergencies which usually give rise to these injuries.

A fracture has been very correctly defined as "a solution of continuity in the bony fibres, which is the result either of mechanical violence or of muscular action." It is generally accompanied by more or less injury to the surrounding soft tissues.

Etiology.—The causes of this solution of continuity in the bony fibres may be divided into those which are predisposing, and those which are immediate or direct.

1. *Predisposing Causes.*—The predisposing causes of fractures are—

The *exposed position* of the bone. Hence the long bones, especially those of the extremities, which are situated between powerful muscles, are most apt to suffer from fracture. The *diathesis* of the patient has also a marked influence in their production, syphilitic and cancerous patients suffering from fractures upon the slightest immediate causes. *Occupation*, also, has its influence; workmen, and those exposed by their trades to falls or blows, being more liable to these injuries than others.

2. *Immediate Causes.* The *immediate causes* of fracture may be divided into two varieties, mechanical violence, and muscular contraction, both of which create fractures by overcoming the natural adhesiveness of the bony fibres. They may be applied in various ways, the mode in which fractures are created being innumerable.

Varieties in Fractures.—Fractures have been classified, 1, according to the nature of the injury; and, 2, according to the direction in which the bony fibres yield. According to the nature of the injury, they are usually divided into simple, compound, comminuted, and complicated; whilst in accordance with the direction in which the fibres of the bone have yielded, they are classified as transverse, oblique, longitudinal, fissured, stellated and depressed, each of which has its special peculiarities.

A *simple fracture* is one in which the fibres of the bone have given way without any *external* solution of continuity in the soft parts, though the latter may have been bruised, or even lacerated internally.

A *compound fracture* is one in which a wound has been made in the outer surface of the soft parts, by which the atmosphere can communicate with the broken ends of the bone. This wound may be made either by the fragments of the bone being driven through the surrounding soft parts, or by the same violence which produced the injury. To comply with this definition of a compound fracture the wound must therefore communicate with the fragments of the bone, otherwise the injury would properly be only a simple fracture complicated with a wound.

A *comminuted fracture* is one in which the bone has been broken into two or more pieces.

A *complicated fracture* is that which is accompanied by some other injury, such as laceration of the bloodvessels or nerves of the limb, &c.

A *transverse fracture* is one in which the fibres of the bone have given way transversely to its long axis.

An *oblique fracture* is that in which the fibres have yielded obliquely.

A *longitudinal fracture* is one in which the division of the bony fibres runs parallel with the axis of the bone.

A *fissured fracture* is one in which there is a simple crack; the term being generally limited to fractures of the cranium.

A *depressed fracture* is also generally confined to the cranium, in which some part of the fragments is depressed below the level of the surrounding portions of the skull.

A *stellated fracture* is an injury of the bones of the head, in which the fissure assumes a radiated, star-like shape.

Causes of the Deformity in Fractures.—As the bones serve for the

points of attachment of muscles, and the action of the latter is resisted by the continuity of their fibres, it follows that in the event of a fracture the action of the adjacent muscles, or those connected with the fragments, will be imperfect, and that the fragments themselves will thus be liable to be drawn out of their natural line, whence deformity of the limb ensues, as well as displacement of the broken ends of the bone.

Displacement of the fragments after a fracture may also be produced at the moment, by the force creating the injury, as well as subsequently by muscular contraction after the fracture has occurred.

This muscular contraction tends towards the reproduction of deformity until the bones have become again firmly united, a fact which should be borne in mind throughout the entire period of treatment. The popular idea is, however, quite the reverse. Thus the ignorant conceive that a bone once set is always set, and often blame the surgeon first seen for having "set the bone wrong;" when the person deserving blame is really the second or third attendant in the case, or the patient himself, by whose constant muscular action, when unresisted by proper mechanical contrivances, the bone is repeatedly displaced.

Displacement after fracture may occur in five different directions.

1. Displacement in accordance with the *length* of the bone, is one in which the fragments are drawn upon each other as in oblique fractures, and produces marked shortening of the limb. By it the free surface of the external periosteum of one fragment is liable to be brought into contact with the free surface of the internal periosteum of the other, and as these two structures differ in vascularity, there will often be such a difficulty, in the formation of callus, as will retard the cure and increase the probability of the formation of an artificial joint.

2. A displacement, in accordance with the *thickness* of the bone, is that which is produced in transverse fractures when one fragment rides the other. Here the medullary canal of both fragments being exposed, and the external periosteum of one fragment brought into contact with the external periosteum of another, it becomes a question whether these two surfaces can unite, a question which will be more fully alluded to subsequently under the head of Callus.

3. Displacement, in accordance with the *circumference* of the bone, or that in which one or both fragments rotate upon their

axes, interferes not only with the formation of callus, but with the subsequent usefulness of the limb; thus, if such a deformity should become permanent in the femur or tibia, the foot would be turned inward or outward by the rotation of the lower fragment, and the patient would walk upon the inside or outside of his foot instead of upon the sole. In the humerus, the elbow would be apt to present inwards, outwards, or even forwards, and the position of the hand would, therefore, be such as would materially interfere with its usefulness as well as with the comfort of the patient.

4. An *angular* displacement is one of the most common of those consequent upon fractures, and is invariably produced when the muscles on one side alone act, or when the two sets of muscles act unequally. Thus, in a fracture of the leg in which the heel is not well supported, there will be more or less angular displacement of the upper end of the lower fragment, but this displacement usually interferes but little in the formation of callus.

5. The fifth displacement is that present in *impacted* fracture, in which one fragment is driven into the other by the force producing the injury. In this displacement, the external periosteum of one fragment, or the bone denuded of its periosteum, presents to the internal periosteum of the other, in consequence of which difficulties in the formation of callus as well as shortening, angularity, &c., are very likely to ensue.

Symptoms.—The symptoms of fractures are divided into two general classes: 1, the rational; 2, the physical.

1. The *rational symptoms* of fracture are readily recognized; thus, the patient suffers pain, which is generally acute and often intense. Indeed, so marked is the pain from a fracture that it has been said that the accident may be recognized by the cry of the sufferer at the moment of its occurrence, or at the first dressing. Frequently, however, there is impaired or irregular sensibility of the affected limb from the pressure of the fragments upon the nerves supplying the part. There is also more or less inability to perform the functions of the limb; thus, if the fracture affects the femur or tibia, the patient will be unable to stand, whilst if it is the humerus he will be unable to perform the usual motion of the arm, which hangs as a dead weight at his side.

2. Among the *physical signs* of fracture, the most important is that of *crepitus*, or *crepitation*, or that sensation caused by the friction of the fragments against each other. This sensation has

been compared to the impression made upon the sense of touch and hearing by rubbing two pieces of loaf sugar or similar porous bodies together. In order to diagnose this condition, which is often rather *felt* than heard, the inexperienced observer should exercise every caution; but once perceived there will be little difficulty in recognizing it again. In some cases it is quite difficult to distinguish the crepitus of a broken bone from certain other conditions, as a diseased state of the bursa connected with certain tendons, where, owing to lymph being effused into the cavity of the bursa, the movements of the tendon produce a sensation which has been confounded with the crepitus of fractures. So also the impression made by the motion of a joint during certain inflammations of its structure. Both these conditions, however, give the impression of the action of moist surfaces, while the crepitus of fracture gives rather the idea of the friction of two dry porous bodies upon each other. Emphysema of the cellular tissue is accompanied by a crackling upon pressure which, under certain conditions, might be mistaken for the crepitus of fracture, but a diagnosis may be readily made by noticing that the crackling or crepitation of emphysema is superficial, while that of fracture is deeper seated.

Besides crepitus, the physical signs of fracture consist in increased or diminished mobility, in displacement or deformity of the part, and in loss of motion, or too great a degree of mobility.

Prognosis.—The prognosis of fractures will depend upon the age, constitution, and habits of the patient, as well as on the extent and nature of the injury.

As a general rule, the fractures of the aged, if they unite at all, unite more tardily than those of the young. There is also more endurance, more vascularity, and more ample formative and reparative power in the young than there is in the old. The prognosis will also vary with the bone that is broken; a fracture of a single bone situated between powerful muscles, such as the humerus or femur, being more difficult to treat successfully, and without deformity, than one in which two bones are concerned, particularly if but one of them is broken, as the radius, or the tibia; since in this case the other bone—the ulna, or the fibula—acts as a splint, so as to keep the parts at rest and prevent shortening. The relation of the fracture to the attachment of muscles also influences the prognosis. If the fragments have muscles attached to them, which have a constant tendency to reproduce the displacement, the cure will

take a longer time, although, with care and proper treatment, it may be ultimately accomplished. The rapidity of the cure, and the probability of deformity, are affected moreover by the nature of the fracture, whether it is impacted, simple, transverse, or oblique.

The social position of the patient has also its effects upon the prognosis. If in wealthy circumstances, surrounded by all the luxuries of life, and able to obtain the little comforts and attentions so necessary for the sick, the chances will be better than when a fracture occurs among the laboring classes. On the other hand, these men have generally more robust frames and better constitutions, and hence their chances are better than too many of the wealthy, who are liable to be debilitated by their mode of life. The general health of the patient also influences the rapidity of the cure, and even the chances of life. The relation of the bones to certain cavities should moreover have its weight in the prognosis, the injury being always severe in fractures of the pelvis, on account of the liability of injury to the viscera, either by the force producing the fracture, or by the effusions which are apt to ensue.

Process of Repair in Fractures.—As it is absolutely essential to a cure that there should be the formation of a proper amount of reparative material, in the healing of the injuries of a structure which, like that of a bone, must gain a considerable degree of close consolidation before its functions can be correctly performed, the investigation of the process of union has always been most carefully conducted. From an early period of surgical science, the mode of union in fractured bones was regarded as one of the most interesting questions in surgery, and the physiology of the reparative action has since then received general attention, so that its course is now well understood.

CALLUS, or the material furnished by nature for the union of the broken ends of a bone, is an example of the modification of structure created in an effusion of lymph by the action of the tissues concerned in the injury. In its formation, the same general steps may be noted as were seen in the effusion of that plasma which served to repair the injuries of the soft tissues. As the cause creating a fracture is always productive of considerable laceration of the vessels of the adjacent tissues, an effusion of blood into the surrounding parts is usually noted soon after the occurrence of the injury. This blood being effused within the integuments, soon creates more or less swelling, as well as discoloration of the skin,

at or near the seat of fracture, rendering the limb black and blue to some distance from the part, and especially in the line of the muscles which have been most violently strained at the time of the accident. Like the effusions of blood in wounds, this blood is soon acted on by absorption, whilst the inflammatory action developed by the injury, leads to an effusion of plasma around it, and to the steps of organization already explained in a previous chapter.¹ In addition to the laceration of the fibres of the adjacent tissues, a fractured bone is always attended by some laceration of both its external and internal periosteum, and the inflammation developed from the injury of these membranes seems to have a marked influence in regulating the character of the deposit which occurs around



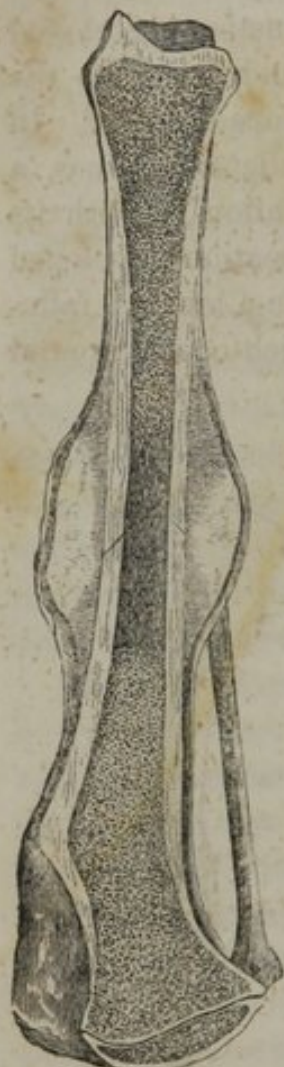
DIAGRAM OF THE EARLY STAGES OF UNION AFTER FRACTURE OF THE HUMERUS.—1. The pouch of blood and the ends of the bone surrounded by it. 2. Plasma occupying the place of the extravasated blood. 3. Organization advanced in the callus which now holds the fragments as in a ferule. (After Miller.)

the broken ends of the bone. The effusion of lymph consequent on the development of inflammation in all the soft structures around a

¹ See page 77.

broken bone is soon apparent in the thickening and enlargement felt at the seat of the fracture a few days after its occurrence. (Fig. 97.)

Fig. 98.



A view of the Ensheathing Callus in a Dog's Tibia, showing that it accumulates solely between the wall of the bone or its compact tissue and the external periosteum, which is thus lifted up from the bone, whilst the bloodvessels which passed from it to the bone in the natural state now pass to their destination through the callus. (After Paget.)

This effusion of lymph being noted by Dupuytren, in his experiments upon animals, to be both around as well as within the ends of the bones, he attributed the exterior mass to the action of the external periosteum, whilst that connected with the ends of the fracture he assigned to the reparative efforts of the medullary membrane. As he thought that the exterior mass of callus, though marked at first, disappeared after the lapse of a few weeks or months, he termed it the "*Provisional Callus*;" whilst that from the ends of the bone, which completed the continuity of its structure, he designated as the "*Definitive or Permanent Callus*." These opinions of Dupuytren being in accordance with the observations of others, have long been received as the true explanation of the condition of parts after a fracture had united by callus or new bony matter; and surgeons yet recognize, to a considerable extent, the existence of these two forms of bony union. Professional opinion has, however, been recently very much modified in regard to the condition of the exterior callus, in consequence of the observations made by Mr. Paget on this subject; Dupuytren's explanation being objected to on the ground of his having experimented on animals, in which it was difficult to keep the broken bones at perfect rest. Mr. Paget thinks,¹ from his observations, that "the method of repair with an ensheathing or provisional callus is rarely observed in man, though frequent in fractures of the long bones of animals;" he "having never seen it in man, as a natural process, in any bones but the ribs."² Subsequently, however,

he admits that he has seen it in the human clavicle and humerus, though in both these instances he deemed it due to the movements

¹ Lectures on Surgical Pathology, p. 165, Philad. edit.

² Op. cit., p. 167.

of the parts having disturbed the more proper mode of repair. That perfect rest and accurate adjustment limit the amount of the provisional callus, must be a common observation of all who have had much experience in the treatment of these injuries; and personal observation induces me to think that Mr. Paget's first opinion on this point will not be maintained by him on further and more extended observation. Wherever a fractured bone is superficial, as in the clavicle or in the tibia, the lump or protuberance caused by the provisional callus will often be too plain to be mistaken, whilst very many specimens of fractures recently united and surrounded by a true provisional callus, that is, one which is larger a few weeks after union than it is some months subsequently, are to be found in most surgical cabinets. The chief objection is certainly correct as respects the use of the term *provisional*, this callus being always present after the union of a fracture, and shown in the greater thickness of the exterior or compact layer of the bone; and it is therefore more accurate to employ the term "*ensheathing callus*" to designate this exterior bond of union, as has been well suggested by Mr. Paget.

In explaining the production of both the ensheathing and definitive callus, Messrs. Paget and Stanley regard them as due to the formation of the granulations which result from the organization of the effused lymph, these granulations being created by precisely the same reparative efforts as those already alluded to as the chief agents in the repair of the soft tissues.

In the repair of injuries to the bones, as well as in those of the soft tissues, certain conditions are necessary. Thus, (1) there must be upon the part of the patient a sufficient degree of vital power to keep up the necessary amount of inflammatory action; and (2) there must be an absence of such stimulants as might induce excessive inflammation, and result in suppuration, or an absorption of the callus, a condition which may ensue upon a too early, violent, or otherwise improper motion of the fragments.

The granulations of repair in fractures form nucleated cells by which ossification is ultimately accomplished, and these spring from the internal surface of the external periosteum, from the compact structure of the bone itself, and from the medullary membrane, as may be demonstrated by an examination of the extremity of a bone in the stump formed by an amputation, where granulations will be seen sprouting from all these sources, and where they are found

shooting up, spreading out, and forming a mushroom-like mass at the extremity of the bone.¹

Any deviation from these processes of repair, results in a modified callus. Thus, certain circumstances so modify the conditions necessary to the perfect formation of callus, that merely a cartilaginous or ligamentous mass results, and some bones consequently present these conditions so invariably that they seldom if ever obtain bony union, as for example the femur within the capsular ligament, the patella, olecranon, &c.

The process of repair and the formation of callus may be divided, for the purposes of study, into two periods.

1. The uniting period, during which the provisional or ensheathing and the definite callus are formed.

2. The modelling period.

1. The *uniting period* presents first a stage of inflammatory exudation, which continues for the first two to four or five days after the injury, and, with the effusion of blood already alluded to, produces the swelling which occurs after fractures.

Then there is a period of four or five days of apparent inaction and decline of inflammatory action, a period of calm after the storm; accompanied by diminution in swelling, pain, and all inflammatory symptoms. These two periods together give, it will be perceived, from eight to ten days, during which nothing has been done directly for the repair of the injury. The third stage, commencing in the neighborhood of the tenth day, and lasting from ten to twelve days, is the formative stage, in which the reparative tissue is formed by an organization of the lymph, as thrown out, and the formation of granulations as stated. This is the period popularly designated as the "knitting" period, during which the patient will often say he can feel the bone knitting, which of course is an erroneous idea, though what causes the sensation, whence the patient obtains this notion, cannot be told. We have thus obtained a period varying from twenty to thirty days, during which usually no osseous matter has been deposited. It is impossible to limit these periods nearer than by the generalization above given, for they vary with the age, the bone broken, the degree of inflammatory action, and many other circumstances. In the fourth stage *osseous matter* begins to be deposited, and soon exhibits the true characteristics of normal bones, as the formation of the Haversian

¹ Paget's Lect., Phila. edit., p. 163.

ossicles, canals, &c., though these are not presented in the fully developed state of normal bone. This stage of ossification is of an indefinite length, varying in different bones, and on account of diverse circumstances not always precisely noted.

2. During the modelling period, which trenches somewhat on the last stage of the first period, sharp fragments and spiculæ of bone are removed or rounded off; any great excess in ensheathing callus disappears; cells are developed on that part of the definitive callus which encroaches upon the cavity of the bone, and the cancellated structure is reproduced to a greater or less extent. (Fig. 99.)

The time required to effect such a degree of union, that the patient may with safety dispense with his splints and bandages, and begin the motion of the limb, varies according to the bone injured. Thus, in the clavicle it is about five weeks, in the humerus six or seven under favorable circumstances. In the case of the femur it would hardly be safe to walk before twelve weeks or three months; and in the tibia it is about eight weeks. But it must be remembered that some fractures never unite by callus, that condition resulting which is spoken of as "false joint," or more properly "ununited fracture;" besides which certain fractures, as before stated, unite only by ligamentous matter, the callus never becoming bone.

Treatment.—The treatment of fractures may be considered as resolving itself into four stages.

Fig. 99.



A view of the Condition of a Bone after the *modelling process* has been conducted through its different stages, showing the removal of the sharp points and edges of the fragments, the closing in or covering of the exposed ends of the medullary canal, the forming of a compact external wall and cancellous interior for the reparative new bone, and lastly, the continuity of these with the walls and cancellated tissue of the fragments.' (After Paget.)

¹ See Paget's Lectures, p. 170.

The first stage relates to those general rules which must be obeyed in all fractures of sufficient magnitude; such as directing the manner of removal of the patient to his dwelling, of placing him in bed, &c. &c.

The second consists in the reduction, or, as it is termed in common language, the "setting" of the fracture.

The third consists in the application of such dressings as are necessary to prevent displacement of the fragments by muscular action.

And the fourth stage embraces the treatment of the complications and constitutional disturbances, which result from the injury or follow the dressing, as chafing, ulceration of the skin, ankylosis of the joints, &c. &c.

A few words devoted to the explanation of each of these stages, so far at least as they are applicable to fractures generally, will save much unnecessary repetition in the consideration of particular fractures.

The first stage embraces that part of the general treatment of fractures which relates to transporting the patient from the spot upon which the injury occurred to that at which he is to be treated, and to the arrangements which become necessary, not only for carrying out the treatment, but for the *comfort* of the patient; the latter being a matter by no means to be overlooked in an injury, where perfect rest is so essential to the cure.

The directions to be given in regard to moving a patient will vary, of course, in accordance with the character and position of the injuries. In the majority of severe fractures, as in fractures of the lower extremities, spine, and head, and often in compound fractures of the upper extremities and other bones, it becomes the duty of the surgeon to suggest means for the accomplishment of this object without adding to his patient's suffering; it being also desirable that he should, if possible, be borne along without jarring the broken fragments, and thus augmenting the laceration of the soft tissue. For this purpose such means must be employed as can be most readily obtained. Where nothing better can be had, a shutter or door taken off its hinges will answer the purpose; but, when a settee can be obtained, it furnishes the most convenient mode of transportation. If the patient is to be carried to his own dwelling, particularly if the house is small and the rooms narrow, care should be taken not to carry the settee into the room in such

a manner as to bring its back to the bedside. This apparently trifling matter is one really of practical importance, as, if it be neglected, it may become necessary either to carry the patient down stairs and bring him up again in the proper position, or to lift him over the back of the settee, by which movement serious mischief may be done to the limb, and unnecessary pain created.

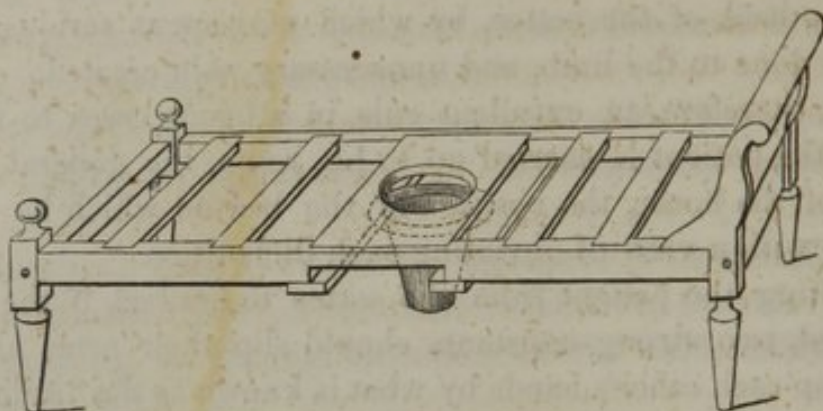
It is, therefore, an excellent rule in all such cases to ascertain, before the patient is carried up to his room, the general arrangements of the house, the position of the bed on which he is to lie, &c. &c., with a view of obviating such difficulties.

In lifting the patient from the settee to his bed, if the femur is fractured, two strong assistants should slip their arms under him and clasp each other's hands by what is known as the "sailor's grip," that is, by placing the palmar surfaces of their flexed fingers together. These hands should be placed one under the shoulder and one under the hip of the patient, while an experienced assistant or the surgeon himself should lift the injured limb. The position of the assistants should also be so regulated that they may be able to lay the patient easily upon the bed—which should always be a narrow one—by one going on each side, when the patient may be gently deposited upon it, the hands being afterward withdrawn. When these details are overlooked, it often happens that the assistants so place themselves that one comes between the bed and the patient, and has then to crawl over the bed whilst sustaining the patient's weight, which incommodes all parties.

Preparation of a Bed.—Previous to this, if the patient has a fractured thigh, leg, cranium, or any injury by which he is likely to be confined to his bed for some days or weeks, the bed upon which he is to lie must be prepared for that purpose. The necessity for such a proceeding is easily seen when it is remembered that a patient with a fractured thigh must lie on his back for six, eight, or twelve weeks without motion; during which time his bowels are to be moved every day, his urine is to be passed, his clothes are to be changed, &c.; whilst all this must be done without producing any displacements in the fragments of the injured limb. To accomplish this, some modification in his ordinary bedstead becomes necessary. One modification which constitutes a very excellent "fracture bedstead" is readily made out of any ordinary single bedstead by sawing its side near its middle into two parts, at about a foot distant from each other. Then the piece thus marked off is to be split out with

a chisel, so as to form a depression. (Fig. 100.) Two cleets, similar to those of a counter drawer, are then to be nailed from one side of the

Fig. 100.



A representation of a Fracture Bedstead, as made by altering the ordinary single bedstead.
(After Nature.)

bed to the other at the edge of the depression, at such a distance apart that a common chamber pot with a width of brim corresponding with the width of the groove in the cleet thus prepared may be slid along it. Such a bed should support its bedding with slats, not by means of a sacking bottom. If a slat bedstead is not at hand, one may readily be made by taking off the sacking-bottom, breaking off the pegs to which it is attached, and nailing on slats of wood, placed two, three, or four inches apart, according to circumstances. The middle slat should be broad, and at its middle, corresponding with the position of the pot, there should be a hole cut out like a privy seat. Such a bedstead can always be made from an ordinary bedstead at an hour's notice. A very excellent fracture bedstead, admirably adapted for the purpose, often difficult to obtain in private practice, but suitable for hospitals, is a simple iron bedstead, having at a proper point a round opening, which can be closed with a trap, and beneath which are proper arrangements for sliding in the pot. Upon this, or upon the more domestic bedstead described above, the *fracture mattress* is to be placed. This consists of an ordinary mattress with a hole in the centre, so made as to correspond with the opening in the bedstead. To fill this opening, when not needed for necessary purposes, it is to be kept closed by a pad, shaped like the cover of a privy seat; the edges being sloped so as to enable it to be slipped in and out under the patient's hips without disturbing his position in the bed.

Although this fracture mattress is very readily made out of an ordinary mattress, still there may be difficulties in the way of obtaining it, or other causes may render it necessary or desirable to substitute a simpler arrangement.

Under these circumstances, four clothes-props, or similar pieces of wood may be jointed into a frame; a sacking-bottom stretched

Fig. 101.



A view of the Fracture Frame for elevating patients from the bed, as described in the text. (After Nature.)

over it, a hole made in the centre and tapes tacked along the edges to prevent the sacking-bottom from tearing out, as in Fig. 101.

If the size of the frame is such as to project a little beyond the edges of the bedstead, a contrivance is obtained which will answer every purpose. It may be laid upon any ordinary bedstead upon which a mattress has been placed; a fracture sheet, which consists in a simple sheet, with a hole cut in the centre, being laid upon it and the patient placed on top of the sheet. Then when he desires to have a stool, it is only necessary to elevate the frame from the bed by means of assistants; to rest its ends upon the backs of four heavy chairs, or any contrivance made for the purpose, and place the chamber-pot beneath the orifice in the sacking-bottom. There is another recommendation of this frame,

particularly in warm climates, or in the summer season, and that is, that as the patient lies constantly upon his back, his skin becomes sodden by perspiration, and he is predisposed to bed-sores, besides the discomfort which he necessarily suffers. All this may be prevented by occasionally elevating him from his couch by some such apparatus as this, and a draft of cool air being thus made to pass beneath him, the danger of bed-sores is materially diminished.

Attention must also be paid to the mode of making such changes in the bedclothes and linen of the patient as are necessary during his confinement. As it is often exceedingly important, particularly in fractures of the lower extremities, to accomplish these changes without compelling any motion on the part of the patient, it may be readily accomplished by a very simple manœuvre. In changing the shirt, take the garment and pass one hand in at

the sleeve and out at the tail; elevate the patient's hands and arms above his head; grasp one of his hands so as to secure all his fingers, and prevent them from catching in the shirt, and draw it into the sleeve up to the shoulder, repeating the same motion on the opposite arm; then drawing the shirt well up into both of his axillæ, elevate his head a little and slip the shirt over it; after which it can be drawn down into the hollow of the back, but not below the hips, or it will be liable to be soiled sooner than necessary. If it is desired to take the shirt off, it can be accomplished readily by movements directly the reverse of those just described.

The removal and replacing of the bedclothes is still more simple. The new sheet should be gathered up into a fold and laid under the neck of the patient, when the upper edge of the old sheet may be made fast to the lower edge of the new one, and as the patient hollows his back a little, or is eased up by assistants, the same motion which draws the old sheet from under him brings also the new one into its place. When in changing the sheets the splints, &c., are reached, as in a fractured thigh or leg, the surgeon should carefully take charge of them until the changes are completed.

These little points may by some be regarded as triflingly minute, but experience has shown their value; and they are closely connected with the comfort and welfare of the patient.

Reduction of Fractures.—The means to be employed in the reduction of the fractured ends of a bone consist essentially in extension and counter-extension.

By *extension* is meant the force applied to the fragment farthest from the centre of the body with the view of drawing the bone into its place. By *counter-extension* is meant the force applied to the fragment nearest to the body, or to the body itself, with a view of resisting the extending force. Thus, for example, in a fracture of the humerus, if the extension is applied at the wrist, and no counter-extending force applied, the extension would simply draw the body out of line; but when, by a properly adjusted counter-extending force, the upper fragment and the body are rendered a fixed point, the extending force is enabled to draw the fragments into place. Hence, the counter-extending force must be equal to the extending force, excepting only the degree of power which must be applied to the lower fragment before the *vis inertia* of the upper fragment is overcome.

When the extending and counter-extending forces are applied judiciously and with sufficient power, it next becomes necessary to adjust the ends of the fragments by those manipulations which have been denominated "*Coaptation*," and which simply consists in well-regulated attempts made by the fingers of the surgeon—while extension and counter-extension are being made—to adjust the position of the ends of the fragments, and bring the parts as accurately as possible into their normal position.

The object of the extending and counter-extending force is to remove displacement by overcoming the muscular action which produces it. That these forces shall be efficacious, therefore, they must have sufficient power to overcome the strength of the spasmodically contracted muscles, and a slighter degree of force will answer, if means are employed calculated to promote relaxation in the muscular tissues.

It is better, therefore, not to attempt to overcome the spasmodic contraction of the muscles in a case of fractured thigh, or a badly fractured humerus, without obtaining perfect muscular relaxation, as may readily be done by means of anæsthetics. The advantages of this mode of proceeding are to be seen in the facility with which these powerful muscles, which are usually so difficult to overcome when spasmodically contracted, can be mastered by the strength of a single assistant. Not only is pain to the patient avoided, but the nervous shock and violence which predispose to inflammation, &c., are obviated by this simple and safe mode of proceeding. Hence, I do not hesitate to recommend the use of anæsthetics in the reduction of every case of fracture of a bone acted upon by powerful muscles, provided there is no affection of the brain or heart.¹

Retention of Fractures.—The mechanical contrivances employed to effect the reduction of fractures are various, and will be detailed in connection with such fracture, as will also the means employed to retain the fragments in position after their reduction, and prevent the action of the muscles from causing a recurrence of the deformity.

After-Treatment.—The after-treatment of fractures consists in employing such means as are necessary to regulate inflammatory action, stimulating measures being resorted to, if there is a deficiency of action, and antiphlogistics, if appearances indicate that it is likely to be excessive.

¹ For the administration of anæsthetics, see *Op. Surg.*, vol. i. p. 183, 2d edit.

Besides which, some means will be required to guard against stiffening of the joints; to obviate the loss of power which sometimes results from the adhesion or wasting of muscles, and to meet the various complications which will spring up from time to time in the course of the mechanical treatment. Thus, fractures may be complicated with chafing and ulceration of the skin resulting from too much violence in the employment of the extending or counter-extending forces, as well as from the careless use of the means necessary to produce these forces, or from tenderness in the skin of the patient, &c. So, also, if the patient lies long upon his back, as in cases of fractures of the cranium, of the vertebræ, of the thigh, &c., troublesome bed-sores may result and their treatment become necessary. From long continuance in one position, pain in the fractured limb, and even violent spasm in its muscles may also result, which, as well as the various complications above mentioned, require to be studied in detail, and will be again alluded to in connection with the fractures in which they most frequently occur.

CHAPTER II.

FRACTURES OF THE HEAD AND FACE.

SECTION I.

FRACTURES OF THE CRANIUM.

FRACTURES of the cranium may be caused by the exercise of direct force or of indirect violence. In either case the force is applied to some portions of the arch formed by the cranial bones, and if sufficiently great, either causes a rupture of their fibres at the point to which it is applied, or, being transmitted along the arch to its abutments, makes the bones at the base of the cranium to give way, the fracture of this portion resulting in consequence of the indirect action of a force which is known as "counter stroke" or "contre coup."

Seat and Etiology.—Fractures may occur at various parts of the vault of the cranium, and these will vary in accordance with the kind of force applied. Thus, when a man is struck with a

bludgeon on the top of the cranial arch, the fracture may occur, if the blow be sufficiently violent, at the point where the force is applied; but if the blow is not violent enough to produce a fracture at this point, it may yet create a fracture of the base of the skull in consequence of its force being transmitted along the walls of the skull to its base, where, meeting the resistance offered by the articulation of the occipital bone with the atlas, the fracture results.

A fracture of the base of the skull may also be produced in another way, as when a man falls from a height upon his hips or feet, the force thus communicated to the sacrum being transmitted along the spinal column to the occipital bone, which then gives way and creates a fracture near its articulation with the atlas.

Structure of the Cranium.—To understand the symptoms and treatment of these fractures, it is necessary to study carefully the anatomy of the head, a few brief allusions to which will probably be useful in this place.

The bones of the cranium are composed of two tables of compact matter containing between them a certain variable amount of spongy or cancellated structure to which the name of *diploë* is applied; and, as this *diploë* is a loose or open bony structure, it acts favorably in the case of blows upon the cranium by diminishing their force; hence, fractures of thin skulls are more extended than those seen in thick, the thickness being chiefly due to the *diploë*.

There are several other structural points which should be borne in mind while studying these fractures; thus, the outer table of the cranial bones is covered by a dense periosteum to which the name of *pericranium* is applied, this membrane being thicker along the median line than elsewhere. As it is very vascular, any force which produces a fracture of the bone beneath it, may rupture some of its numerous vessels and produce the bloody tumor of the head already alluded to, and which is so likely to cause an error of diagnosis in the examination of cases of supposed fracture of the skull.

The cranium is also lined by the dura mater and the membranes of the brain; whilst between the dura mater and the bone lies the middle artery of the dura mater with its numerous branches, the pia mater which lies within the dura mater being also exceedingly vascular. Of course any force capable of producing a fracture of the skull will be apt to rupture some of these vessels, and the

hemorrhage which results will occasion all the symptoms of compression of the brain. (See Fig. 102.) Besides this it is worthy of remembrance that the texture of the integuments covering the cranium is such as to render it exceedingly liable to inflammation, and especially to inflammation of an erysipelatous character.

Fig. 102.



A representation of an Extravasation of Blood by which the dura mater is separated from the cranium at the ordinary site by rupture of the middle artery of the dura mater. (After Liston.)

The bones of the skull which are most liable to fractures are those upon its top and sides, next those forming what is properly spoken of as its base, especially the occipital bone, the mastoid process of the temporal and the sphenoidal bone generally escaping.

Varieties.—Like other fractures, those of the skull may be simple or compound, besides which they are divided into several varieties, according to the manner in which the textures of the bone have given way. Thus a simple crack in the bone is designated as a *fissure*, and is a simple solution of continuity in the fibres of the bone without any other change. This fissure may be combined with wounds and other complications, as may also any other fracture of the skull. When the blow causes a number of fissures radiating from a single point in the shape of a rude star, we have what is known as a *stellated* fracture. A fracture in which the bone is driven in as well as fractured, is called a *depressed* fracture or a *comminuted* fracture. Such fractures require a considerable amount of violence for their production. They may be caused by sabre cuts, by blows upon the head with a bludgeon, by a stroke with a brickbat, by the kick of a horse or mule, or by falls upon the head. In some cases these fractures are accompanied by a loss of structure in the cranium, though this is rare and generally due to injuries from great violence; thus it has been known to occur from fractures of the skull caused by the cutting edge of a circular saw, or by a blow from an axe, cutting out a portion of the bone and leaving the brain exposed.

Repair in Fractures of the Skull.—The bond of union in frac-

tures of the bones of the skull is ligamentous in its character, neither definitive nor provisional callus being thrown out; and it is easy to see that, were it otherwise, serious consequences might result from the callus encroaching upon the brain.

Symptoms.—The symptoms of fractures of the skull vary with the nature of the injury and with the degree of violence producing it. Thus, in all cases there will be more or less contusion or wound of the soft parts, and, if the violence has been sufficiently great, there may be superadded symptoms of concussion of the brain; whilst if the fragments are driven in so as to create pressure on the brain, or if there is hemorrhage from injury to the arteries of the dura or pia mater, there may be symptoms of compression.

Simple Fissure.—The symptoms of simple fissure are, generally, injury to the soft parts and more or less concussion of the brain, which very often terminates favorably, but at times results in effusion and compression of the brain.

Treatment.—In the treatment of a simple fissured fracture of the cranium it should be borne in mind that the chief danger is from concussion of the brain; or that having been passed, from such complications as inflammation of the scalp of the membranes of the brain, or of the brain itself. If concussion occurs it is to be treated in the manner that will be detailed hereafter; but if it is not present the treatment will consist in the use of such means as are calculated to guard against inflammation. Thus the head should be shaved and surrounded by cloths wet with cold water, whilst the whole antiphlogistic system should be actively pursued, bleeding, purging, or mercury, being resorted to as demanded by the principles already detailed in the general treatment of inflammation. (See page 70.)

Depressed Fractures.—The symptoms of depressed fracture are change in the configuration of the skull, and the signs of compression of the brain. Generally speaking, the depression can be *felt* by passing the hand carefully over the cranium after the scalp has been thoroughly shaved to free it from its hair. Besides the injury to the soft parts which necessarily accompanies it, this fracture is also generally attended by all the symptoms of compression of the brain, the latter being due either to the immediate pressure of the broken fragments upon the cerebral substance or to the pressure of a clot formed as above explained.

Diagnosis.—The diagnosis of depressed fracture is important, as

it involves a question of practice; for, in a case of depressed fracture accompanied with symptoms of compression, it will often be necessary to perform the operation of trephining with the view of elevating the depressed fragments. In order, then, to arrive at a diagnosis, the head should be thoroughly shaved and the depression carefully felt for; but it must be borne in mind that every depression felt in the head under these circumstances is not due to a depressed fracture, an effusion of blood beneath the pericranium sometimes assuming such a shape as to give, when felt, an impression well calculated to deceive. Or the line of a suture is sometimes abnormally depressed, and may be mistaken for a depressed fracture; or an inexperienced observer may mistake for the depression of a fracture the natural depression accompanying those irregular elevations of the cranium to which the phrenologists have applied the term *Bumps*. There is also sometimes a depression around one of the ossa triquetra, which has been mistaken for that of fracture. There is, however, an irregularity about the edge of a depressed fracture which is not simulated by any of the above conditions, and attention to the accompanying symptoms will, as a general rule, make the mistake difficult. The degree of depression will vary with the force producing it. Yet it must not be supposed, that every depressed fracture involves the brain; the thickness of some crania being such that a considerable depression may exist in its outer table, and yet the brain not be involved. It is only when a depression, which is evidently the result of fracture, is complicated with marked symptoms of compression of the brain that the operation of trephining is justifiable.¹

Prognosis.—The prognosis in fractures of the skull will depend upon the degree of the injury. Thus a simple fracture without symptoms of compression, and with but a moderate degree of concussion, is less dangerous by far than a depressed fracture; whilst a depressed fracture accompanied by symptoms of compression is, of course, far more dangerous than one without them.

Treatment.—If a depressed fracture is accompanied only by those lighter symptoms which are usually found in connection with simple fissure, the treatment, like that of simple fissure, will consist merely of rest and antiphlogistics, with a view of preventing any inflammation from being set up in the brain or its membranes.

¹ For further details on the cases suited to the operation of trephining, see *Operative Surgery*, vol. i. p. 247, 2d edit.

The treatment of depressed fracture, when combined with symptoms of compression, will consist in the same antiphlogistic measures, and in the performance of the operation of trephining with the view of elevating the depressed fragments and thus relieving the compression.¹

In order to retain a dressing to a fracture of the cranium, either with or without the performance of the operation of trephining, it will be necessary to apply either a T bandage or the recurrent bandage of the head, as shown in Figs. 89, 86.

SECTION II.

FRACTURES OF THE BONES OF THE FACE.

§ 1.—FRACTURES OF THE NASAL BONES.

In order to understand the action of the forces which produce fractures of the nasal bones, as well as the rationale of the symptoms which indicate their existence, attention must be given to the anatomy of the parts concerned.

General Relations of the Nasal Bones.—The nasal bones are placed between the nasal processes of the superior maxillary bones, so that the latter support them on each side. They have also a direct connection with the septum of the nose, as it exists in the ethmoidal bone, and are thus directly connected with the cribriform plate and crista galli of this bone. A blow upon the nasal bones, therefore, if of sufficient violence, may affect the crista galli, shatter the cribriform plate, and even encroach upon the brain itself, producing concussion, or more rarely compression of the brain, or be followed by meningitis. On each side of the nasal bones are the saccus lachrymalis and ductus ad nasum, which transmit the tears to the nose. Blows upon the nasal bone of sufficient violence may therefore encroach upon these important passages, and cause such inflammation as will result in fistula lachrymalis. The inferior part of the nasal bones are attached to the cartilages of the nose, and the cartilaginous septum, whilst above they articulate with the os frontis, and are covered in by the nasal slip of the occipito-frontalis muscle;

¹ For the details of the operation of Trephining see Operative Surgery, vol. i. p. 248, 2d edition.

the common integument of the face covering all, whence these fractures sometimes develop erysipelas of the head and face. Internally the nasal bones are lined by the nasal or Schneiderian mucous membrane, and hence the epistaxis which generally follows the production of this injury.

The nasal bones are so arranged as to present externally the form of an arch, and as they are small, comparatively thick, and well supported by the nasal processes of the superior maxillary bones, it requires a considerable force to break them. Besides which, they are so situated that the prominence of the supra-orbital ridge of the os frontis, protects them above, from chance blows which, glancing down from the forehead, are more apt to light upon the nasal cartilages than upon the bones themselves. In order then to produce a fracture of these bones of the nose, the force must be direct.

Etiology.—A common cause of fracture in these bones is the blow made by the handle of a windlass, carelessly let go, which flying round strikes a bystander in the face, and readily produces the injury; but any similar force may have the same result, as the blow of a bludgeon, kick of horses and mules, gunshot missiles, &c. &c.

Symptoms.—When a fracture of the nasal bones is produced by any of these causes, the symptoms are as follows: There is more or less contusion of the soft parts, with ecchymosis and swelling around one or both eyes. There is also more or less deformity caused by the bones being driven out of their normal line; the degree of this deformity depending upon the amount of violence applied; thus the fracture may be limited to the nasal bones, or extend and implicate the nasal processes of the superior maxillary.

Diagnosis.—The diagnosis will sometimes be a matter of difficulty, although at first sight it would appear to be very easy. Thus, the parts swell and become so painful that the patient resists examination, and it is sometimes only when the bones are much depressed that we are able to tell without difficulty whether they are broken or not.

Prognosis.—The prognosis in this fracture, as in all surgical injuries, depends upon the circumstances of the case, the extent of the injury, the nature of the complications, &c. &c.

Treatment.—The first step in the treatment of this fracture is to

bring the fragments into a proper position; a modification of manipulation being required in different cases to effect this object. If the fragments have been driven to one side, it is necessary to push them back into line; if they are depressed, they must be elevated; but in either case when once reduced, they will, as a general rule, retain their position, as there are no muscles of any power acting upon them, and, except from the displacement which might be caused by swelling, or by effusions bound down by dense integuments, &c., there is little danger of the deformity being reproduced. Still, as a general rule, it will be found difficult to get the fragments back exactly into the ordinary line; and it will be as well for the surgeon to prevent misunderstanding and disappointment by telling the patient that most probably after this fracture he will not have a nose like the original one. The fragments may be brought into position by passing a director, or small stiff probe, into the nostril, keeping it close along the septum narium, pushing it upwards and backwards so as to elevate the

fragments, while, with a finger on the outside, their position may be regulated to the proper degree of convexity. Then, with a view of guarding against any extension of inflammation to the brain, the patient should be put under a strict antiphlogistic regimen for a few days, and any symptoms which may arise be promptly met. If there is excess of action, it should be checked by means of leeches, &c., whilst if from rupture of the bloodvessels of the lining membranes of the nose a troublesome hemorrhage arises, it may be checked by plugging up the nostril with Belocque's canula.¹ Having thus met emergencies, and 48 hours having elapsed with-

out the appearance of any urgent symptoms, the patient may be considered as pretty well out of danger. Any accompanying

Fig. 103.



A VIEW OF THE DOUBLE T BANDAGE, AS APPLIED TO FRACTURES OF THE NOSE. —It should be formed of narrow tapes, of which the vertical turns should be attached to the horizontal portion about one inch and a half apart, as seen in the top of the figure. In its application carry the vertical turns over the head, cross them on the nose over the compresses, and then carrying the horizontal portion from the lip around the back of the neck so as to fasten the vertical ends, bring it around the forehead. (After Nature.)

¹ See Op. Surg., vol. i. p. 341.

wounds of the soft parts of the nose, or of the cartilages, should be dressed by means of sticking-plaster, or if that is objectionable, or if the warm or cold water dressing is to be applied, it may be retained in position by the double T bandage, made of broad tapes, and applied as in Fig. 103. This forms a very excellent means of retaining a dressing to this region, particularly when from too great prominence of the fragments, or from any other cause, it is considered desirable to exercise pressure upon the nose.

§ 2.—FRACTURE OF THE SUPERIOR MAXILLARY BONE.

The shape of this bone, and its position beneath the muscles of the face, are such that it is almost impossible for it to be fractured without wounding the soft parts which cover it. Generally, therefore, this fracture is the result of great force, though one through the alveolar processes sometimes occurs without laceration of the soft parts of the cheek, and is produced by a blow directly upon the front of the teeth. Such an injury may be created by a blow from the fist of a powerful man, or by any other force acting in a similar manner, and the teeth being thus driven in, more or less injury to the interior of the soft parts of the mouth is produced by their being cut by the teeth, though the exterior structures are only bruised.

Treatment.—The fracture of the superior maxillary bone, like the fracture of the nasal bone, is to be treated by coaptating the fragments, keeping the patient at rest, and guarding against inflammation and its consequences. As in the case of the nasal bones, if this fracture is once reduced, there is but little danger of the displacement being reproduced by muscular violence.

If the teeth have been knocked backward, they should be brought carefully back with the finger into their proper position, and kept as perfectly at rest as possible. The patient should also abstain from chewing hard articles of food for several months. After coaptating the injured bones, any wounds in the soft parts that may exist will next require careful treatment, on the general principles already detailed under the head of Wounds of the Face.

§ 3.—FRACTURE OF THE MALAR BONE.

The existence of fracture of the malar bone as an independent injury has been denied by some good authorities; but there are facts which contradict this assertion; and I have now in my possession two specimens of fracture of this bone, of undoubted character.

Etiology.—The fracture of the malar bone may be produced by sabre cuts, by blows from bludgeons, from firemen's spanners, &c.

Treatment.—The treatment is to be conducted upon general principles; thus, the fragments of bone should be coaptated as nearly as possible, and the wounds in the soft part, with which the injury is generally attended, be treated like other wounds, cold water dressings being applied, and any excessive inflammation met by a prompt antiphlogistic treatment.

§ 4.—FRACTURE OF THE INFERIOR MAXILLA.

Fractures of the *lower jaw* are by far more common than those of the upper, but even these are comparatively rare; for the lower jaw is so situated, and its mobility is such, that it yields whenever force is applied, a dislocation being, therefore, much more liable to be created by the application of any ordinary violence than a fracture. Even a blow upon the side of the jaw is more apt to produce a dislocation forwards of that side, than a fracture.

Seat.—Fracture of the lower jaw may occur at almost any point; but it is most common in the adult, just anterior to the insertion of the masseter muscle, fracture at or near the symphysis being more frequent in young persons, before the bone has become perfectly ossified at that point. The fracture may be either transverse or oblique.

Etiology.—This injury is most likely to be produced by the application of great and sudden force to the jaw, particularly whilst it is closed. Perhaps the most common cause is a kick from a horse or mule, a blow of a bludgeon, or some similar violence.

The force necessary to produce the fracture is such that the soft parts are often injured, and a compound fracture results, although this is by no means universal. A compound fracture of the jaw

may, however, exist without any external wound, the fragments communicating with the cavity of the mouth, and such an injury is sometimes quite troublesome, on account of the action of the saliva washing away the reparative lymph as fast as it forms.

In order to understand the causes producing the deformity which generally accompanies a fracture of the jaw, it is necessary to bear in mind the anatomical relation of the muscles attached to this bone, and which produce it by their contraction. Thus, the principal muscles acting upon the jaw from above are the masseter and the temporalis, while below is the insertion of the digastric, the genio-hyoid, and mylo-hyoid, with the muscles of the tongue; and indirectly the sterno-hyoid, sterno-thyroid, muscles which act through the mylo-hyoid by their connection with the os hyoides, &c. The muscles of the cheek, of the throat, and of the front of the neck, are thus concerned, and it is easy to understand from their origin and insertion how depression and irregularity of the fragments will be produced after the occurrence of this fracture at any point anterior to its angle.

Symptoms.—The symptoms of fracture of the lower jaw, independently of the symptoms of the contusion, necessarily produced by a force so violent as that which usually creates the fracture, are as follows: 1. There is displacement, the level of the jaw being no longer preserved. 2. The U shape of the rim of the teeth is destroyed, as is readily seen on opening the mouth. 3. There are crepitus, pain, loss of motion, and the other ordinary signs of fracture.

Treatment.—The object of the treatment is, therefore, to counteract the action of those muscles whose tendency is to draw this bone down towards the sternum, as well as that of the pterygoid muscles by the action of which the posterior fragment may be displaced laterally.

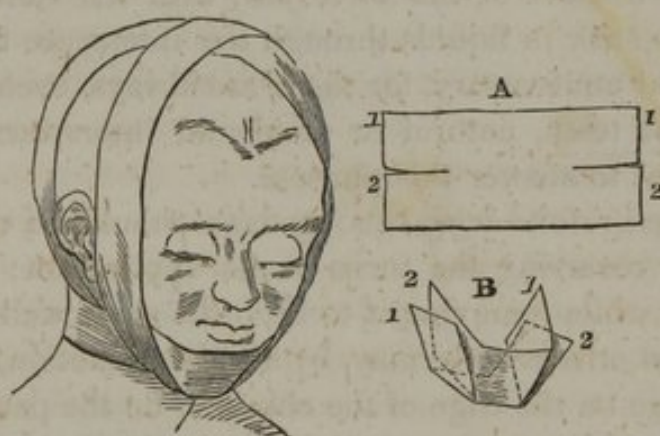
The indications are to restore the line of the jaw and to draw it up to the upper maxilla, so as to prevent displacement upwards or downwards, whilst it is also kept from lateral displacement, by counteracting the action of the pterygoid muscle. Any means capable of carrying out these indications may therefore be resorted to.

One plan of treatment very early employed consisted in wiring together the two teeth next the seat of fracture, but this is necessarily a very imperfect proceeding, for no matter how firmly the wire is applied, it is impossible to prevent more or less motion of

the fragments up and down, and it soon became apparent that in order to effect the cure of this fracture without deformity, some more efficient plan must be resorted to.

A firmer dressing was therefore soon suggested, and consisted of a splint made of some soft material, which soon became hard, as white of egg and plaster, or the more recent articles of gutta-percha or wet binders' board moulded to fit, and then retained by a bandage to the part. To make such a splint or mould, take a piece of binders' board of an oblong shape, and cut two slits at each end so as to extend partly through it. Then after soaking it in warm water apply it to the chin, and fold it up around the chin so that the part marked 1, 1 (Fig. 104, A), can be carried up the sides of the face, whilst that marked 2, 2, is turned backwards on a line with the base of the jaw, thus making a very excellent cast of the chin.

Fig. 104.



A VIEW OF BARTON'S BANDAGE, WITH THE MOULD APPLICABLE TO THE TREATMENT OF FRACTURE OF THE LOWER JAW.—A. Shape of the piece of gutta percha for the chin. B. The same moulded to the part—the ends 1, 1, being turned upwards, and the sides 2, 2, turned from before backwards. The application of Barton's bandage is described in the text. (After Nature.)

A compress of lint should first be laid upon the chin to prevent the splint from chafing, whilst over the whole a suitable bandage is to be applied.

A very excellent bandage for this purpose is that of *Dr. Barton*, of Philadelphia, which is to be applied as follows:—

Place one end of a bandage two inches wide and five yards long upon the mastoid process of the right side; pass obliquely around the left parietal bone over the top of the head and come down along the side of the face, under the chin; then pass up along the

opposite side of the face, over the temple, or between the eye and the ear of this side, across the top of the head and right parietal protuberance to the mastoid process, and thence make a turn circularly around the neck and front of the chin, and from the chin to the neck, which brings the roller back to the point from which it started. These turns being repeated as often as may be considered necessary to give firmness to the dressing, should be fastened by a pin on the top of the head at the point where the turns cross each other (see Fig. 104), after which, the other points at which the turns of the roller cross may also be secured by pins.

In the treatment of the fracture this bandage should be retained in position for several days without being changed, whilst during the whole period of the cure the patient should live upon such fluid articles of diet as he can suck through his teeth, or can be reduced to a pulp with his tongue. It may be here remarked that the barbarous practice of extracting a tooth in the commencement of the treatment of fracture of the lower jaw, with the view of allowing the patient to suck in liquids through the interspace thus left is at once cruel and unnecessary, for there are always, even in the most perfect sets of teeth, natural or accidental interspaces which are quite sufficient to answer this purpose.

After three or four days, the bandage should be removed and reapplied by reversing the turns in its application; the surgeon being careful while removing it to keep the slack well gathered up in his hand, as otherwise he may, by a careless motion, catch a turn of the bandage on the edge of the chin and do the patient mischief by jarring the fragments, as well as cause him great pain. The bandage having been removed, the splint should be supported by the hand of an assistant, and the surgeon should seize the fragments to hold them in position before the latter is removed, after which the skin over the jaw should be rubbed with a little whiskey or soap liniment.

When union has taken place sufficiently to justify the laying aside the bandages and splint, the patient should be cautioned against chewing tough articles of food for some time in order to allow the bone to obtain its full firmness before it is used.

Gibson's bandage is applied by starting from the point of the chin, and making three circular turns around it and the top of the head, drawing the lower jaw firmly up against the upper. Then reversing the bandage at the temporal region of either side, make

three circular turns of the forehead and occiput in order to prevent the first turns from slipping off the face; then passing down upon the neck make three circular turns of the chin and neck, after which the same turns may be repeated until the dressing is considered sufficiently firm. To make it still firmer, a strip of bandage may be pinned from the forehead to the occiput, and the turns of the bandage pinned at every point at which they cross. This forms a good dressing, and one which will fulfil the indications, but Barton's bandage will be found preferable in the majority of instances.

Cases will at times occur—such as certain compound fractures—when the patient cannot bear the pressure of either of the above dressings, or there may be cases in which, from the advanced stage of union, they have become unnecessary, but in which something is yet required to prevent motion in the jaw. Under these circumstances, resort may be had to what is also an excellent bandage to retain dressings to wounds of the chin, to wit, the four-tailed bandage, or *sling of the chin*. This bandage consists of a piece of muslin of proper width split down the middle (as seen in Fig. 104), except at the part corresponding to the chin; it thus presents two tails at each extremity. It is applied on the same principles as the similarly shaped pasteboard splint, the two lower tails being brought up over the top of the head and tied, while the two others (2, 2) are brought round and tied behind the neck: a dressing of considerable firmness, and at the same time exceedingly light, being thus obtained. Some one of these dressings should be worn by a patient who has a fracture of the lower jaw, for from five to seven weeks, after which they may be discontinued with the precautions above referred to.

CHAPTER III.

FRACTURES OF THE NECK AND TRUNK.

SECTION I.

FRACTURES OF THE BONES OF THE NECK.

§ 1.—FRACTURE OF THE OS HYOIDES.

Fracture of the os hyoides is very rare, though it sometimes occurs in consequence of considerable violence applied directly to it by some efficient means, such as the grasp of a powerful man, or some cause acting in a similar manner, or a blow directly upon the bone itself. When broken, it gives rise to a train of exceedingly serious symptoms.

Symptoms.—There is difficulty in deglutition, and a disposition to choking in consequence of the tongue coming back upon the epiglottis; with difficulty in respiration from the fact that the larynx is connected with the hyoid bone. This fracture is also often complicated with laryngitis, loss of voice, and other serious symptoms due to inflammation of this region.

Treatment.—The treatment is to be conducted upon general principles, the fragments being kept in perfect rest, so far as it may be practicable; but little, it must be confessed, can be done in this way, except by means of strips of adhesive plaster. Leeches may be applied, and violent inflammation, should it ensue, be combated by the antiphlogistic treatment which is applicable in all similar cases. If there is such difficulty in swallowing as interferes with the nutrition of the patient, it should be overcome by means of a stomach tube.

§ 2.—FRACTURES OF THE VERTEBRAL COLUMN.

Fractures of the vertebræ are comparatively rare, but may be produced by great violence applied to any point in the length of the column, or at any point of the lower limbs, as in falls upon the feet or hips. However produced, fractures may occur in the bodies of the vertebræ; in the spinous processes, and in the oblique or transverse processes. The force producing these injuries is generally so great that they are most frequently complicated with injury of the contained organ, the spinal marrow. If any marked displacement should occur, the cavity of the spinal canal will be apt to be encroached on, and symptoms of derangements consequent upon pressure on the spinal marrow invariably result. (Fig. 105.)

Symptoms.—The symptoms of these fractures will, of course, vary, according to the extent and character of the injury, and of the complication of the contained organs.

If, for example, there be a fracture of the oblique processes of the second vertebra, the transverse ligament may be detached; there may be a partial dislocation between the atlas and the dentata; pressure may be made upon the spinal cord at that point, and the patient die suddenly in consequence of the interruption of respiration which results. There is no time for treatment in such a case as this, the death being instantaneous.

If the fracture occurs lower down, and is of such a character that pressure is made upon the spinal cord, paralysis of the parts supplied by the nerves, given off from the cord below the seat of injury, will ensue; and this paralysis is very generally of one side only (paraplegia), owing to the pressure being made unequally upon the spinal cord. There being loss of power in the abdominal muscles, with paralysis of the lower extremities of one or both sides, more or less paralysis of the muscular coats of the stomach and bowels, and consequent constipation, with paralysis of the muscles of the blad-

Fig. 105.



A VIEW OF A FRACTURED SPINE bisected so as to show how the spinal cord is pressed on by the displaced bone. (After Liston.)

der, and consequent retention of urine, are also frequently noticed in this class of fractures.

Prognosis.—A fracture of a vertebra is sometimes limited to a simple fissure, under which circumstances it will be difficult to recognize it, and such fractures occasionally recover. Much more serious are those which are accompanied by displacement, and by consequent paralysis of the lower extremities; yet, even after such injuries, patients have lived for months, and bony union has in some cases occurred before death.

The prognosis of fractures of the vertebræ, therefore, though very serious, is not invariably fatal. They are, however, as a general rule, followed by more or less paralysis of the lower extremities, which is very apt to be permanent.

Treatment.—The treatment of these injuries will be rather that required by inflammation of or injury to the spinal marrow, than by the fracture itself; the latter being inaccessible to direct mechanical agents, except the knife. Though one or two operations have been performed for the removal of depressed portions of the spinous processes, the dangers to life from such a plan of treatment will probably preclude its repetition.

In the examination of the spine of a patient supposed to labor under fracture of the vertebral column, with the view of ascertaining the existence and seat of the fracture, the extent of the injury, &c., the surgeon should carefully avoid turning him upon his face, as serious consequences may thence result; because, as the injury to the vertebral column generally produces more or less injury of the spinal cord, there may be paralysis of the abdominal muscles consequent upon this cause. Hence, if the patient be rolled over upon his belly while the examination is being made, the abdominal muscles no longer by their contraction offer a resistance to the weight of the body, and the cavity of the abdomen is encroached upon, particularly if the patient be a heavy man. The descent of the diaphragm then becomes imperfect, in consequence of the upward pressure of the bowels, and the patient, in his weakened condition, may be almost asphyxiated before the surgeon is aware that he is in danger. In making the examination, therefore, turn the patient simply on his side, when quite as efficient an investigation can be made, and the dangers alluded to entirely removed.

As the patient may be compelled to lie for some time upon his back, even under the most favorable circumstances, everything like

blisters or counter-irritants to the spine should be carefully avoided, either in connection with the injury itself, or with the treatment of the spinal meningitis, to which it may give rise. Neglect of this precaution may result in the formation of bed-sores, or cause sloughing, which will very much annoy the patient, give rise to considerable suffering, and seriously complicate the probability of a cure. During the treatment, the patient ought to lie as much as possible on his side at perfect rest, any complications which may arise, as meningitis, &c., being actively treated by leeches, cups, and purging. As the muscular coat of the bladder participates in the muscular debility consequent on the injury, it should be carefully watched from the first, and all accumulations of urine prevented by the frequent use of the catheter. The action of the bowels, which is always sluggish in these injuries, in consequence of the paralysis of the muscular coat of the intestine, should also be watched, and constipation prevented by the free use of laxatives.

§ 3.—SPINAL CONCUSSION AND MENINGITIS.

In all cases of spinal fracture, as already remarked, the symptoms of the consequent compression or concussion of the spinal marrow will be much more marked than the symptoms of the fracture itself. In fact, *concussion of the spinal marrow*, like concussion of the brain, is often met with independently of fracture, in consequence of the jarring of this structure in the spinal canal being much more frequent than fracture itself. This injury is a common occurrence, in consequence of collisions of opposing trains and other railway accidents; because when an individual is seated in a car, with his back resting against the hard back of the seat, and a collision takes place, the back of the patient is brought violently in contact with the back of the seat, and a concussion of the spinal marrow results. Many of the sudden deaths, without any apparent external injury, which have been reported as having occurred during or after railroad accidents, as well as after amputations for fractures of the leg from such injuries, may doubtless be attributed to this cause.

Concussion of the spinal marrow without fracture occurs also from other causes. Often it is combined with more or less concussion of the brain. Thus, a man falling from a height upon his feet or sacrum,

becomes paralyzed, falls back, and, striking his head violently against the ground, receives also a concussion of the brain.

Symptoms.—The symptoms of concussion of the spinal marrow consist in a loss of innervation to all the parts supplied by its nerves, this loss of innervation in some instances being soon followed by death; thus, the respiration may be feeble, the heart contract with little power, the bowels and bladder act tardily, &c., whilst if more marked, it will be followed by such loss of action in the heart and lungs as will soon terminate in death. When *spinal meningitis* is established after a concussion, all the symptoms will appear which might be expected to accompany the development of meningitis from any other cause; thus, there will be pain, fever, paralysis, &c. &c.

The occurrence of spinal meningitis, resulting in effusions often of a limited character, also explains many of those obscure cases of partial paralysis, especially in children, which have been so imperfectly understood, or at least so imperfectly described by writers.

A child sits down upon a damp cold step, and there is, as a consequence, more or less congestion of the lower part of the spinal cord, or of its membranes; this congestion resulting in inflammation, in effusion, or in thickening of the cord and its membrane. This child may suffer little or no pain in the back at the moment, but after a time will be observed to be stiff in his movements and to have lost the power, to a greater or less extent, of his lower limbs; and in such a case as the surgeon can naturally trace the connection between cause and effect, he should regulate his treatment accordingly.

Sometimes it happens that after some such exposure, or after a slight fall, a limited effusion of blood, of serum, or of lymph, has taken place into the cavity of the spinal canal, causing the patient to suffer from a local and limited paralysis, as in the bladder and organs of generation or in the organs of generation alone; and there can be no doubt, I think, of the above rationale of such cases, as this view of their pathology is confirmed by the mode of treatment found most efficacious. This consists in the use of such means, as mercurials, &c., as are calculated to produce the absorption of effusion and the breaking down of the plasticity of the lymph. In one instance of this local paralysis which came to my notice, a married man entirely lost his virility after a fall upon his sacrum on shipboard. For the first few days after the accident he felt no inconvenience, but

after a time noticed that his venereal desire had totally left him, and that he had become almost impotent. This man, after being gently salivated and cupped on the spine as well as steadily purged, recovered his powers entirely, so much so, indeed, that his desires became a source of annoyance to him.

SECTION II.

FRACTURE OF THE BONES OF THE TRUNK.

§ 1.—FRACTURES OF THE RIBS.

When the *ribs* are broken by a direct force, the fracture is generally a transverse one, and presents comparatively little displacement; or, when such does exist, it is generally due to the immediate action of the force producing the injury and not to muscular violence. In an oblique fracture there may be angular deformity, the points of the fragments presenting forwards or backwards. This fracture may be complicated with lacerations of the *pleura costalis*, or even of the lung itself, or with laceration of the intercostal muscles and injury to the intercostal artery and nerves. As a result of these injuries various morbid conditions may occur complicating the more simple symptoms of fracture, such as pleurisy, or pneumonia, or congestion of the lung, or hemorrhage from the intercostal artery; a small aneurismal tumor being sometimes formed in the course of the artery after the injury; or the inflammation set up at the point of fracture, may assume an unhealthy character and result in caries of the rib.

Symptoms.—The symptoms of fracture of the ribs consist in such modifications of the ordinary symptoms of fracture as result from the relations of parts. In the first place the functions of the ribs are interfered with; they are no longer properly elevated, and, consequently, a proper expansion of the cavity of the chest no longer occurs; more or less crepitus, moreover, is to be felt at the seat of fracture, and can sometimes be heard by the patient, though often it is not so distinct. When the patient takes a long breath he is also apt to be checked by a violent pain at a point corresponding with the seat of fracture, this being due either to the sharp fragments pricking against the *pleura*, or to injury of the intercostal nerve.

By passing a finger along the course of the ribs the seat of fracture can also very generally be accurately recognized. Should the fragments happen to have been driven in so as to wound the lung, emphysema, to a greater or less extent, will usually ensue; but this will seldom be developed to any degree, until from twenty-four to forty-eight hours after the injury.

Prognosis.—As in all other cases, the prognosis of fractured ribs will depend upon the nature and extent of the injury, and upon the character of the complications. Thus, if a violent pneumonia ensue, the case will be much more serious than one accompanied by no graver symptom than a slight sticking pain in the side. So the prognosis of a fracture of one or two ribs, without displacement, will be favorable when compared with a case where several ribs are broken, and perhaps driven much out of their natural line, and when the injury is accompanied by pleurisy or emphysema, the prognosis, as with the pneumonic complication, will be much more serious than in the simpler cases. But fractures of the ribs, except when accompanied by violent thoracic inflammation, seldom prove fatal.

Treatment.—The indications for the treatment of this fracture are to prevent the rising of the ribs and compel the patient to breathe by his diaphragm, so as to retain the parts at rest until the bone has united, or at least until sufficient lymph has been thrown out and organized to round the sharp fragments, and thus obviate injury to the thoracic contents.

On account of the practical difficulties experienced in keeping the ribs at rest there is generally a proportionably larger amount of callus formed in the union of these bones than in fractures elsewhere, sharp projections of bone, like exostoses, sometimes becoming permanent, and interfering during the remainder of the patient's life with the perfect motion of this side of the chest.

The indications for the treatment, as above laid down, are to be carried out by means of the ordinary spiral bandage of the chest applied tightly around the thorax, which, in the case of a female, may sometimes be replaced by a pair of corsets tightly laced. Before applying it compresses should be placed on the ribs, so as to obviate deformity, should any exist. If the fragments project outwardly, the compress should be laid directly over the seat of fracture, that the turns of the roller may more directly force them back to their proper line; but, if they project inwards, two compresses should be applied, one at each extremity of the rib, in

order that by their means the broken fragments may be canted out. Then commencing at the waist, apply the ordinary spiral bandage of the chest, as stated in the account of the first roller of Dessault's bandage for the treatment of fracture of the clavicle.

The necessity of beginning this bandage at the waist, and ascending, will be understood by a slight reference to the shape of the body; this portion of it, together with that part of the trunk which joins the pelvis, resembling two truncated cones, the apices of which present to each other. If the bandage is not commenced at the apex of the upper cone, and carried toward the base—that is, from the waist to the shoulder—its turns will be apt to slip down soon after their application.

When a single rib only is broken, so forcible a bandage is not required, and for convenience a broad piece of muslin, with straps and buckles, applied to the chest as described in the treatment of cancer of the breast (see Fig. 48, p. 200), and properly tightened, may be used, and will answer the purpose quite as well.

Very good cures may also be accomplished in these cases simply by the use of a piece of muslin, so torn as to make a slit and tailed bandage, or by applying long strips of adhesive plaster obliquely around the ribs, and over the seat of fracture. After the use of any of these modes of treatment for three or four weeks, sufficient union will generally be obtained to render further bandaging unnecessary. The symptoms of the injury should always be carefully watched for the first seventy-two hours after the accident; and any pneumonia, pleurisy, &c., which may arise, be combated upon precisely the same principles as would guide a physician in his treatment of these diseases had they arisen from any other cause.

§ 2.—FRACTURES OF THE STERNUM.

Fractures of the sternum are sometimes, though rarely seen, and generally result from very great violence. Hence, the most serious symptoms are rather those of the concomitant injuries to the internal organs, than of the fracture itself.

Seat.—The sternum is generally broken at the junction between the first and second of the three bones of which it consists, because the lower two pieces being attached only to the cartilages of the ribs, which are quite elastic, give under a force much more readily

than the upper one does, the latter being firmly supported by its attachments to the clavicles.

Treatment.—The treatment of fracture of the sternum is chiefly constitutional, consisting of rest, opiates, and careful watching for inflammation in any of the internal organs; the latter being promptly met by an active antiphlogistic treatment; but, as the great majority of these accidents are caused by extreme violence, they are often accompanied by complications which result in death. If, after the inflammatory symptoms caused by the injury have subsided, the fragments are observed to play much upon each other during respiration, a compressing bandage will become necessary, and this should be applied as in the case of fracture of the ribs.

As a consequence of fracture of the sternum, suppuration may be developed behind the bone, and travel down and open at the side of the ensiform cartilage, so as to point at the insertion of the rectus muscle; or caries of the bone may result, which will present all the symptoms of caries elsewhere, and require to be treated upon the same general principles.

CHAPTER IV.

FRACTURES OF THE UPPER EXTREMITY.

SECTION I.

FRACTURES OF THE CLAVICLE.

Fractures of the clavicle are usually regarded as of importance, because they are of frequent occurrence, and result, if not properly treated, in a deformity of the shoulders, besides limiting somewhat the subsequent elevation of the arm of the affected side. They may occur at any portion of the length of the bone, as at its sternal third, in its middle, or at its acromial extremity.

To understand the manner in which this injury is produced, it is necessary to bear in mind the function of the clavicle. Situated between the acromion process of the scapula and the end of the sternum, its function is the just preservation of the pectoral space. It acts, therefore, as a stay, by keeping the shoulders apart, whilst it also steadies the motions of the glenoid cavity of the scapula,

against which the head of the humerus plays in the motions of the arm.

Etiology.—Any direct force may cause fracture of this bone, either at the point to which the force is applied, or as in counter-stroke, by the application of a force to its humeral extremity, whilst the other, by its attachments to the sternum, furnishes the resistance. In the latter case, it is readily seen that if the force be applied to the shoulder, so as to drive it towards the sternum, that force will be transmitted through the clavicle, and the sternum will resist it, whilst the clavicle will be broken at some point between these two forces. When a force is thus applied at one end, whilst the resistance is at the other, the fracture will be oblique; and this is by far the most frequent variety of the injury. The direct violence producing the fracture may be the kick of a heavy gun, the blow of a bludgeon, or any similar cause, and this acting on the body of the clavicle, and not on its ends, produces a transverse fracture, with contusion of the soft parts around the bone.

In order to understand the deformities which will ensue upon the occurrence of a fracture of the clavicle, the action of the various muscles attached to the bone must be noted. Thus, at the sternal end of the clavicle is the insertion of the sterno-cleido-mastoid muscle, which has a tendency to hold the sternal fragment upward; it being, moreover, supported in its position by the ligaments at its articulation with the sternum. The outer fragment is chiefly acted on by the pectoralis major muscle; the contraction of which, by drawing the humerus towards the body, tends, when the clavicle is broken, to draw the shoulder or scapula with it, thus producing shortening of the entire bone and a diminution of the pectoral space. Deformity, after a fracture of this bone, will also be produced to a slight extent by the action of the subclavius muscle, causing one fragment to approach the chest, and thus aiding in destroying the level of the clavicle. At the same time, the weight of the arm causes the shoulder, which is no longer supported in the normal manner, to descend, and a deformity is thus created by the prominence of the fragments which can be recognized at a glance. The shoulder is also now evidently closer to the body, whilst the arm is more upon the pectoral space and lower than it ought to be, the forces acting upon it having caused it to fall downwards, forwards, and inwards, from its normal position. Besides which, if the surgeon's finger be passed along the clavicle, it will

be readily observed that its continuity is destroyed at the seat of fracture; and when great swelling is not present, one fragment will be felt riding the other.

In consequence of the false position of the shoulder, the action of the humerus is generally more or less imperfect; it has no longer a firm support, and the muscles cannot therefore cause it to execute its natural movements, as the arm cannot now be elevated, or the hand made to touch the opposite shoulder.

Symptoms.—The symptoms of fracture of the clavicle are generally easily recognized. Thus the patient, after a fall, or a blow upon the arm or shoulder, feels that he has suddenly lost part of the power of the arm of that side as the shoulder descends, the weight of the limb becomes painful, and he is disposed to support it by putting the sound hand under the elbow of the injured side. When a finger is now passed along the clavicle, it will be observed that the proper line of this bone in front is destroyed. The mobility of the limb is also very much impaired, and he suffers great pain both at the seat of fracture and in the axilla from pressure upon the axillary nerves, being from the same cause often annoyed by tingling of the fingers. In consequence of this pressure of the injured bone upon the arteries and nerves of this region, there may be various complications, some of which are very marked. Thus, from pressure upon the axillary nerves, as they pass under the clavicle from their origin in the neck, more or less complete paralysis of the injured arm may ensue, whilst from rupture of the bloodvessels there may be violent hemorrhage, or such an accumulation of blood as will form quite a tumor in the axilla.

Diagnosis.—The diagnosis of fracture of the clavicle is usually easily made, provided the patient is seen soon after the occurrence of the injury, as the superficial position of the bone readily shows its condition. But when swelling has taken place, and especially if the force of the injury has also affected the shoulder-joint, it is sometimes very difficult to recognize its existence. By placing a finger close to the sternal end of the clavicle, and having an assistant to force up the shoulder by pressing on the patient's elbow, the fact of the continuity of the clavicle may, however, generally be made apparent, because, if there is no fracture, the sternal end will move when the humeral extremity is elevated, which it will not do when a fracture exists.

Prognosis.—The prognosis of the fracture of this bone is generally favorable, if proper means are employed to keep the fragments

in position, and perfect cures without deformity of the level of the shoulders can generally be obtained by proper attention. Such results have been so frequently noticed as to leave no doubt on this point in the minds of many, though sometimes such good cures have not been made.

Treatment.—The principles upon which the treatment of a fractured clavicle is to be conducted, and indeed the only principles upon which the injury can be treated so as to obtain a perfect cure, are those suggested long since by Dessault. In investigating this fracture, this accurate observer recognized the fact that the shortening of the bone was chiefly due to the action of the pectoralis major and subclavius muscles, and proposed, therefore, to overcome it, and reduce the shortening by carrying the shoulder outwards, whilst he overcame the deformity caused by the weight of the arm and other causes, which depressed the humeral end of the bone, by so acting under the elbow as to push the shoulder upwards. As, by the giving way of the clavicle, the shoulder had also been drawn forwards as well as inwards by the pectoralis muscle, he proposed in the treatment to carry it backwards. In other words, as the deformity had been produced in consequence of the shoulder being drawn forwards, downwards, and inwards, he proposed the reduction of the fracture by the use of forces calculated to carry it upwards, outwards, and backwards.

In fulfilling these indications, Dessault invented a mode of dressing which is still frequently used. His treatment has, however, been much modified in various hands, and several new dressings have been invented since his day, any of which may be employed, but all of which act upon precisely the same three indications which were suggested by him.

Dessault's Bandage.—This dressing requires the preparation of three long and wide rollers, each 8 yards long and $2\frac{1}{2}$ inches wide; of a wedge-shaped pad nearly as long as the humerus; and of a sling and splint-cloth to surround the body; all of which are applied as follows: The arm of the injured side being held out at right angles from the body by an assistant, and that on the sound side held by the patient or an assistant, a little off from the body, so as to give room to pass the bandage, the surgeon should place the pad in the axilla of the injured side, and taking a roller commence at the pad and make a few circular turns of the thorax to steady it; after which the ordinary spiral turns of the chest should be applied until the bandage reaches the edge of the

axilla, when it is to be finished by one or two oblique turns of the opposite shoulder in order to keep the previous thoracic turns from slipping down. This bandage, as thus applied, is usually designated as the *first roller* of Dessault, and its object is simply to hold the pad in the axilla. Then, in order to draw the shoulder outward so as to overcome the shortening of the bone, the surgeon should lower the arm and carry it against the pad so as to cause the humerus to act as a lever, and elongate the clavicle, the broad end of the pad being the fulcrum. Whilst the arm is thus held by an assistant, it should be secured to the side by a second roller.

The *second roller* of Dessault begins in the axilla of the sound side, and is applied by making oblique turns from this axilla around the arm and body so as to bind the arm to the pad. The turns around the head of the humerus should be loosely made, or they will defeat the object of this bandage, which is to draw the shoulder outwards; but, as the roller descends towards the elbow, the turns should be more tightly drawn in order to force the arm in towards the side, these turns being continued until the point of the elbow is reached, when the bandage should be fastened by a pin.

The *third roller* has for its object the carrying of the shoulder upwards and backwards, and its turns are perhaps more difficult to remember than the others. It constitutes, in fact, the chief difficulty with those who are inexperienced in the application of Dessault's apparatus, though it is really very simple. Commencing at the axilla of the sound side, this bandage passes up over the seat of fracture, where a little compress should be laid in order to prevent undue prominence of the fragments. Thence it passes over the injured shoulder, down the back of this arm to the elbow, under this, and then back to the axilla whence it started, by passing over the front of the chest; this last turn drawing the elbow upward, if applied with sufficient force. From this axilla the roller is now to be passed across the back to the injured shoulder, and over the front of this shoulder and arm to the elbow, from whence it passes across the back to the axilla whence it started; this turn drawing the shoulder backward. Having reached the axilla, the roller, which is represented as free in Fig. 106, should be passed over its previous course, the turns just described being repeated again and again until the bandage is exhausted, when it should be fastened by a pin. When this last bandage is thus applied, it will be perceived that two triangles are made, one upon the anterior and

one upon the posterior side of the chest, the base of the triangles being at the arm of the injured side, and the apex at the axilla of the sound side. In applying this third roller, a very simple rule will prevent the possibility of any mistake in its course, and this is as

Fig.



A VIEW OF THE BANDAGE OF DESSAULT AS APPLIED FOR THE TREATMENT OF FRACTURE OF THE CLAVICLE.—1. The oblique turns of the *first roller*, which holds the pad in the axilla, as carried around the sound shoulder in order to secure the previous turns from slipping downwards. 2, 2. The turns of the *second roller*, which binds the arm against the pad, carries the shoulder outwards, and overcomes the shortening of the broken bone. 3, 3. The *third roller*, as applied in order to carry the shoulder upwards and backwards by acting on the point of the elbow. 4. The short sling, to support the hand after the bandage is applied. The splint cloth, which covers all these bandages, is not represented, as it would conceal the figure, whilst the roller which forms the third bandage is represented as coming from the back under the sound axilla, or point whence it started, in order to resume its previous course. (After Nature.)

follows: Pass always from the axilla of the sound side across the front or back of the chest to the elbow of the opposite side, and from the elbow to the axilla whence you started.

To prevent the last turns from slipping, Dessault generally finished this third roller by one or two circular turns around the body; and, to support the hand, made a sling out of a short piece of roller, which he fastened with a pin to the previous turns of the bandage. Several pins were then put in to secure the dressing, and over the whole a broad piece of muslin was applied to render it still more secure.

This dressing is very firm, and answers an admirable purpose in many cases. It is a capital dressing for children, for lunatics, for those laboring under mania a potu, or others who are likely to

require a very firm bandage, as a patient thus enveloped can hardly, by any possibility, move the broken fragments. But, though firm, and carrying out fully the indications, this dressing is liable to several objections.

One of these, and by no means the least important, is its warmth, the patient being enveloped in a great number of coverings, as there are over him three rollers, each eight yards long, besides the outer cloth. This therefore constitutes a serious objection to the dressing in warm weather, especially in the case of patients with a delicate skin; as the perspiration readily accumulates, the skin becomes sodden, and is therefore soon disposed to ulceration under the axilla. A serious objection to the dressing in females, especially those with large breasts, is the pressure which it makes upon the mammary gland. Then, again, inconvenience sometimes of a grave nature will arise from the pressure of the pad in the axilla against the axillary nerves; this having sometimes paralyzed the fingers when the dressing has been tightly applied over a large pad. These objections, and the fact that the same indications can be carried out by simpler and more comfortable means, lead me to regard some of the other bandages as preferable to Dessault's in the majority of instances.

Brasdor's Bandage.—Another dressing is that of Brasdor, which does not carry out the indications, however, as well as that of Dessault, yet answers a good purpose in cases which demand from any reason a very light dressing. It consists of a triangular back piece, which laces down the middle, and to which are attached two padded straps to surround the shoulders, and draw them backward precisely like the posterior 8 of the chest. Of course, in causing the shoulders to move backward, it throws them more or less outward, though by no means so perfectly as is done by Dessault's apparatus. To the above apparatus a sling is added, which fulfils the third indication, by carrying the shoulder upwards and backwards. This sling may be made of various materials. A very excellent one is that manufactured of gutta percha, lined with cotton velvet, and supported by means of a silk band neatly padded, which passes around the neck, though a handkerchief will readily supply its place. Such a dressing answers well when the fracture is complicated with a wound, as in gunshot wounds of the shoulder, a class of cases for which Dessault's apparatus is manifestly unfit.

Mayor's Handkerchief.—The handkerchief bandage of Mayor for

this injury is a mode of dressing which answers an excellent purpose as a *provisional* application; but it by no means carries out Des-sault's indications, though it is well adapted to cases of railroad or stage-coach accidents, or any other emergency where, after the receipt of the injury, it is probable that the patient will have to be moved some distance before a more permanent dressing can be obtained. It is applied as follows:—

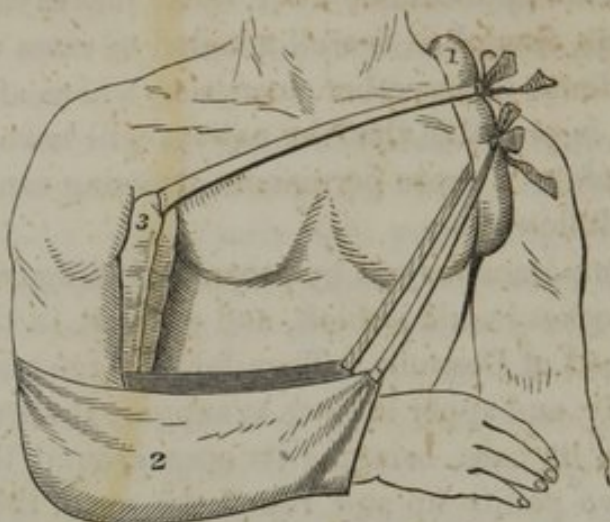
Make an extemporaneous pad by properly folding two soft towels, or two large pocket-handkerchiefs, and place it in the axilla precisely like the pad of Dessault. Then fold a large pocket-handkerchief triangularly, and apply it so as to support the arm by enveloping the wrist in its base, bringing its apex around the elbow, and carrying the two points up and round the neck, the one passing under the sound axilla behind the back to the opposite shoulder, and the other going from between the arm and the body over the front of the chest to meet it on the neck. A second handkerchief, folded into a cravat, should then be made to encircle the whole chest, and bind the arm to the side.

Fox's Apparatus.—A dressing which is very light, and which answers the purpose better than most others, is the bandage of Dr. Fox, of Philadelphia. It consists of a pad like that of Dessault, but shorter, and consequently enables the elbow to be more readily drawn in to the side of the body, thus carrying the shoulder more strongly outwards. This pad is supported by means of two tapes, the latter being attached to a padded collar, which should be made to encircle the opposite shoulder. This collar may be formed by taking a roller about $2\frac{1}{2}$ inches wide, and twenty-four inches long, folding it upon itself, and stitching the edges together so as to form a narrow sack or tube, which may then be stuffed with cotton or filled with bran, and its two ends sewed together so as to make it circular. To complete the dressing, a sling is added, which consists of a piece of muslin cut like a coat sleeve, but open in front, and which, by three tapes, one at the elbow, passing behind the body, and two at the wrist, is fastened to the collar which encircles the sound shoulder (Figs. 107, 108).

Figures 107, 108 show so clearly the simplicity and action of this bandage, that no detailed description of its application is required.

By means of this dressing, very perfect cures have been accom-

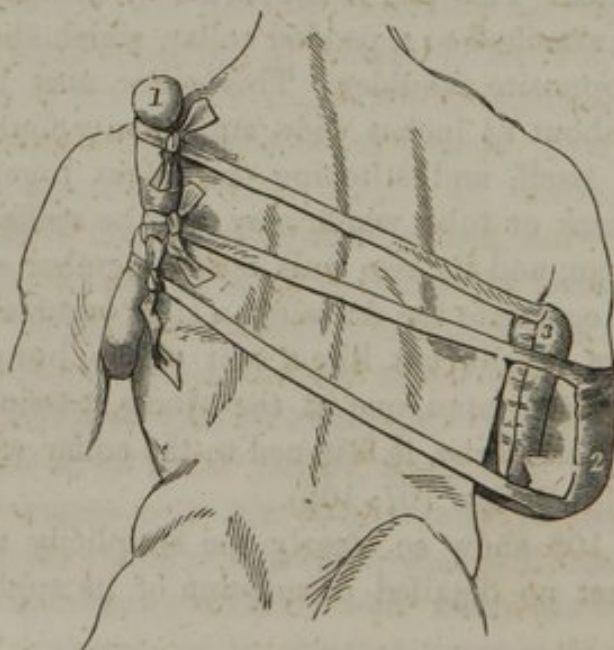
Fig. 107.



A FRONT VIEW OF FOX'S APPARATUS FOR FRACTURE OF THE CLAVICLE.—1. The Stuffed Collar applied to the sound shoulder. 2. The Sling, as applied to the injured arm. The tapes at the wrist being tied to the collar, draw the elbow into the side and throw the shoulder outwards, thus elongating the broken bone. The tapes which are attached to the elbow and upper end of the sling pass across the back and also tie to the collar on the sound shoulder, thus drawing the injured shoulder upwards and backwards, as shown in Fig. 108. 3. The Pad, which is held in the axilla by two tapes, one of which passes across the front, the other across the back of the chest to tie on the collar of the sound shoulder. As the broken clavicle is thus left uncovered, it is easy to recognize the presence of deformity, and overcome it by tightening the proper tape. (After Nature.)

plished. By very perfect cures are meant not only perfect union of the fragments, but union without angularity or any deformity.

Fig. 108.



A POSTERIOR VIEW OF FOX'S APPARATUS AS APPLIED, showing the course of the tapes which are attached to the Sling at the elbow, and also at its upper posterior end; these tapes traverse the back to the collar on the sound shoulder, and thus carry that of the injured one upwards and backwards. (After Nature.)

Objections have been raised to this apparatus on account of the chafing likely to result from the collar, from the sling, &c., which, however, are equally true of every apparatus by which any amount of pressure is made. Still, these may with care be entirely obviated, and if the surgeon sees that ulceration is likely to occur at any point, he should protect the skin with a piece of soap plaster spread on kid, which will often save it.

Apparatus of Levis.—Another apparatus, which admirably fulfils Dessault's indications, and which for neatness and simplicity is fully equal, if not superior to all the others, is one to which the attention of the profession has been lately called by Dr. Richard Levis, of Philadelphia.¹

"It consists of a short, firm pad in the axilla, by which the shoulder is kept from the side, and over which, as a fulcrum, the elbow is drawn to the side. To the front and back of the axillary pad are fastened straps, which pass directly upwards, and are buckled to a wide main supporting band, which, passing from the shoulder across the upper part of the back, and over the shoulder of the sound side, terminates on the front of the chest, as in Fig. 109.



Fig. 109.

A view of the Pad, Sling and Collar described in the text. (After Levis.)

"By this means the shoulder is supported, and the pad immovably held high in the axilla, where its pressure can be more conveniently borne than when its widest part compresses the brachial nerves and vessels lower down; besides, a better leverage is thus given to the arm over the pad.

"To the front end of the wide supporting band is suspended a sling, by which the elbow is supported (Fig. 110). On the back of the sling, at a short distance from the point of the elbow, a strap is attached, which passes obliquely around the back, and, coming in front, is buckled to the main supporting band (Fig. 111). The

¹ See Am. Journ. Med. Sciences, vol. xxxi., Jan., 1856.

Fig. 110.



Fig. 111.



Fig. 110. A front view of the Apparatus, as applied to a Patient. (After Levis.)

Fig. 111. A back view of the Apparatus. (After Levis.)

action of this strap is to draw the elbow to the side, at the same time supporting it, whilst its opposite attachment in front prevents the tendency of the wide band to ride upward and press uncomfortably on the superficial vessels of the neck.

"By this combination, united so as to form one continuous piece, requiring no extra bandage over it, the shoulder is firmly held in the proper direction without any risk of the yielding or slipping of the apparatus, and so secure, that the most restless patient cannot disarrange it.

"In adjusting the apparatus, the arm should be passed through the opening above the pad, the wide band thrown across the opposite shoulder, the elbow placed in the sling, and the long strap attached to the back of the sling brought round in front.

"In removing it from the patient, it is only requisite to loosen the long back strap which draws in the elbow, by unbuckling it at its front attachment. The other straps need never be removed from the buckles.

"The extra buckle, which will be noticed at the front end of the wide supporting band (Fig. 110), comes into use when the apparatus is reversed for the opposite shoulder.

"The apparatus may be made of any strong material, as webbing, drilling, or soft leather. The width of the wide band should be

from two to four inches. The straps which press upon the surface were slightly padded in the apparatus as the writer has used it (Dr. Levis), but this may not always be essential, and temporary pads might be placed if the pressure should become anywhere uncomfortable. Thus constructed, it can be very speedily prepared at an emergency, and buttons and button-holes might even take the place of buckles."

This dressing, which has been too recently proposed to enable its inventor to report many cases of its trial, is one which has been applied to several persons, who described it as being quite easy in all respects. I regard it therefore as an improvement in the means of treatment heretofore suggested, and as admirably adapted to the wealthier class of patients, among whom neatness as well as efficiency is desirable, being satisfied from a careful examination of its action that it fulfils perfectly all the indications required in the treatment of this fracture.

SECTION II.

FRACTURES OF THE SCAPULA.

When we notice the position of the scapula, the character of the muscles which surround it, and the nature of its connections with the body, it will readily be seen that this bone can very seldom be the seat of fracture.

When a man falls so as to strike the point of his shoulder with considerable violence, the scapula being held on the upper back part of the thorax, chiefly by muscular attachments, yields to the force, and slips back towards the spine, instead of resisting the blow and being fractured, as might be the case if it was a fixed point. Hence it happens that dislocations of the head of the humerus, or of the clavicular articulations of the scapula, or fractures of the head of the humerus, are much more common than fractures of the neck of the scapula. Still, there are cases in which the scapula is broken by the application of great violence, as when a man is caught in machinery, or is knocked down and run over by a heavy wagon, or gunshot wounds may create it; such cases having been reported. Under these circumstances, the scapula may be broken at any point, as at the coracoid process, in or below the spine, at its inferior angle, in its body and in its neck. Of these, fracture of the acromion pro-

cess is the most frequent, and may be produced by direct violence, or by indirect force transmitted through the head of the humerus.

Fig. 112.



A representation of the Seat of Fracture of the Neck of the Scapula. (After Fergusson.)

When it exists, the deformity is produced by the action of the muscles inserted into it, as the coraco-brachialis, pectoralis minor, and short head of the biceps, which draw it out of line, and by removing the resistance to the forward motion of the head of the

Fig. 113.



A representation of the condition of the parts in fracture of the Coracoid Process of the Scapula, showing the action of the Muscles. (After Fergusson.)

Fractures of the neck of the bone, except as a result of gunshot wounds, or as complicated with other fractures, are extremely rare, a very few being alluded to by European writers. There are, I believe, only two in the extensive museum of Dupuytren in Paris, and these were accompanied by fractures of other portions of the bone, or with dislocation of the head of the humerus,¹ but I am not aware of there being any well authenticated dried specimen of it in this country.

So with *fracture of the coracoid process*, which is extremely rare, seldom occurring as a distinct accident.

the humerus facilitate a partial luxation of this bone.

Fracture of the acromion process is not so rare; but, from the point at which it occurs, it is doubtful whether some of the specimens of it which have been preserved are not due rather to a failure in the production of ossific union between the epiphysis which constitutes the extremity of the process than to a true fracture, though the latter is sometimes met with; the union between the fragments being generally ligamentous.

¹ See Malgaigne, *Traité des Fractures*, tome i. p. 498, Paris, 1847.

When fracture of the acromion process is produced by any force, such as a fall upon the shoulder, or the blow of a bludgeon, a deformity results, which consists in drooping of the arm and destruction of the proper configuration of the shoulder.

Treatment.—Fracture of any portion of the scapula is to be treated by acting upon the elbow in such a manner as to press the arm upward, so as to bring the head of the humerus in contact with the broken extremity of the scapula, if broken near the glenoid cavity, or by holding it in the same position so as to keep the scapula at rest, when the fracture is seated in the body of the bone; after which no elevation of the humerus should be permitted until union has had time to become firm, owing to the thin flat character of this bone. These indications are best carried out by means of the same dressing as would be adapted to fracture of the clavicle, omitting the pad, as described in connection with that injury.

SECTION III.

FRACTURES OF THE HUMERUS.

Fractures of the humerus are much more common than the preceding, and may occur in any portion of the bone; thus there may be fractures of its head, these being generally the result of gunshot wounds or of extraordinary violence; fractures of the anatomical neck, which are more common in young persons than in adults, in consequence of the want of close union between the head, which is an epiphysis in early life and the shaft of the bone; and fractures of the surgical neck. By the *surgical neck* of the humerus is meant all that portion between the anatomical neck and the insertions of the pectoralis major and latissimus dorsi muscles. Fractures may also occur in the *shaft*, or that part of the bone above the condyles, and below the surgical neck and through the condyles either by passing directly through the epitrochlea, so as to involve the articulating surface—the latter exposing the patient to the risk of inflammation of the elbow-joint, and consequent ankylosis—or by simply splitting off the projection of the internal or external condyle without involving the joint; but the fracture through the epitrochlea is, perhaps, that most frequently alluded to as fracture of the condyles.

Etiology.—Fractures of the humerus at any point may result from falls, from blows, from violence of any character; or may be due to muscular action.

§ 1. FRACTURE OF THE SURGICAL NECK OF THE HUMERUS.

Symptoms.—Fracture of the *neck* of this bone will present a somewhat complicated train of symptoms, the deformity consisting both in angular displacement as well as rotation of the fragments. Thus, in a fracture of the surgical neck or part above the insertion of the pectoralis major and latissimus dorsi, the action of these two large and powerful muscles will draw the upper end of the lower fragment in towards the axilla (Fig. 114); while the action of the

Fig. 114.



A FRONT VIEW OF THE RELATION OF THE PARTS CONCERNED IN A FRACTURE OF THE SURGICAL NECK OF THE HUMERUS.—1. Deltoid muscle. 2. Pectoralis major dissected off from its origin and turned over the humerus so as to show its insertion. 3. Insertion of the latissimus dorsi muscle. 4. The subscapularis muscle. 5. The supra-spinatus, as seen behind the clavicle. (After Hines.)

supra and infra-spinatus muscles, which serve, in the normal condition of parts, to aid in the extreme elevation of the arm, act, when the continuity of the bone is destroyed, to cant the lower end of the upper fragment outwards.

In consequence of the action of the pectoralis major and latissimus dorsi drawing the upper end of the lower fragment inwards

the elbow will generally project somewhat from the side. The prominence of the lower end of the upper fragment can therefore be distinctly felt, and, as the head of the bone still retains its position, there is usually no flattening of the shoulder.

The upper fragment is not only canted out by the action of the supra and infra-spinatus muscles, but is moreover rotated by the subscapularis and pectoralis minor, so that there is often more or less displacement as regards the circumference of the bones, whilst the lower fragment is forced up towards the axilla by the contraction of the flexor muscles of the arm.

The deformity, therefore, in fractures of the surgical neck of the humerus, is threefold: first, there is angular displacement; secondly, displacement as regards the circumference; and thirdly, more or less shortening, due to the action of the deltoid, biceps, triceps, and coraco-brachialis muscles which, arising from the scapula, are inserted into the radius and ulna. The danger of shortening in fractures of the humerus is very apt to be overlooked, but it deserves the greatest care on the part of the surgeon, although the shortening of this limb is not so important as it is in fractures of the lower extremities.

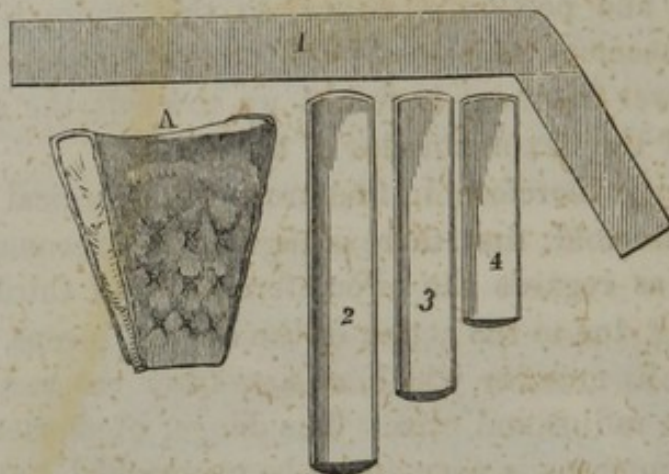
In order to prove that the bone has been accurately reduced, its length should be measured, as may be readily done by means of a tape extended from the acromion process of the scapula to the external condyle of the injured side, this being subsequently compared with a similar measurement made upon the sound limb.

Prognosis.—The prognosis in simple fractures of the surgical neck of the humerus is highly favorable as regards union, but if appropriate treatment be not employed the deformity will be quite marked.

Treatment.—In the treatment, such forces should be applied as will counteract the action of those muscles which have been described as tending to produce deformity. Thus, it will be necessary, to counteract the tendency of the pectoralis and latissimus dorsi, to draw the upper end of the lower fragment in towards the axilla; to overcome the tendency of the supra-spinatus and other scapular muscles, to throw the lower end of the upper fragment outwards, and the disposition of the triceps, biceps, deltoid and coracoid brachialis to produce shortening. These indications may be answered by Boyer's dressing, which consists of three splints and a pad. (Fig. 115.) The pad resembles that used by Dessault for fracture

of the clavicle, whilst of the three splints one is for the front of the arm, extending from the rotundity of the shoulder to the bend of the elbow (4), but not long enough to interfere with the flexing of the forearm upon the arm; the two remaining splints (3, 2)

Fig. 115.



A VIEW OF THE PAD AND THREE SPLINTS required for the treatment of a Fracture of the Surgical Neck of the Humerus, as well as of the angular Splint used with the three shorter Splints in the treatment of Fracture of the *shaft* of the bone.—A. The wedge-shaped pad of Dessault. 1. The angular inside splint for fracture of the shaft, (as hereafter described.) 2, 3, 4. The three splints for the outside, back, and front of the arm in fracture of the surgical neck, the pad acting as a splint for the inner side. (After Nature.)

being intended one for the outside and the other for the back of the arm. These splints should be of pasteboard, or of light wood, carved to suit the convexity of the arm.

Before proceeding to apply these splints, a bandage should be carried from the fingers up to the shoulder, in order to prevent capillary congestion and the consequent œdema which would otherwise arise from the necessary pressure made about the seat of the fracture, as well as to compress the muscles. This bandage should be the ordinary spiral of the upper extremity (see page 128). After applying it carefully, let one assistant keep up extension and counter-extension, whilst another applies the three splints, having first guarded the extremity of each by a little pad of carded cotton to prevent them from exercising undue pressure on the skin. After thus arranging the splints, secure them on the back, front, and outside of the arm, by simple spiral turns of a roller; then placing the pad in the axilla, with its thick end up, when the lower fragment is drawn inwards, bring the arm down to the side, and bind it to the pad and the body by means of circular

turns around the chest (Fig. 116); these circular turns being terminated at the elbow, beneath which none should be made, lest,

Fig. 116.



A VIEW OF THE DRESSING FOR FRACTURE OF THE SURGICAL NECK OF THE HUMERUS as applied to the body. The dotted lines show the apparatus inside the turns of the roller which binds the arm to the body. A. The pad in the axilla. 2, 3, 4. The splints in position, as previously seen in Fig. 115. The hand is supported by a sling. (After Nature.)

by pressing upwards, shortening be induced. The dressing is then to be completed by a sling, which should merely support the wrist, and allow the arm to hang, so that its weight may aid in preserving its length, and thus prevent the occurrence of shortening.

Boyer's dressing for fracture of the neck may be modified when the upper end of the lower fragment projects outwards, and the lower end of the upper fragment is drawn inwards, by simply inverting the pad, and putting the thin end upwards. But this deformity is much more apt to occur in fractures just below the surgical neck in which the deltoid muscle draws the upper end of the lower fragment outward, while the pectoralis and latissimus dorsi draw the lower end of the upper fragment inwards, than in fractures of the true surgical neck of the bone.

§ 2. FRACTURE OF THE SHAFT OF THE HUMERUS.

Fracture of the shaft of the humerus is often followed both by angular deformity and shortening of the limb, in consequence of the

action of the muscles, especially the biceps and triceps, which arising from the scapula are inserted into the radius and ulna. The forces, therefore, to be resisted are these muscles, whilst the flexion and extension of the forearm, or any motion of the elbow-joint,

must be prevented, owing to its connection with the lower fragment.

Fig. 117.



A view of a Fracture of the Shaft of the Humerus, showing the action of the Biceps and Triceps Muscles in producing shortening and displacement. (After Hines.)

Symptoms.—The symptoms are those of fractures generally, as pain, deformity, and increased mobility at the seat of fracture, with loss of the proper motions of the arm.

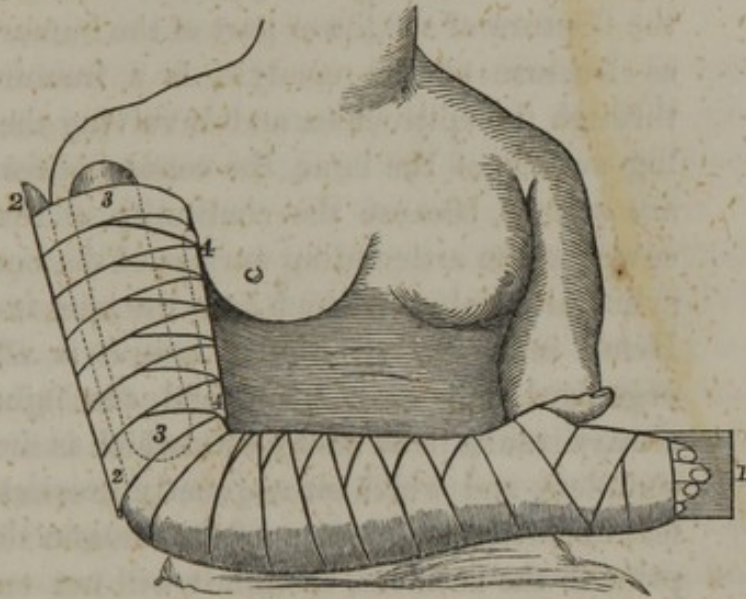
Diagnosis.—The increased mobility, the crepitus, deformity, and history of the case generally, suffice to make the diagnosis of this injury quite easy.

Prognosis.—The prognosis of this injury is very favorable in a simple fracture correctly treated; but it should be remembered that false joint is very frequently met with after fractures of this bone, this result being created either by want of rest, or by the fracture occurring near to the point of entrance of the nutritious artery.

Treatment.—The treatment of fractures of the shaft of the humerus requires four splints, one of which is angular and long enough to reach from the axilla to the ends of the fingers, and is to be applied to the inner side of the arm (see (1) Fig. 115); another (2) of the length of the arm is to be applied to the back of the humerus; (3) one for the outside, and (4) one for the front of the arm, all of which should be made of light wood and well padded with cotton. Then, whilst an assistant keeps up extension by drawing on the forearm near the elbow, and counter-extension is made at the shoulder, commence at the wrist and apply the spiral reversed bandage of the upper extremity (page 128), continuing its turns up to the shoulder, making several extra turns on the arm at the seat of fracture, so as to compress its muscles with moderate

firmness. Next place the arm and forearm upon the angular splint, the latter being well padded, especially at the elbow, and bind the arm and forearm to this splint with another roller, commencing at the wrist and continuing the bandage as far as the elbow. Then apply the three short splints, padding them well at

Fig. 118.



A VIEW OF THE DRESSING APPLIED TO A FRACTURE OF THE SHAFT OF THE HUMERUS. 1. The inside angular splint. 2, 2. The splint on the back of the arm. 3, 3. That on the outside. 4. That on the front of the arm, the position of the arm across the chest making it appear to be placed towards its inner side, but this is the seat of the angular splint which keeps the elbow at rest. (After Nature.)

the ends, and, resuming the roller, bind them all to the arm as in Fig. 118. After which the forearm should be carried across the chest and supported by a sling around the neck.

The advantages of the use of an angular splint, which extends from the finger to the shoulder on the inner side of the arm, over the inside short splint, as advised by Boyer, will be found in the permanency of the dressing, and the perfect rest of the fragments insured by its application. After employing this dressing for two or three days, it should be taken off and the arm well washed with whiskey, when, on reapplying it, modify the angle of the splint or substitute another, so as to prevent the stiffness of the elbow which may ensue from the joint being kept constantly in one position.

§ 3. FRACTURE OF THE CONDYLES OF THE HUMERUS.

Fracture of the condyles of the humerus is a more serious injury, so far as the probability of the perfect motion of the extremity is concerned, than the fracture of the shaft of the bone just described.

As before remarked, the external or internal condyle may be simply split off without involving the joint, but most frequently

Fig. 119.



A view of the ordinary seat of fracture through the epitrochlea of the humerus.
(After Nature.)

the fracture of the lower part of the humerus, known as fracture of the condyle, is a fracture directly through the epitrochlea and involving the articulating surface of the bone, the consequences of which are serious, because the continuity of the cartilage covering the articulating surface of the bone and the synovial membrane which lines the joint is destroyed. Hence inflammation results, lymph is effused and organized, adhesions form, and the injury almost always results in an ankylosis, which is more or less complete, and which subsequently prevents the perfect extension and flexion of the forearm that existed prior to the accident, though it will not entirely destroy the use of the joint.

The articulating surface of the bones being thus involved, the condyles no longer retain their ordinary shape and position, dislocation of both bones of the forearm backward ensuing on the fracture, in consequence of the action of the triceps muscle, the injury being thus liable to be mistaken for dislocation. From this, however, it is important to distinguish it, as may be readily done by attention to the circum-

stances which will be pointed out in connection with the diagnosis.

Etiology.—Fracture of the condyles of the humerus is generally seen in young persons or children, and due to a force applied either directly upon the elbow or indirectly to it through the bones of the forearm. Thus, it may result from a fall upon the point of the elbow, in which the olecranon, striking violently against the ground, is driven forwards against the condyles, which give way, and develop the fracture. Sometimes the bone is broken transversely across, through its articulating surface, creating a separation of its epiphysis from the shaft at this point; or it may be broken by in-

direct violence, as when the patient falls forwards upon his hands, the force being transmitted along the bones of the forearm to the condyle whilst the resistance is made by the weight of the shoulder.

Symptoms.—The symptoms of this fracture are as follows: After the receipt of an injury upon the elbow, or a fall upon the hand, the patient suffers great pain in the neighborhood of the joint, which increases whenever he attempts to flex the forearm upon the arm; the mobility of the joint being also always impaired, and, in marked cases, almost completely destroyed.

Combined with the above symptoms there is generally more or less deformity, which consists, in some cases, in complete dislocation of both bones of the forearm backwards, thus causing the injury to be confounded with the latter accident.

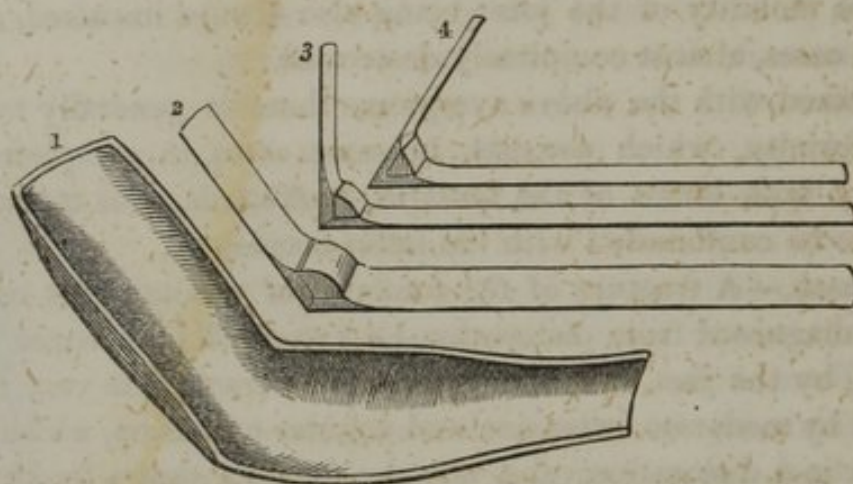
Diagnosis.—A fracture of the condyles of the humerus can readily be diagnosed from dislocation backward of both bones of the forearm, by the fact that the deformity in fracture is very readily reduced by moderate extension and counter-extension, which is not the case in a dislocation; and also by the fact that a fracture, unlike a dislocation, reproduces the deformity so soon as the extending and counter-extending force is intermitted. Crepitus and the ordinary symptoms of fracture are also present in fracture, whilst, if these circumstances are insufficient for a diagnosis, the injury may be recognized by the following rule: If, in health, the forearm be flexed upon the arm, and a circular line drawn around the elbow-joint from the external to the internal condyle, it will touch the point of the olecranon, as well as the two condyles; but if a fracture has occurred which involves either the condyle or the olecranon, these points will no longer be within the line.

Prognosis.—The prognosis of fractures of the condyles of the humerus should always be very guarded, compound fractures often demanding amputation, and simple fractures resulting in deformity, and partial ankylosis of the elbow, as well as loss of pronation and supination in the hand. The patient should, therefore, always be told that in all probability there will be more or less loss of motion in the joint, as well as imperfect pronation of the hand.

Treatment.—In treating fracture of the condyles, it is necessary to overcome the action of the triceps, and thus prevent the dislocation of the bones of the forearm backward, whilst the arm should be kept at perfect rest in order to reduce the inflammation of the joint; passive motion being carefully made, after the first twelve days, in order to prevent ankylosis.

These indications can be best carried out by means of an angular splint made to fit the *front* of the arm, and jointed with a hinge at the elbow, so that, by means of a wire properly applied, the splint can be placed at any angle desired; or several splints, like those in Fig. 120, 2, 3, 4, may be prepared of different angles. Then having,

Fig. 120.



A REPRESENTATION OF THE SPLINTS REQUIRED IN THE TREATMENT OF FRACTURE OF THE CONDYLES OF THE HUMERUS.—1. The curved splint for compound fractures, or simple fractures when accompanied by much inflammation. 2, 3, 4. Angular splints of different angles, to be applied to the front of the arm, as described in the text. (After Nature.)

by extension and counter-extension, with flexion of the forearm on the arm, reduced the fracture and applied the spiral bandage of the upper extremity from the fingers up to the shoulder, place a wad of cotton in the bend of the elbow to avoid injury from the pressure of the splint, and fasten the latter to the arm by means of a roller, beginning at the wrist and regularly ascending the arm up to the shoulder.

The pressure made in the bend of the elbow by this splint will certainly prevent dislocation backward, whilst it obviates the dangers consequent on ulceration of the integuments over the internal condyle, as made by the side angular splint that was formerly placed on the inner side of the arm, in accordance with the suggestion of Dr. Physick.

A compound fracture of the condyles of the humerus sometimes occurs, with accompanying laceration of considerable extent. Under these circumstances, it would be worse than useless to attempt to apply one of these splints. The arm should therefore be simply placed upon a pillow in a semi-flexed position, while leeches, cold cloths, and other measures proper for the treatment of inflammation

of the soft parts are employed; as the injury to the soft tissues, with the consequent inflammation, is here often the most serious part of the accident, the patient being very fortunate if his surgeon is able to save the limb. When the injury is not quite so extensive, and is so situated in regard to the joint as to permit it, advantage will be found from the use of the carved splint (Fig. 120, 1), or one of paste-board or gutta-percha, either simple or supported on the outside by strips of tin. In employing the carved splint, the arm may be laid within it, and supported by the bandage of Scultet; but if the splint be properly applied, this bandage may be laid aside, as the limb can be raised and the wound dressed daily when a few turns of the ordinary spiral roller are loosely applied around it, without deranging the fragments, or removing the arm from the splint.

Of the splints required in compound fractures, that carved out of wood is infinitely preferable, and may be readily made by the following process:—

Having selected a piece of soft poplar or white pine about two inches thick, lay the injured arm upon it, and mark its outline with a lead-pencil. Then, with a penknife, if nothing better can be obtained, or with a gouge, hollow out the wood so as to make it correspond with the shape of the arm. Having thus worked it out in such a manner as to fit the arm as nearly as possible, shave down the outside so as to leave the splint as light and thin as would be consistent with firmness, after which a piece of buckskin may be glued over the inside to protect the skin, and a piece of muslin or linen placed on the outside to prevent the thin wood from splitting or warping. Of course, if a finished article is required, it must be procured from a carver; but a splint like the above, which will answer a very good purpose, can be made under the direction of the surgeon by any workman.

SECTION IV.

FRACTURES OF THE FOREARM.

§ 1.—FRACTURES OF BOTH BONES OF THE FOREARM.

The bones of the forearm may be broken at any point in their length, but most frequently the injury will be found at some point below the upper third, and in one bone rather than both. The reason why the upper third of these bones is so seldom broken is

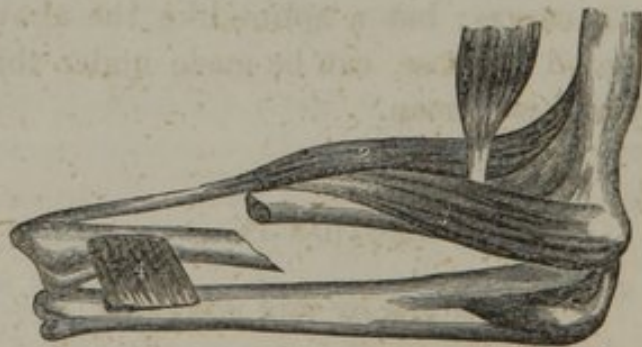
to be found in the protection afforded by the bellies of the muscles of the forearm, which envelop them so that a simple fracture at this point is of rare occurrence.

Etiology.—The causes of these fractures are blows, falls in which the weight of the body is caught upon the hands, or in which the arm is caught under the body, railroad accidents, etc.

When a fracture of both bones occurs, it happens, as a general rule, at one point in the radius and at another in the ulna, particularly if the injury has been caused by a fall upon the hands. Still, cases occur in which a fracture of both bones is found at the same point, as when the arm is thrown up to fend off a blow. Such fractures may also be caused by catching the hand or forearm in a wheel, &c.

Besides fractures of both bones, either the radius or the ulna alone may be broken at any point in their length without a fracture of the other bone. In this case there will be no shortening, the sound bone acting as a splint, and preserving the normal length of the arm. Indeed, there is seldom any shortening in fractures of the forearm, even where both bones are broken, in consequence of the character of the muscular attachments of the part, and of the interosseous ligament. The displacement, therefore, in fractures of the forearm is rather an angular deformity than shortening, besides which there is frequently more or less displacement in the circumference caused by the action of the pronator or supinator muscles. Whether the fracture affect both bones or but one, the symptoms and the treatment are very similar.

Fig. 121.



A VIEW OF THE MUSCLES OF THE FOREARM AS CONNECTED WITH THE DEFORMITY CREATED BY A FRACTURE OF THE SHAFT OF THE RADIUS.—1. Biceps flexor cubiti. 2. Pronator radii longus. 3. Pronator radii teres. 4. Pronator quadratus. (After Hines.)

Symptoms.—The symptoms in either case will be pain, swelling, inability to execute the functions of the forearm, more or less con-

tusion of the soft parts, and consequent infiltration of the cellular tissue with blood.

These general symptoms will be found without much change in all fractures of the bones of the forearm, whether the radius, ulna, or both bones be involved.

Sometimes there is a disposition towards partial fracture, combined with bent bones, of which there are two specimens in the Wistar and Horner Museum of the University of Pennsylvania,¹ but the symptoms are then complicated with the ordinary symptoms of bent bones, and the deformity which results would hardly be mistaken for that of fracture.

Treatment.—The object of the treatment is to keep up such an amount of extension and counter-extension as will retain the fragments in position, and prevent such angular deformity as might encroach upon the interosseous space; for it will readily be understood that, if there is an angular displacement in either bone so as to encroach upon this space, it will interfere with the free pronation and supination of the hand. A very moderate amount of extension and counter-extension will usually suffice to effect this object, and it may be accomplished by seizing the patient's hand with one hand, and his elbow with the other, and then drawing with moderate force until the fragments are brought into the proper line. The surgeon, then giving the limb in charge of an assistant, should coaptate the fragments, carefully observing that the interosseous space is preserved. The importance of this latter point in the treatment of fractures of the forearm cannot be over-estimated; as, even if the deformity in the bones themselves does not interfere with the pronation and supination of the hand, it should be borne in mind that the ensheathing callus which is thrown out will extend beyond the bones, and thus limit their motions; hence this fracture should be kept at perfect rest, not only because motion is liable to displace the fragments, but because the quantity of ensheathing callus thrown out is liable to be increased by the frequent action of the part.

Fig. 122.

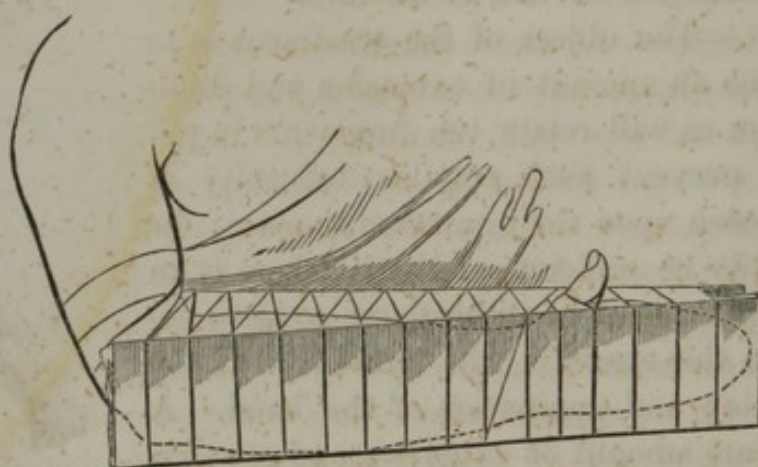


A representation of a partial Fracture of the Radius in a young patient, accompanied with the bending of the fragments. (After Fergusson.)

¹ At Philadelphia.

The dressing best adapted for the treatment of fracture of both bones of the forearm is as follows: the forearm should be semi-flexed upon the arm, the thumb pointing upwards, and two splints, carefully padded, be placed one upon the front and the other upon the back of the arm, these splints being padded so as to make pressure on the interosseous space, and preserve the parallelism of the bones. Then, whilst they are held in position, fasten them to the forearm by a roller, beginning at the wrist and moving up to the elbow.

Fig. 123.



A view of the Splints, &c., as applied in the treatment of a Fracture of one or both bones of the Forearm. (After Nature.)

A very simple fact will at once point out to the surgeon whether the parallelism of these bones has been preserved. If, after applying the dressing, the thumb points upwards when the forearm is semi-flexed upon the arm and carried across the chest, as in Fig. 123, it may be taken for granted that the fragments are properly in position.

The dressing as thus applied should be supported by a sling, and changed from time to time—say every two days—stimulating frictions being applied to the skin when the splints are removed, in order to prevent chafing. Sometimes patients will require to be carefully watched to prevent them from making improper movements with the splints, particularly in the case of children, who are often disposed to use the ends of the splints in various ways, thus causing displacement of the fracture as well as of the dressing.

§ 2.—FRACTURE OF THE RADIUS.

A simple fracture of the *shaft of the radius* presents all the symptoms, and requires precisely the same treatment, as fractures of both bones of the forearm. The deformity in this case does not, however, consist in shortening, as the ulna, being uninjured, continues to preserve the length of the forearm, but rather results from an approximation of the two bones at the seat of fracture and a loss of power in pronating or supinating the hand, in consequence of the action of the pronator or supinator muscles, as shown in Fig. 121.

There are also fractures connected with the lower third of this bone which are frequently met with, and require special consideration in consequence of their effect on these motions of the hand and wrist. These fractures of the *lower extremity of the radius*, although of frequent occurrence, are, perhaps, oftener overlooked than any other accident in surgery, either because the patient is seldom seen until the swelling has gone to such an extent as obscures the injury, or because it is regarded by him as a sprain for several days after the occurrence of the accident.

A very little attention to the mechanism of the wrist-joint will show at once why this fracture is more common than fracture of the ulna. The radius articulating with two of the bones of the carpus—the scaphoides and lunare—receives, when a patient falls upon the hand, the greater part of the force, the elbow-joint acting as a resistance. Hence, it gives way just above the wrist, this part being in reality its weakest point, although the bone is here much thicker than above, its extra development at this point consisting, however, principally of cancellated structure; neither has it the cylindrical shape which gives strength to bone.

Barton's fracture.—There are two distinct fractures met with at this end of the radius—one oblique, the other transverse—both of which extend through the articulation, the transverse one chipping off the anterior edge; and as this injury was originally described by Dr. Rhea Barton, of Philadelphia,¹ it is known as *Barton's fracture*.

Mechanism.—When from a fall, or any similarly applied violence, this accident occurs, the action of the extensors of the thumb and of the flexors of the fingers, combined with that of the pronator

¹ Phila. Med. Examiner, vol. i. 1838.

quadratus, at once produces a deformity on the *front* of the wrist which is so marked that it is not unfrequently mistaken for dislocation of the extremity of the radius forwards. At the same time, the fibres of the capsular and lateral ligament of the wrist giving way, I have no doubt, from the specimens that I have seen, that in some cases there is also a fracture of the styloid process of the ulna, just as fractures of the fibula above the ankle-joint are sometimes accompanied by fractures of the internal malleolus. This latter complication is well illustrated by a specimen now in my cabinet.

Fig. 124.



A REPRESENTATION OF THE OBLIQUE FRACTURE OF THE LOWER ARTICULATING SURFACE OF THE RADIUS KNOWN AS "BARTON'S FRACTURE."—1, 1. The seat of fracture on the styloid side of the radius. 2. The external lateral ligament of the wrist-joint on the stretch from being dried. 3. Fracture of styloid process of the ulna, which existed in this specimen. (After Nature.)

Symptoms.—The symptoms produced by this accident are as follows: The patient complains of pain in the wrist, which is very marked in its character, though often regarded as due to a sprain, and, upon examining it, a fulness is observed on the front of the

Fig. 125.



A representation of the deformity caused by Barton's fracture, showing its resemblance to a lateral and anterior dislocation. (After a cast from Nature.)

wrist looking not unlike a swelling of the bursa of the tendons, whilst on the back of the hand there is but little deformity, more or less *lateral* displacement being always present, particularly if the styloid process of the ulna is broken in the manner above described. Fig. 125.

Diagnosis.—If, under these circumstances, the surgeon places a finger upon the head of the radius and pronates and supinates the *hand*, the head of the radius will be observed to rotate under his finger, because the attachments of the carpal, as well as of the interosseous ligaments, prevent such a separation of the fragments as would enable the lower fragment to be moved independently of the wrist. In consequence of this apparent continuity, an inexperienced person might be deceived and be led to suppose that no fracture existed. But, if the surgeon, observing the facts just stated, puts his finger upon the head of the radius, and, then *seizing its styloid process* with the fingers of the other hand, rotates it gently, the head of the bone will be observed to remain stationary, while the fragment below will rotate, and create such violent pain, that the diagnosis can be at once made.

With regard to the diagnosis of this injury from dislocation of the radius forwards, a few words may be said. Barton's fracture is an accident of comparatively frequent occurrence, dislocation of the radius rare, though the two may exist at the same time.

The following facts will aid in the diagnosis of those doubtful cases which are occasionally met with.

If extension and counter-extension be employed, the deformity in the fracture will disappear just as that of dislocation might be expected to do; but, as soon as these forces cease to act, the deformity will be reproduced in the fracture, or in dislocations consequent upon fracture, but will not be so in simple dislocations.

Besides this, the force sufficient to overcome the deformity in Barton's fracture is much less than that which would be necessary to overcome the deformity consequent upon a simple dislocation.

In addition to Barton's, there is another fracture of the lower part of the radius, which was first noticed by Mr. Colles, of Dublin, in the year 1814. He described it as occurring at a point about *an inch and a half* above the wrist-joint, not involving the articulation, and therefore differing in this respect from that of Barton. *Colles' fracture*, as it is now designated by writers, produces a deformity which approaches in character to that of Barton, though not precisely similar. In both there is lateral displacement, this being most marked in Barton's; but, in Colles' fracture, the fulness on the *front* of the wrist is not so marked as in Barton's, while that upon the *back* of the hand is much more so.

A fracture producing the same deformity as that attributed by Mr. Colles to the fracture which bears his name, has been more

recently, and more accurately, described by Mr. Smith, of Dublin, as a fracture of the radius *three-quarters of an inch* above the articulating surface, thus also differing from Barton's fracture in not invariably entering the articulation and affecting the joint. The deformity produced by this injury upon the back of the hand is quite a peculiar one, and has been graphically described by Velpeau as the "*fork-like*" deformity, in consequence of the general resemblance to the shape of the ordinary silver fork presented by the back of the wrist and hand in these cases—a comparison which, however, does not apply to cases of Barton's fracture. In the work of Mr. Smith, of Dublin, "*On Certain Fractures as yet not Accurately Described*," several cases of Colles' fracture will be found detailed and accompanied by drawings.¹ I cannot but think, however, that such a fracture as is described by Colles or Smith is much more rare than the fracture involving the articulation, and known in the United States as that of Barton. Yet all these fractures somewhat resemble each other, and may be confounded: thus, all are fractures of the lower part of the radius; all create deformity about the wrist; all impair the motion of the joint; but the principal difference between them is to be found in the fact that one (Barton's) passes into the articulation, whilst the others (Colles' and Smith's) do not; though all, if not well reduced, materially impair the motions of flexion of the wrist, as well as pronation and supination of the hand. Barton's also creates marked lateral deformity.

Treatment.—The indications for the treatment of these fractures are very similar, it being necessary to counteract the same muscular forces on each, such as the extensors of the thumb, the pronator quadratus, as well as the weight of the hand. The question, therefore, of the identity of these fractures becomes rather one of history than of practical importance, though it is always advantageous to have a correct perception of the true seat of an injury.

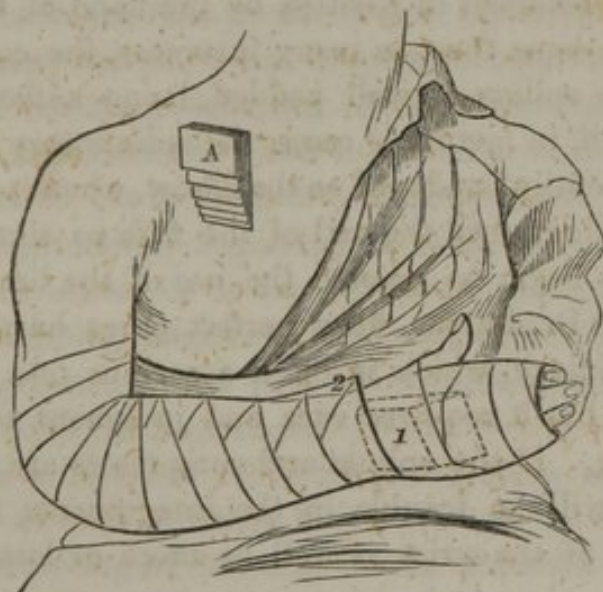
The original dressing suggested by Dr. Barton for his fracture consisted in the application of two graduated compresses to the wrist and two splints to the forearm. The graduated compresses should be made as follows: Take a bandage, of the width of two and a quarter inches, and make six, eight, or ten folds of it, about three inches long, so as to give it firmness; after which continue making

¹ Treatise on Fractures in the Vicinity of Joints, &c., by Robert Wm. Smith. Dublin, p. 137.

folds, each a little shorter at one end than that previously made, until the compress has assumed the desired shape, when the whole may be fastened together by a stitch. (Fig. 126, A.) The dressing is then applied as follows:—

Mould the parts with the fingers accurately into position, making gentle extension and counter-extension, if necessary, upon the hand and forearm. Then place one compress upon the front of the wrist, at the seat of fracture, about one-eighth of an inch above the articulating end of the radius, with its thick end downwards, whilst the other is placed upon the back of the wrist on a line with the upper row of carpal bones, with its thick end upwards. The thick ends of each compress being thus brought to the same line (Fig. 126), are then fastened in place by light turns of a roller, to prevent them from slipping. Simple splints, similar to those employed for fracture of

Fig. 126.



A VIEW OF BARTON'S DRESSING FOR FRACTURE OF THE LOWER END OF THE RADIUS, AS DESCRIBED IN THE TEXT.—A. The graduated compress. 1, 2. The thick end of each compress as applied to the wrist, and represented as seen through the splints and bandage, which retain them in position. (After Nature.)

the forearm, being then placed one upon the front and one upon the back of the arm, should be retained in this position by turns of the ordinary spiral bandage of the upper extremities (Fig. 126). As thus applied, these splints now make pressure through the compresses upon the fragments, and retain them in position; but care is requisite not to draw the bandages too tight at first, lest they create too much pressure on prominent points about the wrist, and inflamma

tory ulceration, or even sloughing, be induced; in which case the inflammation might extend to the wrist-joint and set up synovitis, which might result in ankylosis. The bandage should, therefore, be loosely applied at first, and drawn firmer and firmer, as it can be borne; the arm being then supported by a sling. After three or four days the dressings should be removed; and, while the limb is carefully supported, the parts should be well rubbed with a sponge wet with soap liniment, to relieve any congestion in the capillaries of the skin, after which the dressing should be reapplied. About the sixth or eighth day, the same process should be repeated, and passive motion of the small joints of the fingers be at the same time carefully practised, in order to prevent any probability of false ankylosis, an accident which occasionally ensues when the fingers are long kept at rest in splints if this precaution is neglected.

After two weeks, when the dressing is changed, passive motion should also be cautiously made at the wrist-joint, the fragments being carefully retained in position by the hand of the surgeon.

At about the same time, in many instances, the compresses may be omitted, the splints, if well padded, being sufficient. In four weeks and a half, in favorable cases, the splints may be left off and the forearm carefully bandaged to the elbow, when it should be supported with a sling, until the end of the fifth or sixth week, when the patient may begin to resume the use of the limb. By means of this plan of Dr. Barton, very perfect cures have been accomplished in an injury, which is often a serious one to treat without deformity; but it requires care and judgment to be exercised in its execution. If the splints and compresses are carelessly employed, there will be trouble in the integuments from pressure upon the bones of the wrist as well as more or less ankylosis of the fingers.

Another excellent dressing for the treatment of this injury is that suggested a few years since by Dr. Henry Bond, of Philadelphia.¹

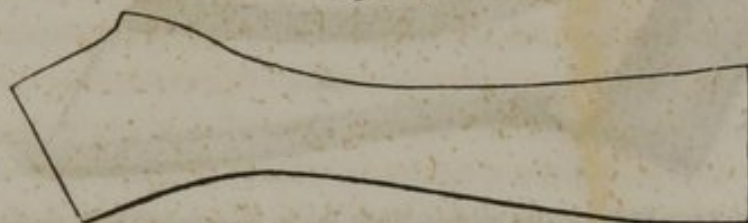
The splint used by Dr. Bond for this purpose is made as follows:—

“1. With a light board, of proper thickness for a splint, take a profile of the well forearm and hand of the patient, placing the hand in its habitual inclination towards the ulnar side of the arm, and extending the profile from the elbow downwards, so that it

¹ Am. Journ. of Med. Sciences, vol. xxiii., April, 1852.

shall reach the second joint of the fingers on the inside, when these are moderately flexed—as much flexed as they are when the points of the thumb and fingers are brought into contact. The lower end of the board must then be cut off obliquely (at an angle of fifteen or

Fig. 127.



A board cut to correspond with the profile of the forearm and hand. (After Bond.)

eighteen degrees) in a direction corresponding with that of a body grasped in the hand, when the hand is inclined to the ulna, as above indicated. Fig. 127.

"2. Cover the board thus prepared with sheeting, or other strong fabric. This may be done by winding around it, from end to end, a narrow bandage, covering all of it as nearly as may be with few or no duplications. This is the most expeditious method. A neater one is to cut a piece of sheeting, of the general form of the board, but extending beyond it on every side, and fasten this upon the board either by a few stitches, drawing towards each other the overlapping edges, or by gluing down those edges upon that side of the board which is to be towards the arm, these edges being covered with the pasteboard.

"3. Prepare a block of soft, light wood, from seven-eighths to eleven-eighths of an inch thick, and from two to two and a half inches wide, according to the size of the patient's hand, and of a length corresponding with the width of the board in the palm of the hand. This block is to be carved and rounded, so as to adapt it to the form of the hand, and make it easy for the thumb, and in the grasp of the hand when it is placed on the board. It is to be fastened there by screws or nails, so that the remote edge of it shall correspond exactly with the lower oblique end of the board.

"4. Upon that part of the board not covered by the palm-block, fasten, by means of small carpet tacks, a piece of bookbinder's pasteboard, extending on each side beyond the edges of the board about an inch. If the pasteboard be very thick and stiff, make a slight incision in it along the edge of the board, in order to bend

more easily the two projecting portions of it, thereby making a kind of box for the lodgment of the arm. Fig. 128.

Fig. 128.



A. This whole space down to the palmar block (B) to be covered with pasteboard. c. c. Parts of the block, which must be more or less cut away, to suit the prominences of the hand. D. D. The projecting and elevated edges of the pasteboard. (After Bond.)

“The flannel or other fabric with which the splint is lined should extend a little beyond the edges of the pasteboard, and the same piece may be extended over the palmar block; but it will be better to cover this block with a separate piece. For this purpose, take a piece of flannel large enough, when it is doubled, to cover the block. Through the doubled edge, with a proper needle, carry a small string (such as ligature-twine), and tie this around the splint immediately above the block. The covering of the block thus applied may be conveniently changed, without removing the arm from its bed.

“Two compresses will generally be required: the anterior or palmar, and the posterior or dorsal. The proper construction and application of the former of these is a most important point in this dressing, and certainly not less so when long, straight splints are employed; and deformity of the radius or wrist will most frequently result from negligence or want of skill in its use. If the compress be deficient in thickness, and the bandage be applied with its usual tightness, there will not fail to be either a curvature forwards, or a sigmoid flexure, which are the usual deformities. If the thickness of this compress be excessive, there may be a curvature backwards, which I think seldom occurs; but there will be such undue pressure by such a compress as to increase the danger of adhesions, and to aggravate the discomfort of the patient.

“In order to determine with precision the requisite thickness of this compress in any case, place a long, straight splint upon the palmar side of the uninjured forearm of the patient, and make a compress of such thickness as will fill the space, so that the splint

applied shall bear as firmly upon the compress as the ends of it do upon the wrist and upper part of the forearm. It is to be observed that, when the hand has its usual inclination backwards, the space between the forearm and splint will be less, and of course require a compress of less thickness than when the hand and forearm are swathed upon a long, straight splint.

"After the forearm is laid into the splint, apply the dorsal compress. This compress is seldom essentially necessary in these cases; but it may always be advisable to use it. Its thickness is comparatively unimportant, especially when a dorsal splint is not employed. It may be made of folds of a bandage of about the width of the wrist, and so long as to cover the lower fragment of the radius and the wrist, but not extend upon the hand. After adjusting this compress, apply a roller, beginning upon the lower fragment of the radius, carrying it down over the wrist, the metacarpus, and the first joints of the fingers, leaving the thumb free; then returning with the bandage to the upper end of the splint, and attaching it in several places by pins to the woven covering of the splint. If the compresses have been properly made and adjusted, it is unnecessary, with this splint, to apply the bandage with anything like the tension ordinarily employed in dressings with the long straight splints; and those accustomed to the use of these splints will be liable to err on this point.

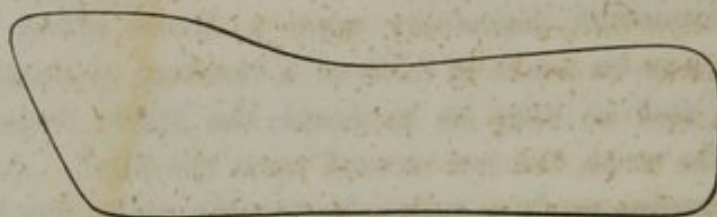
"A dorsal splint is unnecessary, unless the fracture occur so high up that there is danger of diminishing the interosseous space between the bones of the forearm. In such a case, it is necessary. It should be so wide that the bandage will not pass upon the fragments in such a manner as to lessen the interosseous space; and it should be so long as to reach from near the elbow to the hand, but not extend upon the metacarpus."

The mode of treating Barton's fracture, as suggested by Dr. Bond, has now been very frequently tested and always proved satisfactory. In several instances under my own observation patients have expressed their satisfaction at the comfort derived from the position of the hand on the splint. I cannot, however, but add my experience to the suggestion made by Dr. Bond respecting the proper application of the front compress. It is absolutely essential to the cure, as, unless it is sufficiently large to prevent the inequality of surface which exists between the carpus and the

fleshy part of the forearm, the position of the hand on the block will tend to augment the anterior deformity.

Hays' Splint.—A very good extemporaneous apparatus for the treatment of this fracture, which answers the same purpose as Bond's splint, has been suggested by Dr. Isaac Hays, of Philadelphia.¹ It consists of the rough outline of the forearm, cut out of any thin piece of wood, as the top of a cigar-box, with a good thick

Fig. 129.



Shape of Splint as cut from cigar-box. (After Hays.)

roller bound in such a position as to supply the place of the block of Bond's splint; its application, with the compresses, &c., being the same as that directed by Dr. Bond.

Fig. 130.



A view of the modified form of Bond's Splint suggested by Dr. Hays. (After Hays.)

SECTION V.

FRACTURES OF THE CARPUS.

Fractures of the carpus, as might be anticipated from the size and position of its bones, are generally compound fractures, and hence, in the treatment of this injury, attention to the condition of the joint and to the means calculated to combat inflammation is more

¹ Am. Journ. of Med. Sciences, vol. xxv., N. S., p. 265, Jan. 1853.

demanded than any particular dressing applicable to the bones themselves. Most generally the injury results in ankylosis, and all that can be done by the surgeon is to see that it shall occur in the position most favorable to the usefulness of the limb. Indeed, a patient with a bad compound fracture of the bones of the carpus, produced as it generally is by very great violence, such as the hand being caught in the teeth of a cotton-gin—or injured by a gunshot wound; or from having, as sometimes happens, the wheel of a wagon pass over the hand—may think himself extremely fortunate if he escapes the risks and inconvenience of amputation, even though his hand remains afterwards in a state of permanent ankylosis.

Nothing, therefore, in the way of apparatus, will be required, in the majority of these instances, except a broad forearm splint, properly padded, upon which the arm may be supported by the light turns of a roller, while leeches, the cold or warm water dressing, or other means likely to combat inflammation, are applied upon it. As a general rule, the most successful results in these injuries will be obtained from the prompt and constant application of cold water by means of irrigation, as directed in the treatment of inflammation; cases having recovered surprisingly well under this treatment after severe lacerations by machinery. After the danger from inflammation has subsided, the parts should be kept at rest, or passive motion attempted, in order that ankylosis may be prevented if possible.

SECTION VI.

FRACTURES OF THE METACARPUS.

The bones of the *metacarpus* are also liable to be broken at times, and by the same class of injuries, as a general rule, as those producing fracture of the carpal bones. Although the fractures thus created may affect any of the metacarpal bones, still there are some which are most likely to suffer; as the metacarpal bone of the thumb, and those of the ring and little finger. The latter bones are often broken by falls upon them. Of these fractures, that of the metacarpal bone of the little finger is perhaps the most frequent, as it forms the abutment of the arch of the hand, and, in falling upon the hand,

sustains the chief weight of the body. When a fracture occurs in the metacarpal bone of the thumb, it may be dressed with four straight splints, the one on the back and front of the thumb extending from the wrist to the end of the phalanx, whilst those inside and outside of the bone should be only the length of the thumb. These splints should be retained in position by the ordinary spiral bandage of the thumb. Fractures of the metacarpal bone of the little finger, or that of the ring finger, may be dressed by a straight forearm splint, well padded, so as to fill up the hollow of the palm, preserve the arched shape of the metacarpal bones, and prevent any prominence of the fracture on the back of the hand; the splint being made to extend all along the front of the forearm. Compresses may also be required on the back of the broken bones, to preserve their proper convexity, the whole being kept in position by light turns of a roller.

SECTION VII.

FRACTURE OF THE PHALANGES OF THE FINGERS.

Fractures of the phalanges of the fingers sometimes occur, but are by no means so common as might be supposed, when the exposed position of these little bones is taken into consideration, the mobility of the parts being such that they give way upon the application of violence in such a manner that dislocation is a much more common accident than fractures. Still, fractures are sometimes produced by violence applied directly to the bones themselves, as by blows of the fist, weights falling upon them, etc.

Treatment.—The treatment of these fractures is to be accomplished as follows: Mould the parts accurately into position, then take a narrow finger bandage, and, commencing at the wrist, make one or two circular turns to fix the bandage, which is then to be brought over the back of the hand to the extremity of the injured finger, and made to envelop it with the ordinary spiral of the fingers, so as to support the vessels of the skin and to prevent swelling. Then two long, narrow splints, long enough to reach from the wrist to the extremity of the injured finger, and about one-half or three-fourths of an inch wide, are to be padded with cotton, and covered with a bandage precisely like a forearm

splint, and, one of these splints being placed upon the front and one on the back of the hand, two shorter splints, prepared in the same manner, being placed one on each side of the finger, the whole should be supported by the turns of a finger bandage, applied from the wrist, as just directed.

As in these cases the principal danger to be apprehended is ankylosis, either from the inflammation which is developed by the injury, or from the continued extension of the finger, necessitated by the treatment, the dressing, when changed, should be followed every few days by passive motion—the fragments being meantime accurately held in position—before the splints are reapplied.

If, however, the surgeon perceives it probable that ankylosis will ensue, notwithstanding his efforts to prevent it, owing to the violent contusion, &c., he should place the finger in such a position as will prove most useful to the patient when it is established, and that is semi-flexed, a finger that is ankylosed in the extended position being constantly an annoyance, whilst a semi-flexed position will enable it to perform many of the ordinary motions of the fingers.

SECTION VIII.

FRACTURE OF THE OLECRANON PROCESS OF THE ULNA.

The *olecranon process of the ulna* may be broken by muscular action or by direct violence. In either case it will be at once recognized from the elevation of one fragment by the action of the triceps extensor cubiti, which causes it to take a position upon the back of the arm above the greater sigmoid cavity of the humerus. Hence the power of perfect extension of the forearm is lost, whilst that of flexion is still retained; the action of the biceps flexor cubiti and the brachialis internus remaining unimpaired.

Symptoms.—The symptoms of this injury are as follows: After a fall upon the elbow, or sometimes after some muscular violence capable of producing a rupture of the bony fibres, the patient finds himself unable to extend the arm, which is held in a semi-flexed position by the action of the biceps and brachialis muscles. There is, also, violent pain with swelling of the joint, and on running the finger along the posterior face of the humerus the surgeon

will soon feel an unnatural prominence on the back of that bone just above its sigmoid cavity, caused by the upper fragment being drawn above the joint, as above explained. If now the arm be extended, it will be found that the patient can partially flex it, but if it is flexed he will be unable to extend it, except to a very limited degree. When flexed, the space between the upper and lower fragments is, of course, greater than it is when the arm is extended, as extension of the forearm causes the lower fragment to approach the upper, whilst it also relaxes the triceps muscle, and thus renders the approximation of the upper fragment to the body of the ulna more easy.

Treatment.—The treatment of fractures of the olecranon consists in counteracting the action of the triceps muscle—thus bringing the upper fragment down upon the lower—and in obviating the tendency to inflammation and the formation of lymph within the joint, which may, in these cases, create partial ankylosis of the elbow.

As the union of the fragments in this fracture is most generally

effected by the formation of ligamentous matter, it becomes important that it should be as short as possible, for the longer the intervening structure the more the action of the triceps will be diminished. Thus, if the triceps muscle be elongated a quarter of an inch, the patient will no longer be able to extend his arm properly, and if half an inch the power of extending the arm will be still more impaired; but even in the most favorable cases the extension of the forearm will seldom be as perfect as it was before the accident. In order, therefore, to prevent disappointment, the surgeon should inform the patient of this fact at an early period in the treatment.

The reason why the bond of union in fractures of the olecranon is so universally ligamentous is owing, it is thought, to the fact that the vascularity, and consequently the vitality, of this end of the ulna, depend almost entirely upon the supply of blood derived from the nutritious artery, which passes into the bone near the middle of its shaft, whence it is distributed throughout its sub-

Fig. 131.



View of a specimen which exhibits the usual site of a fracture of the olecranon process, with the position of the ligamentous bond of union in a degree which would materially impair the usefulness of the arm in extension. (After Ferguson.)

stance. When, therefore, the bone is broken just below its olecranon process, it will be perceived that the upper fragment has no supply of blood except the small quantity derived through the tendon of the triceps or the ligaments which are inserted into it; and this is not sufficient to enable such changes to take place on the surface of the upper fragment as would result in the formation of callus. The ligamentous matter which unites these fragments is often very strong, but, as it allows them more or less separation, it in effect lengthens the triceps muscle, and thus diminishes its power.

In order to treat this fracture as successfully as possible, the forearm should be well extended, and the fragment, which is drawn up by the triceps muscle, be drawn down into position by the surgeon's fingers and carefully kept there; the action of the triceps being counteracted by a straight splint applied on the front of the elbow or bend of the arm. The dressings which have been suggested for this purpose are very varied. That most frequently employed, and perhaps the most simple, is the dressing originally suggested by Dessault, which is applied as follows:—

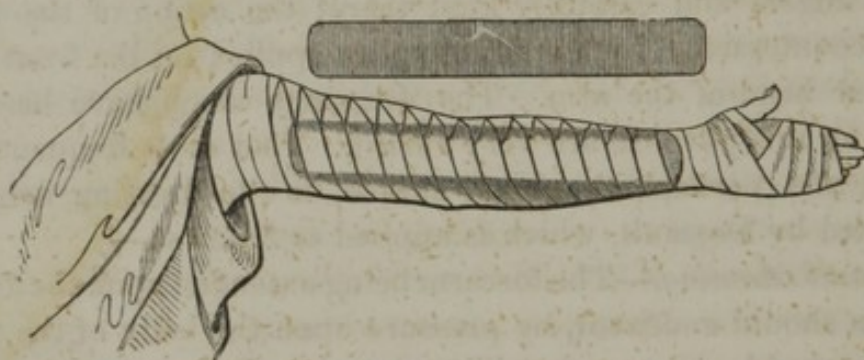
Dessault's dressing.—The forearm being extended upon the arm, the surgeon should endeavor, by pressure upon the belly of the triceps with one hand, to counteract its contraction whilst using the fingers of the other hand as a hook to draw down the upper fragment, picking up at the same time, or directing an assistant to pick up, the skin over the elbow-joint, in order to prevent its being caught and pinched between the fragments. Then commencing at the wrist, apply the ordinary spiral bandage of the upper extremity, ascending the arm till the bandage reaches the elbow, when the joint should be covered in by figure of 8 turns in such a manner as to hold the two fragments closely in apposition, after which the bandage should be continued up the arm to the shoulder, in order to compress the triceps and counteract its contractions. Then, placing a little wadding in the bend of the arm to prevent pressure upon that point, apply a straight splint of wood long enough to reach from the middle of the arm to the middle of the forearm, and bind it in position by the ordinary turns of a roller, the dressing at first being loosely applied lest it give rise to such excoriation and ulceration as may in the end become so serious as to require the dressing to be given up altogether. After a few days, the patient may

be allowed to walk about with his arm hanging by his side in the extended position.

When three, four, or five days have elapsed, this dressing should be taken off, the fragments being held carefully in position by the hand of the surgeon, whilst stimulating frictions are employed with a view of overcoming any capillary congestion of the skin; this friction being repeated whenever the dressing is changed, which should be at least every four days.

About the twenty-first day, the surgeon, whilst carefully holding the fragments in position, should make cautious passive motion of flexion with a view of avoiding ankylosis of the elbow-joint;

Fig. 132.



A view of the front surface of the left arm with the dressing applied in the treatment of fracture of the olecranon, showing the size and position of the splint. (After Nature.)

and after six weeks, in the majority of cases, the dressings may be dispensed with, when the patient may begin cautiously to use his arm.

Cooper's apparatus.—Another dressing is that of Sir Astley Cooper, which is very powerful, and particularly applicable to the second and third week of the injury, the earlier stages having been treated by means less likely to produce excoriation and ulceration. This dressing is commenced by applying the spiral bandage of the upper extremity from the fingers to the shoulder; after which two tapes, long enough to extend from the axilla to below the middle of the forearm, should be placed one on the front and the other on the back of the arm, and fastened in position by the circular turns of a roller above and below the joint. Then, on drawing upon the tapes and tying them, the ends of the fragments will be brought into juxtaposition, and a dressing obtained which is exceedingly

firm, and which in intelligent patients will answer without the addition of a splint; but, if the patient is troublesome, a splint may be applied to the arm, so as to retain it more certainly in the extended position.

The after-treatment, where this apparatus has been used, is precisely the same as that which has been detailed in connection with the other dressings.

Gerdy's dressing.—The uniting bandage of Gerdy has also been employed in these cases, and will be fully described in connection with fracture of the patella, to which injury it is better adapted.

CHAPTER V.

FRACTURES OF THE LOWER EXTREMITY.

SECTION I.

FRACTURE OF THE FEMUR.

THE *Femur* is a bone which, from its situation between powerful muscles, its shape and construction, is much exposed to fracture, and when broken is exceedingly difficult to keep in proper position during treatment. This fracture is liable, therefore, to give great trouble to the surgeon and to result in deformity—the latter on account of the position of the bone causing great inconvenience to the patient by laming him, more or less, for life. Hence, fractures of the femur are of importance, and the indications to be fulfilled in their treatment, with the forces to be counteracted, demand careful study.

By referring to the character and variety of the muscular attachments of the femur, it will at once be understood that a fracture at different points in the length of the bone will give rise to special deformities, each demanding a particular course of treatment to overcome them successfully.

Seat.—Fractures of the femur may occur at any point of the bone, and are described under the head of fractures through the head of the bone; fractures through its neck within the capsule;

fractures lacerating the capsule and affecting the bone, both within and without it; fractures of the neck without the capsule; fractures through the trochanter major; fractures of the upper third of the bone; of the middle third, of the lower third, and of the condyles; all of which will occasionally require special forms of apparatus, in order to accomplish their successful treatment.

§ 1.—FRACTURE OF THE HEAD OF THE FEMUR OR OF THE NECK OF THE BONE WITHIN THE CAPSULE.

This seat of fracture of the femur presents us with a class of injuries which are sufficiently common. They generally occur in elderly persons, though not strictly limited to the aged, having been found as early in life as eighteen, though at this age the accident is very rare, the subjects of it being most frequently on the shady side of fifty years.

Etiology.—Among such persons, a fracture of the neck of the femur is often produced by apparently insignificant causes; thus, a patient whilst walking across the floor catches his foot in the carpet, feels something give way at the hip and drops upon his side, and from the fact that he generally falls towards the injured side or upon it, it has been supposed that the fall was often the origin of the fracture; hence we see it not unfrequently stated that the most common cause of fractures of the neck of this bone is the application of force to the trochanter major. A more careful investigation, however, would tend to show, from the line of the fracture, from its position, from the manner in which one fragment is sometimes driven into the other, and from the direction in which the capsular ligament has been torn, that the injury cannot have been produced in this way in many instances, and that the fall has been rather the consequence of the fracture than the fracture the consequence of the fall, though the impaction of the fragments, after the fracture, is evidently due to the fall. We are led from such investigations, therefore, to believe that in these fractures the solution of continuity in the bone is rather due to muscular violence or to mechanical force applied to the foot; thus, in the instance given above, the foot being caught in the carpet, the contraction of the muscles, while the femur is in that position, will be sufficient, when combined with the weight and onward impetus of the trunk, to break the bone at its neck.

When the fracture occurs in the first instance from muscular contraction, or from a force applied to the neck of the bone through its shaft, the fibres of the bone usually give way in a direction corresponding with the character of the producing force, and a fracture is created which will run from the exterior edge of the head through the neck, towards the base of the trochanter. When, on the other hand, the force is applied to the great trochanter, the fibres of the bone may be expected to yield in a different direction, the fracture running from the trochanter obliquely upwards, and inwards, the fracture being also often impacted. (See Fig. 133.)

The history of the accident, therefore, becomes of importance, as showing the probable line of the fracture and the amount of injury sustained within the capsular ligament, this latter fact being of importance to the surgeon, from the fact that the greater the distance of the fracture from the insertion of the capsular ligament, the greater the probability of a marked degree of shortening.

When the head of the femur or its neck within the capsule is the seat of fracture, it may be stated, as a general rule, that osseous union will not take place; the bond of union in this, as in fractures of the olecranon and patella, being of a ligamentous character, and for the same reason, to wit: the deficient vascularity of the fragments, especially of that connected with the head of the bone. So uniformly is this the case that it was at one time denied by surgeons of high standing—as Sir A. Cooper—that bony union was possible

in a fracture of the neck of the femur within the capsule. As in the case of the patella and olecranon, however, bony union sometimes takes place in these fractures; and there is, in the Wistar and Horner Museum of the University of Pennsylvania, a femur, apparently that of an old woman, in which the neck has been fractured near the head, yet in which complete osseous union, though with some degree of shortening, has taken place. I have, moreover, in my own cabinet a specimen in which the bone has been fractured through the neck near the head, the fragment having slid down beneath its natural position, and the fracture travelled obliquely

Fig. 133.



A representation of an impacted fracture of the neck of the femur through the trochanter; the upper fragment being wedged into the lower. (After Miller).

down the neck, though still within the capsule, splitting it off in the line of the inter-trochanteric ridge. In this case, which must

Fig. 134.



A front view of a fracture of the neck of the femur, within the capsule, in which there is perfect bony union. (After Nature.)

have produced marked shortening of the limb, there is *complete osseous union*. From a careful study of these and other specimens of fracture within the capsule, both with osseous and with ligamentous union, we may safely conclude that there are a limited number of cases in which osseous union does occur; and that, as a general rule, the nearer the fracture is situated to the head of the bone, or, in other words, the shorter the upper fragment, the greater will be the probability of osseous union, because the shorter the upper fragment the greater the chance that the little vessels which supply it with blood through the round ligament will be able to furnish it with an amount of material sufficient to enable osseous union to take place. On

the other hand, the nearer the seat of fracture to the shaft of the bone, the greater the probability that ligamentous union only will result, though there will be a great amount of irregular ensheathing callus thrown out within and without the capsular ligament, so as to support the fragments in this position.

When a fracture of the neck of the femur occurs within the capsule, there is a large effusion of blood from the ruptured capillaries of the cancellated structure of the bone. This effusion of blood, being mixed with synovia, can act no part in the processes of reparation; but must, like any other foreign matter, be removed by nature before anything can be accomplished towards the repair of the injury. As the broken surface next the shaft is freely supplied with blood, lymph will here be thrown out and become organized. Not so, however, with the lower end of the upper fragment; its supply of blood being derived principally from the little vessels which reach it through the round ligament, many of which collapse, an imperfect effusion of lymph occurs, and a merely ligamentous

union results; this union being, however, strengthened by the irregular callus formed near the shaft of the bone, as in Fig. 135.

Fig. 135.



A view of three specimens of Intracapsular Fracture of the Neck of the Femur near to its junction with the shaft of the bone. In all these specimens, though there is a considerable amount of callus formed on the shaft of the bone, so as to strengthen and support the fragment connected with the head of the femur, yet little or none is found in connection with the latter, union being imperfect in all the preparations, as shown after their maceration. (After Nature.)

If this explanation be correct, we would look for bony union as more probable in fractures of the head than in fractures of the neck; and, in fractures of the neck, as more probable in those near the head than in those near the trochanter. This, it will be perceived, is the reverse of what has generally been stated in works upon the subject; but it is a statement which seems to be borne out by the specimens that have been carefully observed by myself and others, though further observation is necessary to the establishment of this opinion. Whether confirmed hereafter or not, it cannot be denied that osseous union in fractures of the neck of the femur within the capsule is exceedingly rare; and, as the ligamentous matter which furnishes the bond of union in the majority of instances is a very imperfect means of support, the patient always remains more or less lame; as, every time the weight of his body comes upon the injured limb, the latter gives way, and his body sinks to a degree equal to the length of the new ligamentous structure. The patient will, therefore, always limp more or less after the healing of this fracture, and the longer the bond of union, the more marked will be the limp, and the more imperfect the usefulness of the limb. It becomes, therefore, a matter of importance so to conduct the treatment that this ligamentous matter shall be as short as possible.

Symptoms.—The symptoms of fracture of the neck of the femur within its capsule are sometimes sufficiently difficult to recognize,

and a diagnosis will only be correctly made by an accurate investigation. Sometimes, however, the signs of the fracture are so plain as to be readily distinguished.

After a fall in crossing the floor, as above described, or in crossing a gutter and tripping, or falling upon a curbstone, or sometimes, in very old persons, after an attempt to turn over in bed, in which the patient has caught his foot in the bedclothes, the following train of symptoms are observed:—

There is, as a general rule, a disposition in the foot to fall *outwards*, in consequence of the action of the rotatory muscles, which are inserted near the base of the trochanter major. The patient also complains of pain in the line of the joint, and is unable to flex his thigh upon his pelvis by means of the appropriate muscles, though he can do so by carefully raising the limb with his hand, or with his other foot; this motion, however, giving him great pain.

On examining the hips, before swelling has occurred, it will be seen that the prominence of the trochanter major is less upon the injured than upon the sound side, and that the fulness of the glutei muscle is greater upon the injured than upon the sound side; whilst, when the comparative lengths of the limbs are measured, the injured limb will prove to be from one-half to three-fourths of an inch shorter than the sound side. This shortening, it should be remembered, will not be so marked immediately after the occurrence of the accident as it will be in the course of from twenty-four to forty-eight hours, when the muscles have had time to act, and it will be more marked when the capsular ligament has been lacerated than when that accident has not taken place. Of course, on the other hand, there will be less shortening when the fragments are impacted. In a marked case of impaction, indeed, there may be no shortening at all, no crepitus, no fulness of the glutei muscles, and a failure of all the ordinary symptoms of fracture; and these cases are therefore exceedingly obscure, and difficult to diagnose.

As the subject of shortening has been mentioned, the proper mode in which measurements should be made, with a view of ascertaining how much shortening exists, may here be stated. If the shortening of the limb be judged by the comparative position of the foot, it will be in the power of the patient to produce, through accident or design, a marked amount of shortening, simply by a slight inclination of his pelvis or body. In order to avoid being

misled by such a condition of parts, the surgeon should therefore observe the following rules:—

Lay the patient upon his back and draw an imaginary line with the eye, or a real one with a tape, transversely across his abdomen from the anterior superior spinous process of the sound to that of the injured side, so that the two anterior superior spinous processes of the ilia may be exactly on the same level; or if they are not, adjust the patient so that this line may be at right angles to the length of the body. The position of these two processes being now marked with a lead pencil or a pen, measure the length of the sound side by a tape drawn from the anterior superior spinous process of the sound side along the inside of the limb to the bottom of the internal malleolus, after which the injured limb should be measured in the same manner. From one-half to three-quarters of an inch shortening will then be observed soon after the accident, but, as above stated, after some twenty-four or forty-eight hours, when the muscles have had time to act, and shortening has fully taken place, a greater degree may be noted, an inch or an inch and a half having been found, and one of two inches being recorded, though the latter measurement seems somewhat exaggerated, if taken after the muscular spasm has passed away.

Besides the symptoms, due to muscular action, the surgeon should also be able to recognize in these cases the ordinary symptoms of fracture of the bone. He should, therefore, endeavor to feel the crepitus; though in doing so he must proceed cautiously lest he do the parts a serious injury. In order to recognize the crepitus in a satisfactory manner, and at the same time do no harm to the patient, direct an assistant to seize the limb by the ankle and make moderate traction, and then placing a thumb upon the trochanter major, and a finger as near as possible to the trochanter minor, let the assistant rotate the limb gently. In this manner the crepitus will generally be made perceptible to the patient and to the surgeon; and being transmitted through the limb it will also often be distinctly recognized even by the assistant who has hold of the ankle. Besides this, the surgeon should notice the *character of the arc of the circle* described by the trochanter major during the rotation of the bone.

Under ordinary circumstances, the rotation of the femur, as indicated by the rotation of the toes from their extreme point inwards to their extreme point outwards, causes the trochanter major to

describe an arc which is very nearly a semicircle, but after a fracture of the neck of the bone the trochanter will be found to describe a shorter arc than the sound trochanter on the opposite side.

The mechanism of the deformity in this fracture is very readily understood by referring to the muscles around the joint. Thus we

Fig. 136.



A VIEW OF THE MUSCLES CONCERNED IN THE DEFORMITY OF FRACTURE OF THE NECK OF THE FEMUR—ALSO OF FRACTURES OF THE UPPER THIRD.—1, 1. Psoas magnus and iliacus internus muscles turned off from the pelvis. 2. Muscles inserted into the trochanter and drawing up lower fragment. The smaller and upper cut shows the deformity in the upper fragment in fractures of the upper third of the bone. (After Hines.)

have the action of the gemini, pyramidalis, and other rotating muscles, as well as of the large and powerful glutei muscles no longer antagonized by the continuity of the neck of the bone, and these, therefore, rotate the femur outwards, thus causing the falling outwards of the toes which has been already alluded to.

Besides this, there is shortening, which is not only produced by the glutei, the adductor and other muscles acting directly upon the upper end of the shaft of the femur, but by the quadriceps femoris, the semimembranosus, semitendinosus, and biceps; muscles which, inserted into the head of the tibia, tend to draw it towards the pelvis, and to produce shortening of the thigh when their action is no

longer counteracted by the continuity of the neck of the femur. The eversion of the foot, however, is not a universal accompaniment of fracture of the neck of the femur, nor is it by any means a positive sign that such a fracture has occurred, as a dislocation of the head of the bone upwards and backwards on the dorsum of the ilium may cause the toes to be turned outwards in a similar manner, so that a diagnosis can only be made when eversion of the foot is seconded *by the presence of the other signs of dislocation*.

Prognosis.—The prognosis of fracture of the neck of the femur will depend upon the age of the patient and other concomitant circumstances; thus, in a man of fifty there would be more probability of bony union than in one of seventy years of age. In a case of impacted fracture there would also be less shortening, and the patient would have a more useful limb than in a case of oblique fracture through the neck. As a general rule, however, an unfavorable prognosis should be given, the patient being frankly told that in all probability he will always walk with a limp, for not one case in a thousand unites so as to give a perfect limb.

Treatment.—As the best union is imperfect in these fractures, it becomes a matter of importance to use such means in the treatment as shall cause the ligamentous bond of union to be as short as possible, in order that the limp may be as trifling as it can be made. Unfortunately, however, the class of persons in whom this fracture occurs being generally elderly people, pressure is very badly borne, the skin being liable to become ulcerated by long-continued pressure upon the point of the sacrum, thus creating bed-sores. The attempt, therefore, to save the limb from deformity may endanger the patient's life, and for this reason it is better to subject him, when well advanced in life, to no extension and counter-extension further than can be obtained from position, and to give up the idea of producing union without deformity, relying rather on supporting his general health, and sustaining him as well as possible under the depressing influences of his confinement.

The simplest and best plan of treatment in a patient of this class is to place him upon a mattress, and folding a pillow so as to make a double inclined plane, place it beneath the knee so as to retain the limb in a flexed position, keeping him in this position for about six weeks, and then transferring him to an arm-chair. Or, if a tendency to the formation of bed-sores be developed, he may be set up earlier, being taken out of bed at the end of the second week, placed

Fig. 137.



A representation of the Double Inclined Plane as formed by a Pillow, and applied to such cases as are described in the text. (After Nature.)

in a chair, and allowed to recover with deformity, as indeed he most probably would do, under the most perfect apposition of the fragments.

§ 2.—FRACTURE OF THE NECK OF THE FEMUR WITHOUT THE CAPSULAR LIGAMENT.

In a *fracture of the femur, outside of the capsular ligament*, there are two fragments, both well supplied with blood, the lower end of the upper fragment obtaining it through the arterial foramina seen in this part of the bone, vessels entering them chiefly through the insertion of the ligament and muscles connected therewith. Osseous union, if the fracture be properly treated, is therefore of more frequent occurrence, and it becomes a matter of importance to overcome the deformity, and place the parts as perfectly at rest as possible. This fracture, moreover, happens generally to people less advanced in life, and in whom the reparative effort is more active; and the best mode of treatment is by means of a firm properly made inclined plane.

A very excellent apparatus for this purpose, made of sheet iron, so as to fit the limb, padded, and capable by means of screws of being elongated to suit any limb, or of being adjusted at any angle, is the apparatus generally known as McIntyre's splint. (Fig. 138.)

By means of such an apparatus the limb may be efficiently treated, the foot being attached to the foot-board, and the counter-extension made from the bend of the knee, by binding the leg to it with a bandage, while the counter-extension is made by the weight of the body, the whole limb being secured by a bandage. Very

Fig. 138.



A side view of McIntyre's Splint as formed into a double inclined plane by the action of the screw beneath the knee. (After Fergusson.)

good cures may be thus effected, and the apparatus is lighter and neater than the double inclined plane of wood, which, however, answers perfectly well, and a drawing of which is given in Fig. 142.

Fig. 139.



A side view of Liston's modification of McIntyre's Splint, showing its attachment to the limb, &c. This splint is also very useful in the treatment of compound fractures of the leg, as shown in the cut. (After Liston.)

Liston's Long Splint.—There is another mode of dressing fractures of the neck of the femur just without the capsule, and fractures of the trochanter, which has also been applied to fracture of the shaft of the femur, and that is by the splint known as Liston's splint. This is a simple splint, long enough to go from the axilla to about six inches below the foot, and perforated with two holes near its upper extremity, whilst at its lower end two deep notches are cut so as to divide the lower extremity into three points; besides which, a hole is cut so as to receive the external malleolus.

In its application, a junk-bag is laid along the splint from one end to the other, and tied in position with several tapes. Then an ordinary roller being torn into two tails, one of which is passed through each of the holes at the top of the splint and tied on the outside, the roller should be carried smoothly down over the junk-bag to the inferior extremity of the splint, so as to obtain a firm connection.

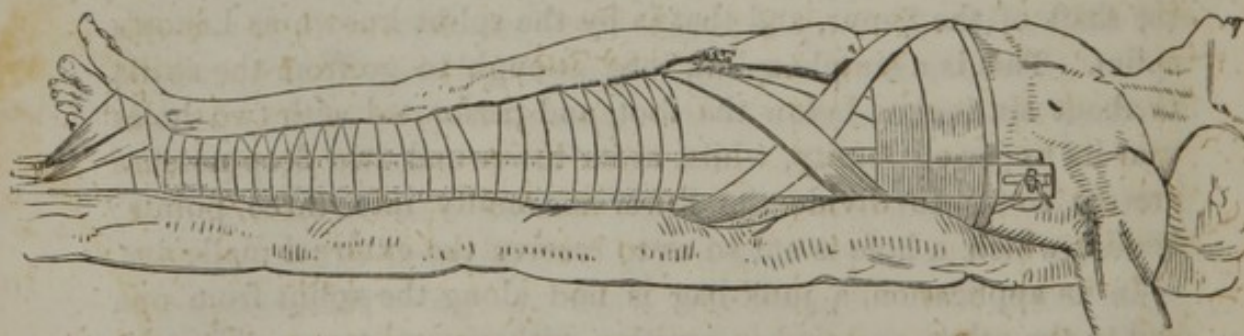
Fig. 140.



A handkerchief or towel should now be folded into a cravat and placed in the perineum with a view of making a moderate degree of counter-extension and drawing the limb outwards towards the splint. Then, having laid the splint on the outside of the limb and brought the roller down over the junk-bag till the foot is reached, a turn is to be made around the foot, and the bandage carried down around one of the points at the extremity of the splint back to the foot, around which another turn should be taken to one of the points again, and so on, until a firm hold is obtained of the foot so as to make the extension, counter-extension being kept up by means of the handkerchief in the perineum, which is to be made fast to the two holes in the top of the splint. Having thus fastened the foot by means of the turns of the roller to the points at the bottom of the splint, bandage the limb and splint together all the way up to the groins, the perfect extension and counter-extension of the splint preventing displacement whilst the limb is raised sufficiently to permit the application of the bandage.

By means of this apparatus, a moderate extension and counter-extension will be kept up, the trochanter be pressed in upon the neck of the bone, the parts be kept at rest, and very good cures accomplished at a point where it is difficult to apply a retaining force by any other

Fig. 141.



A view of Liston's Splint, as applied in fracture near the trochanter, or any other portion of the shaft of the femur. (After Liston.)

means. In the *extra-capsular* fracture of the neck of the femur I have found this a useful dressing, but do not like it so well in fractures of the shaft of the bone.

§ 3.—FRACTURE OF THE SHAFT OF THE FEMUR.

Under the head of fracture of the shaft of the femur are included all such fractures as happen at any point between the trochanter and condyles. This fracture may occur in all ages, but is more common in the middle-aged, and may be produced by mechanical violence, or by muscular action.

Diagnosis.—When it has occurred, there can be no difficulty in making a diagnosis; as, in consequence of the muscular attachments, the power of which is very great, there will always be more or less deviation from the normal course of the limb; with shortening, angular deformity, destruction of the function of the limb, crepitation, and all the ordinary signs of fracture.

Seat of Fracture.—Fracture of the shaft of the femur generally occurs at one of three distinct points: to wit, at the upper third of the shaft, at its middle, and at its lower third.

1. FRACTURE OF THE UPPER THIRD OF THE FEMUR.—When fracture of the shaft occurs at its upper third, a deformity is produced, which is quite characteristic, and consists in the elevation of the lower end of the upper fragment and its projection forwards, as well as in shortening of the limb.

The anterior prominence of the lower end of the upper fragment is due to the action of the *psoas magnus* and *iliacus internus* muscles, which, being inserted into the trochanter minor, have for their function the flexing of the thigh upon the pelvis, a function which, owing to the solution in the continuity of the femur, they are no longer able to accomplish, and it is in their attempt to do so that the lower end of the upper fragment is canted forwards. The shortening, as in fracture of the neck, is due not merely to the action of the adductors upon the lower fragment, but to that of the *semimembranosus*, *semitendinosus*, *biceps* and other muscles, which are inserted into the head of the tibia, and draw the lower extremity of the femur upward. (See Fig. 136.)

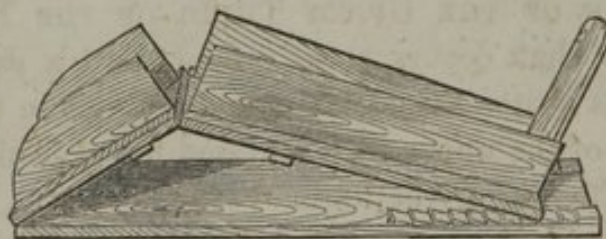
Treatment.—In the treatment, therefore, it becomes a matter of importance, not only to reduce the shortening, but to use means to prevent the upper fragment from projecting forward, the latter deformity rendering this fracture very troublesome to treat, owing to the necessary pressure upon the front of the thigh being badly borne; hence it is extremely difficult to overcome the displace-

ment. Besides which, callus is here liable to be thrown out in irregular forms resembling exostoses, and these interfere with the subsequent action of the muscles, and prevent the motions of the limb from being properly executed.

It becomes, therefore, a matter of importance that this fracture should be carefully treated, and that the fragments should be brought into the most favorable position.

The best plan of treatment, therefore, when pressure upon the lower end of the upper fragment is badly borne, and the upper fragment cannot be pushed down to the line of the thigh, is to bring the line of the thigh up to it by flexing the limb upon the pelvis in the position into which it would be drawn by the action of the psoas muscles, and the best apparatus for this purpose is the double inclined plane and fracture-box as made of wood, jointed and hinged as shown in Fig. 142.

Fig. 142.



A side view of the Double Inclined Plane and Fracture-Box as described in the text. (After Nature.)

On this, a pillow is to be laid, the limb placed on it, and the foot fastened with a bandage to the foot-board; after which the plane should be bent to such an angle as will bring the fragments into position by making the line of the lower fragment correspond with the line into which the upper one is drawn by the muscular contraction. Lateral pressure should also be made by drawing up the side pieces so as to press the pillow firmly against the limb, retaining them in this position by passing round them strips of bandage.

If, in spite of the use of such a dressing, the upper fragment still projects forwards, a carved splint, carefully padded, may be laid upon the front of the limb and retained by a bandage, or, if this is not sufficient, a compress may be laid between the splint and the projecting point. Carved splints suitable for this purpose can be

obtained at any of the instrument-makers, and come in bundles of assorted sizes, so as to be adapted to a limb of any length.

Another splint, which is admirably adapted for the front of the thigh, and which may be substituted for the carved splint in the above dressing, is the flexible splint, composed of a thin piece of wood sawed longitudinally almost through, in a number of places on one side, and covered on the other with chamois leather securely glued on. When required for use, the wood can be split completely through by slight pressure, and thus made to adapt itself to a limb of any convexity. Like the carved splints, they come assorted in bundles, containing a number of splints of different lengths. Or one may be formed of strips, as shown in Fig. 143.

Fig. 143.



A front view of the Flexible Splint for the thigh as formed by slipping strips through two straps of leather cut to receive them, as shown in the figure. (After Nature.)

2. FRACTURES OF THE MIDDLE THIRD OF THE FEMUR.—In this fracture, the shortening which generally ensues seems rather due to the action of the extensor and flexor muscles of the leg, which, coming from the pelvis, are inserted into the head of the tibia, as the rectus and vasti, the biceps, semimembranosus and semitendinosus, than to the action of the adductors and glutei, which were active agents in producing deformity in fractures of the upper third of the bone. Sometimes, however, the adductor muscles are concerned in the production of the deformity, which then assumes more or less of an angular character, the points of the fragments being drawn inwards (Fig. 144). It is, however, by no means an invariable rule for the fragments to point inwards; sometimes other muscles are brought into play, and the points of one or both fragments project outwards or forwards. A more common displacement of the fracture when low down is the projection of the upper end of the lower fragment backwards, a deformity produced by the action of the gastrocnemius muscle, which, arising from the condyles of the femur, is inserted through the tendo-Achillis into the os calcis, and which, using the os calcis as a point of support, acts upon the condyles, and pulls the lower fragment backwards. Consequently, in the treatment it becomes essential to overcome this

tendency in the lower fragment, as may generally be done by a good thick mattress, which acts as a splint, or, better still, by an appropriate splint padded and fitted to the back of the limb.

Fig. 144.



A front view of the Action of the Adductor Muscles in creating one form of deformity in fracture of the middle third of the femur, with a side view of the position of the foot, the eversion being aided by the leverage of the leg. (After Hines.)

Symptoms.—The symptoms of fracture of the shaft of the femur are those of fracture elsewhere. There is the deformity already described, with pain, swelling, crepitus, unnatural mobility at the seat of fracture, destruction of the function of the limb, &c.

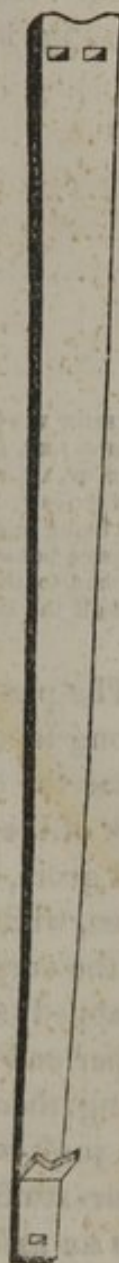
Treatment.—In the treatment of fracture at this point, the indications are, 1. To overcome the shortening by firm and patient extension; and, 2. To make such lateral pressure as will counteract muscular contraction and angular deformity.

Numerous dressings, some simple and some complicated, have been proposed at different periods for the treatment of this fracture in the extended position; almost all being liable to the objection that extension and counter-extension are so made as to produce excoriation, ulceration, and sloughing of the integuments at the points most pressed on. Among the earliest plans was that of Dessault, which consisted in the use of a splint for the outside and one for the inside of the thigh of the length of the entire limb; in junk-bags, to prevent the splints from pressing against the limb, and in a splint-cloth to keep them in contact with it. But, owing to the shortness of the outside splint, this apparatus was liable to the objection that any inclination of the body from the injured side allowed the fragments to slide by each other, and thus permitted a degree of deformity which seriously interfered with the subsequent usefulness of the member.

Physick's Modification of Dessault's Splint.—Dessault's apparatus

was, therefore, modified by Dr. Physick, of Philadelphia, his modification consisting in extending the splint as high up as the axilla, and binding it to the side by a handkerchief around the chest, in order to prevent the inclination of the body. A small block was also added at his suggestion, by Dr. Hutchinson, to the lower end of the splint so as to make the extending band act more directly in the line of the limb than it did in the splint of Dessault. (See Fig. 145.) This dressing, after having been tested for many years, still retains a large share of professional confidence, and, having been variously modified, now consists of the following articles: A long splint, with holes in each end, and a block at the lower extremity, as seen in the figure; of another plain splint, long enough to reach from the perineum to the sole of the foot; of a splint-cloth one yard and a half long by one yard in width, in which the splints are to be rolled, so that they shall be about three inches wider apart than the width of the limb; of two muslin bags called junk-bags, one of which should be of the length and width of the inside splint, and the other about six inches longer, both being filled with bran to about two-thirds of their length. A soft silk handkerchief folded into a cravat of about two inches in width, or a padded band, is also required to make the counter-extension. The means recommended for the purpose of preserving the extension have been very varied, the great difficulty being to find something which, while supplying sufficient power, would not cause excoriation of the heel. The best plan of keeping up extension, no matter what form of the straight splint is employed, is as follows: A strip of adhesive plaster two inches wide, and long enough to reach from the outer side of the knee to two inches below and around the foot up to the inner side of the knee, should be warmed, and made to adhere to the limb; a thin block of wood of the width of the sole of the foot being placed in the loop formed below the foot, so as to keep the strips from pressing against the sides of the ankle, the side straps being also secured by three transverse pieces carried across the front of the leg. This plan has proved so efficient in the treatment of all cases

Fig. 145.



of fractures of the lower extremities that the suggestion of it has been claimed by various surgeons in the United States, each of whom seems to have been unaware of its previous employment. (See Fig. 146.)

Fig. 146.



A SIDE VIEW OF THE EXTENDING BAND AS MADE OF ADHESIVE PLASTER, AND APPLIED TO THE LEG IN ALL FRACTURES OF THE FEMUR AND LEG WHICH DEMAND THE EMPLOYMENT OF AN EXTENDING FORCE.—A. The broad outside strip which is retained by the cross strips 1, 2, 3 passing over to a similar wide strip on the inner side of the leg—this strip being one entire piece. B. The little block placed in the loop of the side strip where it passes beneath the foot, thus furnishing a firm support to the tape which is to be attached to the lower end of the splint, whilst it also keeps the pressure of the extending band off the sides of the foot. (After Nature.)

The plaster having been thus applied, and a strip of bandage or strong tape attached to the block below the foot, the cravat which forms the counter-extending band is to be slipped beneath the buttock of the injured side, and carried across the edge of the perineum and groin, so that it may tie to the upper end of the outside splint. Then, whilst the limb is extended and slightly elevated by the hands of the surgeon at the ankle, let an assistant pass the splint cloth as wrapped around the two splints, underneath the limb, until the upper end of the inside splint reaches the perineum. The splints being then laid down as thus placed, on each side of the limb, the junk-bags should be arranged upon them in such a manner that their stuffing may correspond with the inequalities of the limb. Let an assistant now hold the outside splint with its bag up against the limb until the extremities of the counter-extending cravat are passed through the holes at its upper end and securely tied. Then, whilst the surgeon draws the limb gently, but firmly, downwards, so as to make extension, let another assistant tie the strip of bandage attached to the block below the sole of the foot to the lower end of the outside splint, thus preserving, by means of the adhesive plaster, the extension previously made by the hands of the surgeon. The inner splint, with its junk-bag, being now brought up against the limb, the two splints should be secured in position by three strips of bandage, gently introduced beneath the knee, and slid

into position. Two crossed hoops should then be applied over the foot so as to protect the toes from the weight of the bedclothes.

It will be seen that the short splint in this apparatus has nothing to do with the extension and counter-extension, its object being merely to make pressure upon the inside of the limb, and thus preventing muscular contraction, undue projection of the lower fragment backwards being prevented by the firm hard mattress on which the patient should be placed, as well as by the splint-cloth which surrounds the splints and binds them to the sides of the limb.

Should the patient complain of pain in the perineum after wearing this apparatus for a few days, the dressing should be loosened, as indeed it should be every two or three days during the first fortnight after the injury, and the points pressed on rubbed with soap liniment, to obviate that capillary congestion which gives rise to the inconvenience, and, if unchecked, will result in ulceration. But if the pain reappears after the dressing is reapplied, the apparatus must be laid aside and some other resorted to.

When from this cause, or from any complication, a different dressing seems desirable, resort may be had to the modification of the above splint suggested by the late Dr. Horner, of Philadelphia, a short time before his death, but of which no account has yet been published.

Horner's Splint.—This modification of Dessault's splint consists of two splints similar in length to those just described, but padded throughout their length so as to supersede the necessity of junk-bags. The outside splint is otherwise precisely like that of Physick's, but the upper extremity of the inside splint is so shaped as to supersede the necessity of a perineal band (see Fig. 147), being slightly carved out like a crutch-head and having stretched across it a soft leather strap. On the inside of the upper portion of this splint, two leather loops are nailed to serve for the attachment of the counter-extending band. This inside splint, therefore, makes the counter extension by being drawn up against the perineum, pressure being thus made upon a different point from that which bore the counter-extending band in Physick's dressing. The apparatus thus prepared is applied as follows: Four or five strips of bandage being laid down transversely on the bed, the patient should be placed on them (no splint-cloth being required), and the splints laid one on each side of the limb, a piece of bandage being passed through the leather loops on the side and near the upper end of the inside splint,

one portion of which should be carried beneath the buttock whilst the other passes in the line of the groin to the top of the outside

Fig. 147.

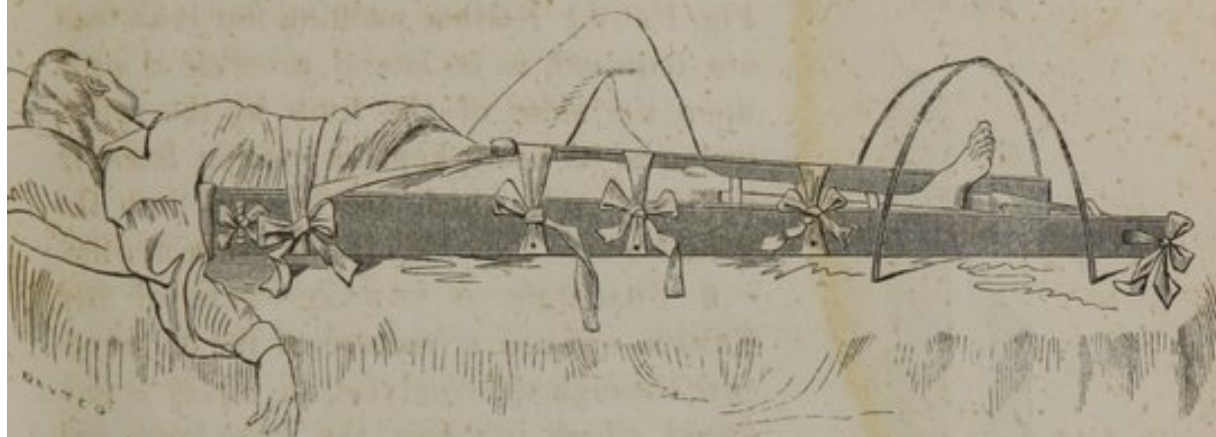


A FRONT VIEW OF HORNER'S SPLINTS.
—A. Bottom of outside splint. B, B. Block for extending band to pass over, so as to keep the extension in the line of the body. C. Perforation for the passage of one end of the extending band, which can thus be tied on the bottom end of the splint at A. D. The two perforations at the top of the splint through which the counter-extending bands are to be passed. This splint is to be padded, as shown in the cut, so as to do away with the junk-bags. E. Excavation of upper end of inside splint. F. Strip of leather stretched across it to serve as the point of counter-extension. G, G. In the magnified view of the upper end of the inside splint are the two loops of leather as tacked to the outer side of the inner splint to receive the counter-extending tape. H, H. The tape or bandage as passed through these loops. The width of this tape is of no consequence if it is strong enough, as it does not press on the body; the only point pressed on being the perineum, and here the pressure is made by the soft leather, which is stretched across the excavated end of the inside splint. Physick's Splint may therefore be readily converted into Horner's when it is desired to vary the seat of pressure from the counter-extending band. (After Nature.)

splint where they are tied, so as to make the counter extension. Extension being then made by means of sticking-plaster, as already described, the bandage should be attached to the block below the foot, and be made fast to the lower end of the outside splint as in the previous dressing. The counter-extension is thus made on the lower part of the perineum by means of the loops fastened near the inner side of the inside splint acting on the strap stretched across the upper end of this same splint whilst the extension is made in the middle line of the limb, as in Physick's splint. The dressing is completed by tying the strips of bandage, previously laid on the bed, around the two splints, and fastening each strip to the two splints by means of a carpet-tack, which firmly secures them to the limb and obviates the necessity for a splint cloth. This dressing is particularly adapted to cases in

which ulceration has resulted from the use of any other apparatus. As in the preceding dressing, it is necessary to protect the foot from the weight of the bedclothes, for so tender does the heel become

Fig. 148.



A side view of Horner's Splint as applied to the patient. As the cross strips are tacked fast to the splints, as represented by the black dots in the figure, they act in supporting the splints laterally against the limb with much greater certainty than the splint-cloth of Des-sault, this being liable to slip, and also difficult to apply so as to obtain the proper width for the limb between the splints. (After Nature.)

that the mere weight of the clothes, forcing it back against the mattress, is often quite sufficient to produce ulceration, particularly if the heel becomes moistened by perspiration, and thus has its cuticle softened.

Another apparatus admirably adapted to severe cases of compound fracture, and which makes the counter-extension by the upper end of the inside splint pressing on the perineum, is that of the late Dr. Hartshorne, of Philadelphia.

Hartshorne's Splint.—This consists of an inside and outside splint,

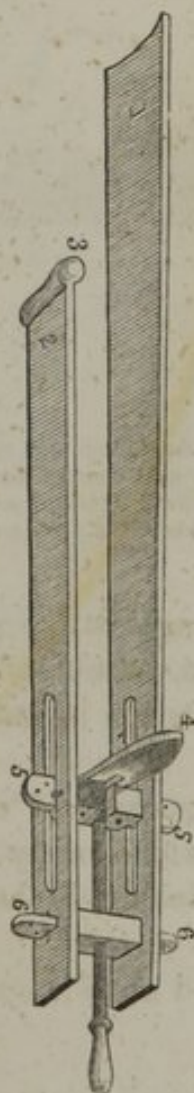
Fig. 149.



A side view of Hartshorne's Splint, as applied to the patient, the extension being made at the foot by fastening it to the footboard and turning the screw, whilst the counter-extension is made by a pad on the upper end of the inside splint. The upper end of the outside splint is also represented as padded, but this is merely to protect the edge of the axilla, and has no connection with either the extension or counter-extension. In compound fractures this outside splint may be removed and the wound dressed, without affecting the extension of the limb. (After Nature.)

which are fastened together at the bottom, where there is a movable footboard which can be shifted up and down by means of a screw. (See Fig. 150, 7.) Extension is made by this screw, acting on the footboard, whilst the counter-extension is made by the padded head

Fig. 150.



A VIEW OF HARTSHORNE'S SPLINT FOR FRACTURE OF THE SHAFT OF THE FEMUR. —1. Upper end of the outside splint. 2. The inside splint. 3. Its padded end by which counter-extension is made. 4. The movable footboard. 5, 5. Two movable tenons to which the footboard is attached. 6, 6. Two fixed tenons in which a screw plays so as to approximate 5, 5. 7. The screw which passes through 6, 6 is fastened on 5, 5. (After Nature.)

of the inside splint in the perineum. (See Fig. 150, 3.) Neither padding nor junk-bags are required, as no lateral pressure is made upon the sides of the limb by the splint, owing to its being kept in position laterally by little pegs, which are inserted into the tenons where they play in the lower mortise.

3. FRACTURE OF THE CONDYLES OF THE FEMUR.—When a fracture of the femur occurs through the condyles, an injury is produced which involves the knee-joint, and which, therefore, besides the dangers incident to fracture, exposes the patient to all those likely to result from the inflammation of so important an articulation.

Symptoms.—The symptoms of this injury are generally quite marked; thus, there is increased width of the joint, with great pain and swelling; crepitus, as a general rule, being readily perceptible. As there is usually some effusion into the joint, the accident, if the patient recovers without amputation, can hardly result in anything but ankylosis.

Treatment.—In the treatment of such a case the remedies are to be addressed rather to the prevention of inflammation of a high grade than to the mere injury of the bone; extension and counter-extension not being demanded, nor could they be borne. A long fracture-box, long enough to reach from the foot to above the middle of the thigh (see Fig. 151) should, therefore, be selected, a pillow placed upon it, and the limb laid on the pillow, when, the sides of the box being brought together, pressure can be made, and the parts kept at rest, whilst leeches, cold

cloths, lead-water, &c., are applied to check the rising inflammation.

After continuing this treatment for several weeks, or until the inflammatory action has diminished, passive motion should be gently tried with the view of limiting the extent of the ankylosis.

Fig. 151.



A SIDE VIEW OF THE LONG FRACTURE-BOX FOR THE TREATMENT OF INJURIES OF THE KNEE-JOINT.—1. Outer side. 2. Inner side. 3. The footboard. 4. Bottom piece. 5, 5. Hinges which attach the side pieces to the bottom and enable them to shut against the sides of the footboard, thus making lateral pressure on the limb when placed within the box on a pillow. (After Nature.)

It should, however, be commenced very carefully, the knee being raised at first only half an inch or so from its position in the box and set down again; when, in a day or two, it may be flexed a little more.

Compound fracture of the condyles of the femur is best treated by means of a fracture-box prepared as for Dr. Rhea Barton's bandaging, the mode of employing which will be described in connection with compound fractures of the leg.

SECTION II.

FRACTURES OF THE PATELLA.

Fracture of the patella resembles greatly fracture of the olecranon in the causes and effects of the fracture, as well as in the indications to be fulfilled in its treatment.

Anatomical relations.—The patella is so situated that it is between two forces, one of which possesses great power, its attachment by

the ligament of the patella to the tuberosity of the tibia holding it firmly below, whilst superiorly it is acted on by the tendon of the quadriceps femoris, a muscle of considerable magnitude. The tendon of this muscle being continued over and around the patella, unites at its inferior edge with the ligament as it passes towards its insertion into the tibia, the bone being thus made to act the part of a sesamoid bone and facilitate the play of the tendon over the condyles of the femur and the knee-joint.

Etiology.—The patella is liable to fracture, not only from external forces, but also from muscular action, the contractions of the quadriceps femoris muscle becoming, under certain circumstances, so powerful that the tendinous expansion over the face of the bone gives way, and the bone is fairly torn in half, the upper fragment being carried up towards the lower fifth of the shaft of the femur. (See Fig. 155.)

Patients.—The class of individuals who suffer from this accident are, therefore, those who, from their calling, are in the habit of making violent muscular contractions of the lower extremities, such as ballet or tight-rope dancers, or circus-riders, in whom it sometimes occurs whilst in the act of leaping.

This fracture is also sometimes produced by mechanical violence, as when a person falls with his knee upon some sharp substance that cuts through the patella, the force being thus applied directly to the bone.

However produced, this fracture, like that of the olecranon, diminishes to some extent the usefulness of the limb, bony union seldom occurring, the fragments, like those of the olecranon, being generally united by a ligamentous band, which, though ultimately very firm, yet destroys more or less of the power of the muscles inserted into the patella by adding to their length.

In this, as well as in every fracture in the neighborhood of a joint, the inflammation set up by the fracture, or caused directly by the injury, may also extend itself to the joint, synovitis and partial ankylosis sometimes complicating the injury.

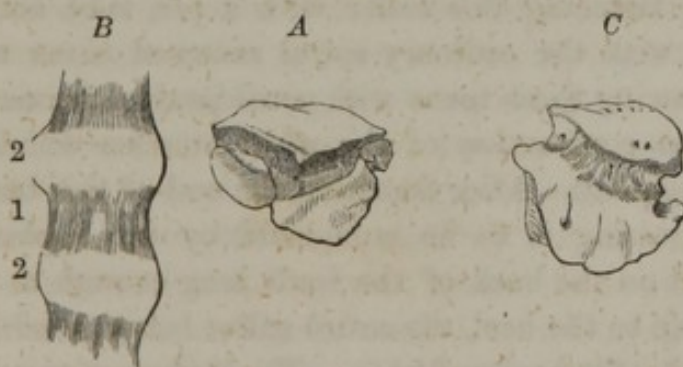
Symptoms.—When a fracture of the patella occurs, the following train of symptoms supervene: If the patient is in the erect position at the time of the occurrence, especially in those cases in which the bone is broken by muscular violence, he drops to the ground suddenly, as if he had been shot, and finds himself unable to

rise upon his feet. Soon afterwards a considerable amount of swelling will be observed about the knee, and, as the fracture is generally transverse, an apparent increased length of the patella can be noticed. When the fingers are passed along the sides of the fragment, a deficiency in the correct outline of the bone will also be observed, and, if the swelling has not become too great, the fingers can depress the front of the soft parts between the two fragments, and thus show distinctly the nature of the case. Some modifications of these symptoms will sometimes occur, owing to circumstances; thus, if the fracture is oblique, there will be a difference in the character of the deformity; and, if the tendinous expansion over the bone be not entirely ruptured, the separation between the fragments will not be so complete as if it had happened.

Diagnosis.—When there is much swelling, the diagnosis of the fracture may be difficult at first, but generally the mobility of the upper fragment establishes the character of the injury.

Prognosis.—The result of a simple fracture of the patella is favorable, as regards the ability to walk, though there will probably be some loss of power in the extension of the leg, the union in these cases, as before stated, being so generally ligamentous that the possibility of osseous union has been denied. Several cases of osseous union have, however, been met with, and there is in my cabinet a specimen, the history of which is unknown, in which the union is very complete. (*C*, Fig. 152.) The fact that such union may occur

Fig. 152.



A VIEW OF THE CONDITION OF THE PATELLA AFTER A FRACTURE.—A. An oblique comminuted fracture of the patella. B. A transverse fracture showing the union by ligamentous matter, and the manner in which it adds to the length of the quadriceps femoris muscle and thus diminishes its power. 1. Intervening ligament between the fragments. 2, 2. The upper and lower fragments. C. Represents a case of osseous union of the patella. After Nature.)

renders it, therefore, exceedingly important that, in the treatment of these cases, the fragments should be kept accurately adjusted, so as to present the most favorable circumstances for this desirable termination, or, if the surgeon fail in procuring osseous union, that such an apposition of the fragments may at least cause the ligamentous band between them to be as short as possible.

Treatment.—The treatment in fractures of the patella, as in fractures of the olecranon, will consist in keeping the limb at rest in the extended position, and in the use of such apparatus as can retain them in position, and is calculated to counteract the power of the muscles which act in separating the fragments. This apparatus may consist in any of the following dressings:—

The dressing of *Dessault* for fractured patella is applied as follows: Take a strip of muslin $2\frac{1}{2}$ inches wide and long enough to go from the ankle to the groin, and lay it along the front of the limb; then, commencing at the ankle, bind it in position by the ordinary spiral bandage of the lower extremity, covering in the heel lest the swelling which may ensue from the compression of the skin should predispose that point to take on ulcerative action. After covering the heel, continue the turns of the roller regularly up the limb until the knee is reached; when two slits should be cut in the band first laid upon the front of the limb in such a manner as to permit the surgeon's fingers to pass through and draw the upper fragment down. Then, retaining the fragments in apposition, cover in the knee with the ordinary figure of 8 turns so as to bind the upper and lower fragments in nearly accurate juxtaposition, and fastening this roller with a pin, take another roller and proceed with the ordinary spiral reversed turns to cover in the thigh, drawing these turns with considerable firmness in order to prevent the contraction of the great muscles which act upon the upper fragment. After fastening the end of this bandage with a pin, the dressing is to be completed by the application of a straight splint on the back of the limb long enough to reach from the tuber ischii to the heel, the entire splint being carefully padded, especially under the heel and knee. The limb may now be elevated upon a single inclined plane (Fig. 153) of sufficient length to flex the femur upon the pelvis and thus diminish still further the power of the muscles upon the front of the thigh. Besides which, this inclined plane, by elevating the limb and draining it of blood, does

away with the tendency towards the swelling and inflammation which might ensue upon the application of the roller or the cause producing the injury.

Another dressing is that of *Boyer* for fractures of the olecranon, which is equally adapted to fractures of the patella, and is as follows: Having applied the ordinary spiral bandage of the lower extremity, and carried it up as high as the knee, a long compress of muslin should be folded, and applied in the form of a figure of 8, so as to draw

the upper fragment down, after which the fragments should be held in position by another bandage, which, commencing at the knee and covering in the joint by figure of 8 turns, should be carried to the groin, a long splint being applied to the back of the limb, precisely as was done in *Dessault's* dressing.

Another dressing, by means of which a considerable amount of power can be obtained, and one which can generally be made upon the spur of the moment, is that of *Dr. Dorsey*, formerly Professor of Surgery in the University of Pennsylvania. It consists of a straight splint for the back of the limb, long enough to go from the tuberosity of the ischium to the heel, upon which two strips of bandage are nailed with carpet-tacks, one a little above and the other a little below a point corresponding with the back of the knee-joint. Then the splint being carefully padded and a bandage applied to the limb, from the toes to the groin, place the splint on the back of the limb, and carry the upper strip (1, 1, Fig. 154), as attached to the splint, round the knee so as to tie, on a compress, below the lower fragment, whilst the lower strip (2, 2, Fig. 154) is in like manner to be carried round and tied on a compress above the upper fragment. These two strips, thus acting on the compresses, will hold the fragments accurately in position, while the splint will keep the limb extended and prevent the contraction of the muscles. After arranging these, bandage the leg fast to the splint by the ordinary spiral bandage of the lower extremities. This dressing is one of very great power, and in some cases will

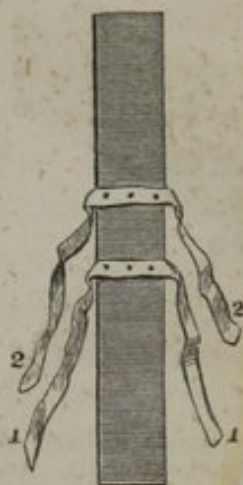
Fig. 153.



A side view of the simple inclined plane for elevating the lower extremity. (After Nature.)

be very well borne, but in the early stages of the majority of cases its employment would expose the patient to great risk of inflammation and ulceration.

Fig. 154.



A VIEW OF THE MIDDLE PORTION OF THE SPLINT AS ARRANGED BY DORSEY FOR THE TREATMENT OF FRACTURE OF THE PATELLA.—1, 1. The lower strip nailed on to the splint so that it can be carried over a compress which is to be placed *above* the upper fragment. 2, 2. A similar strip as arranged to pass *below* the lower fragment. (After Nature.)

There is perhaps only one mode by which the fracture can be kept more thoroughly in position than by this apparatus of Dorsey, and that is the plan of Malgaigne, the French surgeon. This gentleman hooks two little iron clamps into the fragments and approximates them by means of a screw; a very painful method, but one which he says is exceedingly successful, being not unfrequently followed by bony union. It is, however, a plan which seems objectionable not only from its rude character, but from the liability of the ulceration produced by the hooking of the iron clamps through the skin into the bone to result in erysipelas.

The same apparatus which was described as Sir Astley Cooper's apparatus for fracture of the olecranon may also, with very trifling modification, be adapted to fractures of the patella. Its application need not be repeated in this place, having been described under the head of Fracture of the Olecranon.

Very good cures have also been accomplished in these cases by the use of strips of adhesive plaster, a dressing which was many years since considered particularly applicable to compound fractures, or to fractures combined with wounds in the region of the knee, as it at the same time served as a dressing to the fracture and as a means of closing the wound. In its application, cut the sticking-plaster into strips about twelve inches long, and about three-quarters of an inch wide, and apply the ordinary spiral bandage of the lower extremity as high as the tubercle of the tibia. Having reached this, whilst an assistant holds the fragments in apposition, let a strip well warmed be applied with considerable firmness around the joint, starting from the outer side of the head of the fibula, passing up over the front of the knee above the upper fragment and down upon the inner side of the joint and of the head of the tibia, to terminate at a point opposite that from which it started. A second

strip, having been also well warmed, should then be applied by commencing at the posterior part of the external condyle of the femur, and descending across the front of the limb be tightly drawn beneath the lower fragment so as to keep it in firm juxtaposition with the upper, which is drawn down by the first strip, this second strip being made to ascend on the inner side of the joint along the inner condyle to a point opposite that from which it started. A sufficient number of strips being thus applied, each covering one-half of the preceding strip, until the whole joint is covered, the fragments will be held accurately in position, when the roller should be continued up the limb to the groin, and the dressing completed by means of a splint, or the single inclined plane if it be deemed essential.

This dressing may be retained for a week, when it should be taken off and reapplied, the fragments being carefully held in position by an assistant during the change, and may be continued for five or six weeks, by which time passive motion or flexion of the joint may cautiously be made. In the Pennsylvania Hospital, of Philadelphia, it has been frequently applied to simple fracture with satisfactory results—attention having been recalled to it by Dr. John Neill.

Another dressing is by means of the uniting bandage of *Gerdy*. In this dressing two strips of muslin about two and a half inches wide are prepared by making three slits in one and tearing the end of the other into three tails; then the ordinary spiral bandage being applied to the leg and thigh, but without covering in the knee, the first piece of muslin is to be laid so that the slits will correspond with the edge of the lower fragment, when it should be bound upon the leg by the circular turns of a roller applied below the knee. The piece with the tails being then laid upon the front of the thigh should be fastened in like manner above the upper fragment by the spiral turns of a roller, which commences above the knee and extends to the groin. Two compresses being then placed, one below the lower fragment, and one above the upper, the tails should be passed through the slits, and the two fragments be closely approximated. After which the whole limb should be bandaged with a second spiral roller, the object of which is to fasten the strips and retain the uniting bandage in its position.

The after-treatment and general directions of this dressing are the same as those stated in connection with the others.

A neat and convenient apparatus is now made by the cutlers for the after-treatment of these cases. It consists of a piece of padded leather, which buckles round the limb above and below the fragments, and the two parts being approximated by means of straps, the fragments are held accurately adjusted. Such a dressing is very neat, well suited to the better class of patients, and particularly adapted to those persons who are obliged to travel after a fracture of the patella before the bond of union is sufficiently firm to justify the omission of all dressings.

SECTION III.

FRACTURES OF THE BONES OF THE LEG.

The bones of the leg may be broken at any part of their length, the accident being sufficiently common. A fracture high up through the tubercle of the tibia sometimes occurs, and is very troublesome, not only because it is liable to involve the knee-joint, but also because it is apt to be followed by gangrene of the integuments, the latter being due to injury of the branches of the tibial artery. When both bones of the leg are broken, it rarely happens that the fracture occurs at the same point in both; thus, if a fracture of the tibia has occurred at the junction of the middle and lower third of the bone, the fracture of the fibula accompanying it will be apt to happen at the junction of the middle and upper third of the bone, and *vice versa*. Still it sometimes occurs, as when a person has been run over by a wagon or railroad car, that both bones are broken in the same line.

Fractures of the bones of the leg may be transverse or oblique, simple, compound, or comminuted.

Displacement.—Various deformities result from these fractures, which differ in accordance with the character of the force producing the injury, and with the point at which the fracture occurs. Perhaps the most common deformity is a disposition in the upper part of the lower fragment to project forwards (see Fig. 155), the gastrocnemius and soleus muscles which are inserted into the os calcis contracting so as to approximate the heel to the back of the thigh, in consequence of which the foot is pulled backward, and the upper end of the lower fragment thrown forward. Shortening, when it exists, is generally due to the action of the extensor mus-

cles; it is, however, seldom marked in these fractures, on account of the insertion of the interosseus ligament. The angular deformity, it should be remembered, is more marked when the fracture is transverse than when it is oblique; but in an oblique fracture, although the deformity is not so great, there is risk of the fragments wounding the anterior or posterior tibial artery. Sometimes, when great force has been used, the fragments become impacted, or may be driven through the skin so as to cause a compound fracture. There is still another displacement, which must be guarded against in the treatment of fracture of both bones of the leg, and that is a displacement in the circumference of the limb, as shown by a rotation of the foot causing the toes to turn inwards or outwards, though most frequently the latter. In fracture of either the tibia or fibula alone, there is generally little or no displacement, the unbroken bone acting as a splint to support the injured one, so that there can be no shortening of the limb.

Treatment.—The means by which the indications which should be fulfilled in fractures of these bones are to be carried out are various. In hospital practice, and in the army and navy, where the patient can be controlled, perhaps the best means of treating them is by the fracture-box (see Fig. 157), but it is a mode of treatment against which patients in the better ranks of life will often rebel. It is also often complained of in consequence of the pressure of the point of the heel against the bottom of the box, causing pain and ulceration, even when the heel is well supported by a pillow, this point of the foot being usually very intolerant of pressure.

The fracture-box is made by cutting a piece of board, a little wider than the limb, of such a length that it will reach from the sole of the foot to the knee; a foot-board should be attached to its inferior extremity at right angles—not obliquely, as is sometimes

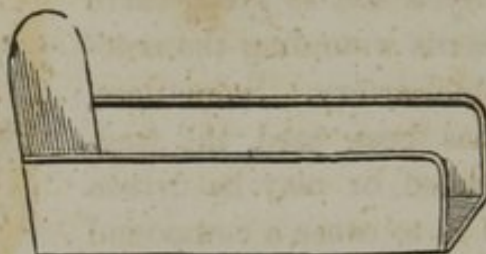
Fig. 155.



A side view of the angular deformity of the tibia, often seen after fractures of the leg, showing the action of the gastrocnemius and soleus muscles. The drawing also shows the action of the quadriceps femoris muscle in producing a separation of the fragments in a fracture of the patella. (After Hines.)

done—as this elevates the heel and consequently does not allow of the accurate reduction of the displacement, the box being then completed by two side pieces which are fastened on to the bottom by hinges.

Fig. 156.



A representation of the Fracture-Box for the treatment of fractures of one or both bones of the leg. (After Nature.)

In applying this apparatus two strips of bandage of sufficient length should be laid down transversely to the length of the limb, on which the box is to be placed and a pillow laid in the box. The limb being then laid upon the pillow and a proper degree of extension and counter-extension made by the hands of the surgeon, the foot should be fastened to the footboard by the simple turn of a roller, the sides of the box being closed upon the pillow and then tied so as to make lateral pressure on the limb. If the inflammatory action of the soft parts

Fig. 157.



runs high, leeches, cold cloths, or cloths wrung out of lead-water, &c., can conveniently be applied without removing the dressings, though in this case the pillow must be covered with a piece of oiled silk, in order to protect it. This treatment may be continued during the first eight or ten days after the accident, after which it becomes necessary to pay special attention to the situation of the limb with reference to the deformity. Lymph is now beginning to be effused, granulations to form, and organization to take place around the

seat of fracture, and it becomes therefore a matter of importance that the union should be accomplished in such a manner as will give the patient a limb that will correspond in shape with that upon the other side of his body, and thus enable him to walk with as much facility after as he did before the accident.

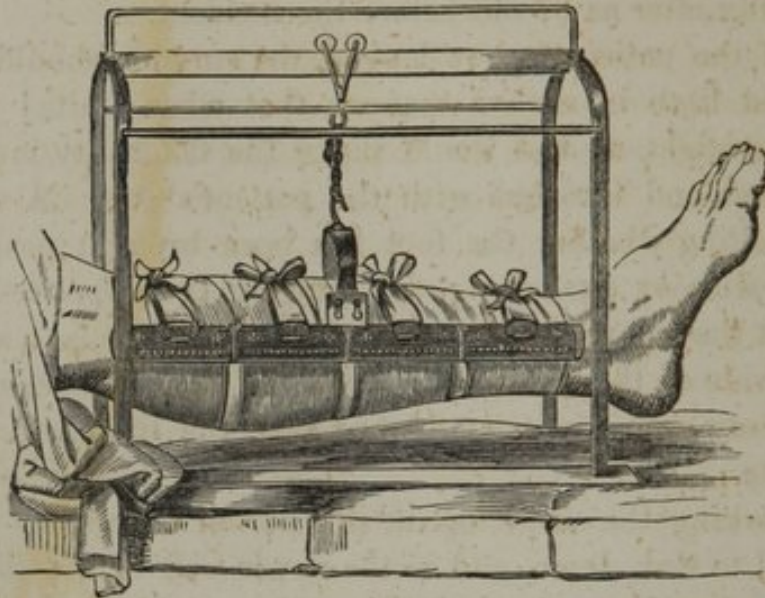
Thus, if the patient is bow-legged, the surgeon should not treat the injured limb in such a manner that when united it will be perfectly straight, as this would make the deformity in the other leg apparent and interfere with the patient's gait. A very good rule for telling whether the foot has been brought properly into line, even without examining the limb on the opposite side, is to notice that the inner side of the ball of the great toe is in a line with the inner side of the head of the tibia. If this is the case, the surgeon can say with great confidence that the limb will be in its normal line.

If in making the dressings at this period a tendency is noticed in the heel to sink down, and in the upper end of the lower fragment to project forwards, as in Fig. 155, a pad of cotton, or some similar substance, should be placed under the heel, but beneath the pillow, to prevent it. If the toes have a tendency to fall inward, it may be counteracted by tying a piece of bandage around them, drawing them outwards as much as necessary, and fastening the strip with a pin to the side of the pillow.

Although the fracture-box is a good dressing for the treatment of fracture of the leg, when the patient is entirely under the surgeon's control, as in the instances above alluded to, yet its usefulness will be found to be very much impaired when it comes to be applied to the limbs of those in the better condition of society. These individuals, being more or less accustomed to independence of action, often fail to give to the commands of the surgeon that prompt obedience which can be exacted in the wards of a hospital, but have their heads propped up with pillows until they commence to slip down, owing to their being thus placed, as it were, on an inclined plane. As the weight of the fracture-box retains the foot in position, the upper fragment is therefore pushed past the lower, and shortening is thus induced. Or, if the pressure of the apparatus proves uncomfortable, and produces pain, the whole will be loosened by a friend, and tied up again in such a manner that its utility is destroyed. For this class of patients, therefore, another mode of

dressing becomes desirable, and resort may be had to the beautiful apparatus of Salter, of England.

Fig. 158.



A view of Salter's apparatus for the treatment of fracture of both bones of the leg. The limb being bandaged and a carved or tin splint applied beneath the calf, it should be placed in the sling, which, being attached to a little wheel which runs on the centre bar in the top of the frame, the sling moves with the motion of the patient; the latter being able to move the limb up and down with the motion of his body without deranging the fragments. (After Fergusson.)

Salter's apparatus consists of a tin splint hollowed out at its inferior extremity, to receive the heel without making pressure upon it. This splint reposes in a sling, attached to wheels which play up and down the centre-piece of an iron cradle, somewhat similar to that sometimes used to prevent the weight of the bed-clothes from pressing upon the toes, and enables the patient to sit up or lie down in bed without displacing the fragments, as there is no point of resistance connected with the foot so as to create shortening. The heel also is not pressed on, and the patient is thus saved a great source of annoyance. The lightness of the bandage which surrounds the limb will usually be well borne by patients in good circumstances, as in the accidents of the better classes of society we have seldom those extensive and terrible injuries to the soft parts which are met with among the laboring classes. A laboring man has his leg broken by being crushed under a gravel bank, whilst the gentleman breaks his by slipping and falling down upon the ice; and it is to such injuries as the latter, that is, injuries un-

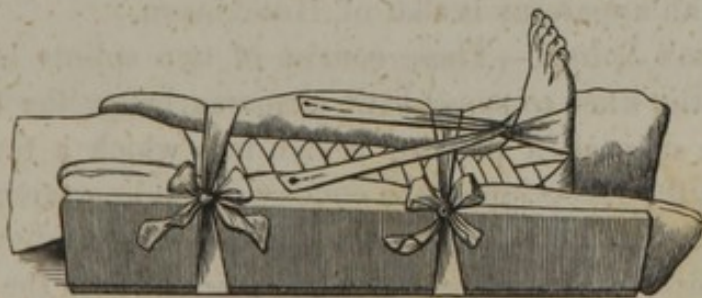
accompanied by severe contusion or laceration of the soft parts, that Salter's apparatus is particularly applicable.

But in the treatment of contused cases, the limb should be simply laid upon a pillow for the first few days and supported by light turns of a roller, the foot being steadied by a band fastened to the pillow. When inflammation has subsided, extension and counter-extension to the requisite degree may be made, the spiral of the lower extremity loosely applied, the tin splint padded and laid upon the back of the limb, and then retained by a bandage, when it may be laid in the sling of Salter's apparatus, the patient being no longer obliged to confine himself to one position. He may therefore move about in bed to a reasonable degree, or even sit up, the sling sliding along on its rollers, and adapting the position of the limb to the motion of the body, so that no danger of displacement is incurred. Salter's apparatus is, therefore, a neat and convenient dressing for such cases, being very useful where expense is not an object, being highly lauded for its comfort by those to whom I have applied it. Where, however, it cannot be obtained, and some simpler dressing is desirable, its place may easily be supplied by a ruder contrivance of wood.

Another very excellent mode of treatment is by means of the old dressing of Boyer.

It is applied as follows: Three strips of bandage are laid down transversely to the course of the limb, precisely as the two strips were laid down in the dressing with the fracture-box. Upon these

Fig. 159.



should be laid a splint cloth of appropriate dimensions, say half a yard by a yard; on the splint cloth a pillow, and upon the pillow an 18-tailed bandage; by which is meant a bandage of strips formed upon precisely the same principles as the bandage of Scultet, but each piece, as it is laid down, being sewed fast to a longi-

tudinal strip, in order to give greater strength to the bandage. A proper degree of extension and counter-extension being made, the 18 tailed bandage should be firmly applied and fastened by a pin. The splints should then be taken of such a length as to reach from the knee to a few inches below the foot, and be rolled in the splint cloth so as to make firm pressure on each side against the pillow, and through that against the limb; after which, the three strips of bandage should be firmly tied to hold it in that position. (Fig. 159.) The dressing is then completed by tying another strip of bandage in a loop about the toes, and fastening it so as to prevent inversion or eversion of the foot, and by placing a cradle properly made for the purpose, or two hoops tied crosswise over the limb, to prevent the pressure of the bedclothes. This dressing is preferable to the ordinary fracture-box, because, when the patient slips down in bed, the apparatus which is attached to his leg slips before him, and the upper fragment does not ride past the lower, as was shown to occur sometimes in the case of the fracture-box, which is only preferable, as above detailed, in hospitals, in the army and navy, and under circumstances generally where the patient can be completely controlled.

It sometimes happens that the force which produces the fracture drives the fragments into each other, or into the soft parts, so as to wound and irritate the muscles, produce spasm, and not only create shortening, but reproduce it after it has been reduced. Under such circumstances an apparatus will be required by means of which a suitable degree of extension and counter-extension can be kept up, though this is not generally required in injuries of the leg. Such an apparatus is that of Hutchinson.

Hutchinson's Splints.—These consist of two splints long enough to go from the knee to some little distance below the foot. Near the bottom of each a mortise is cut, into which a tenon can be inserted for the reception of the counter-extending tape; this tenon being drilled with holes, so that the distance of the splints apart can be regulated by means of pegs of wood inserted into the holes. At the top of each splint four perforations are made at equal distances so as to form the corners of a square. (Fig. 161.) In applying this apparatus, Barton's handkerchief (see Fig. 160) may be employed as a means of making extension. This handkerchief is to be applied as follows: A good soft handkerchief being folded into a cravat, its body should be laid against the point of the heel of the injured limb in such a manner that two-thirds of the handkerchief

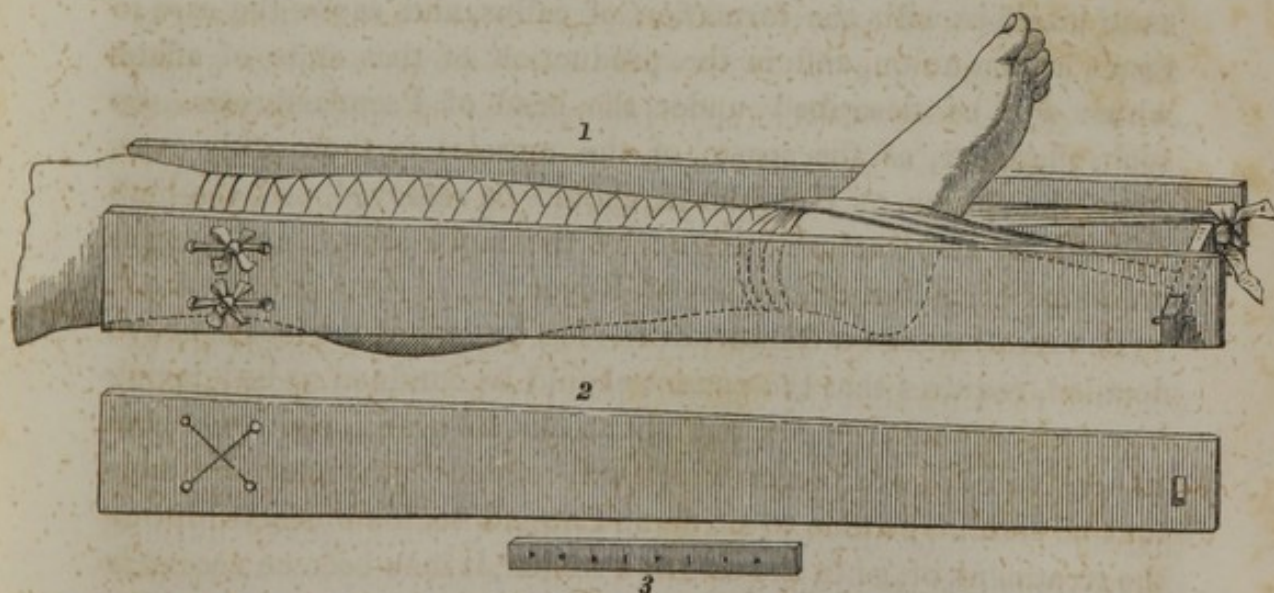
may be on one side of the heel and one-third on the other, after which the longest side should be carried round across the instep to the opposite side, where it is to take a turn around the other extremity of the handkerchief, which is then carried under the sole

Fig. 160.



of the foot to be turned around the first turn, and form a knot at the opposite side of the foot from the first; both ends of the handkerchief being then carried off perpendicularly from the limb, and extension made by fastening them to the tenon at the foot of the apparatus. The counter-extension is made by means of four tapes, applied two on the inside and two on the outside of the limb, these tapes being laid lengthwise upon the limb, and fastened in position

Fig. 161.



HUTCHINSON'S SPLINTS.—1. The splints applied to the leg as covered by Scultet's bandage, the tapes being fastened by circular turns below the knee, and then tied through the holes at the upper end of the splint.—2. The splint.—3. The tenon for the extending band. (After Dorsey.)

by circular turns of a bandage. Previous to the application of this part of the dressing, however, the limb should be covered by

the bandage of Scultet, or some similar means to prevent the swelling which would otherwise ensue from the constriction of its vessels by the circular turns of the bandage that secures the tapes. The tapes being now passed through the holes in the upper extremity of the splints and securely tied, counter-extension will thus be kept up while extension is made by means of the handkerchief around the foot. As a precautionary measure the splints may be padded to any necessary degree before they are applied, by means of cotton and a bandage in the manner described in connection with fractures of the forearm.

After this dressing has been applied for three, four, or five days, it will generally be found that the spasm of the muscles has been overcome, so that there is no longer any occasion to maintain so powerful a degree of extension and counter-extension as is secured by these splints, and if the patient begins to suffer from the pressure of the extending and counter-extending bands, the apparatus may now be laid aside. But there is a much graver reason for laying it aside, and that is that the constriction of the limb necessary to secure the counter-extending tapes, interferes with the circulation. The fragments are therefore not as freely supplied with blood as in the other dressings, and this diminution in the quantity of the supply of nutritive material may become so serious as to interfere with the formation of callus, and cause the case to result in non-union, and in the production of that state of affairs which will be described under the head of Pseudarthrosis. So soon, therefore, as the spasm of the muscles is thoroughly overcome, the splints of Hutchinson should be removed, and the limb dressed by the fracture-box, or by the more secure and elegant dressings of Salter, or by that of Boyer.

The treatment of a fracture of the leg by any of the means above detailed, requires that the patient should be confined to bed during a period varying from six to eight weeks, or even longer. Circumstances will however occur which will render it extremely desirable that he should be able to sit up and attend to his business during the treatment, or, as in the case of a soldier, it may become necessary for him to be removed to a considerable distance a few days after the accident. Under such circumstances, resort may be had to some immovable apparatus, such as the starch bandage, or the dressing of Laugier, which is composed of brown paper and glue.

The Starch bandage has been repeatedly applied by me with advantage, having used it first as early as 1838,¹ upon a lawyer of Philadelphia, to whom it was applied with great benefit, permitting him to return to his office duties within two weeks after the occurrence of the injury. This, and some other patients to whom I applied it, were the first cases thus treated in the United States.

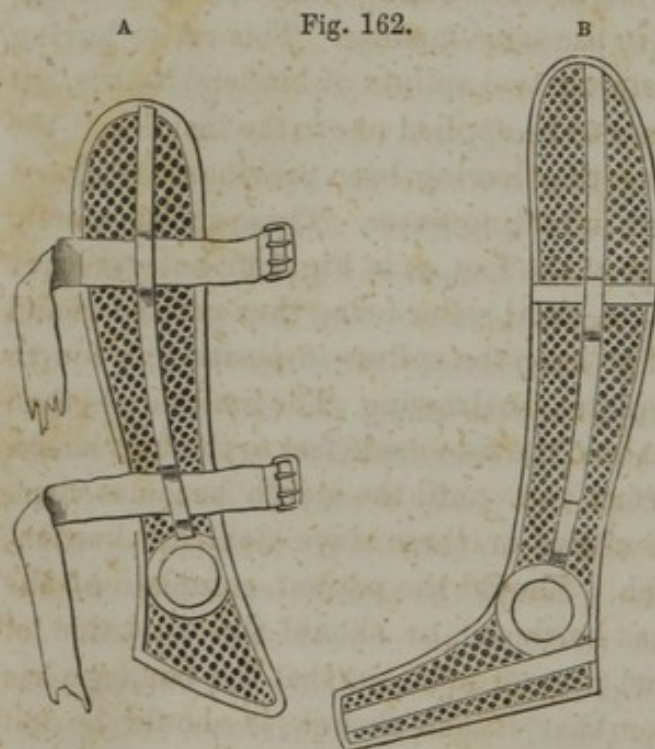
The starch bandage, though an excellent dressing, should not, however, be resorted to, in the treatment of even simple fractures of the leg, until all active inflammation has subsided; that is to say, not until the third or fourth day of the treatment at the very earliest, and seldom before the tenth. In its application, a washed roller should be placed upon the limb, so as to cover in the foot and leg and extend as high as the knee, *leaving the heel and toes exposed* so as to enable the surgeon to judge of the state of the circulation in the limb. If this precaution be not observed, serious injury may ensue. The roller thus applied is then to be well smeared on its outer side with ordinary starch, or dextrine if it can be obtained, and a second washed roller applied over the first in the same manner. This roller having also been well coated with starch, two splints of binders' boards, cut to suit the size of the limb, are to be applied one to the inside and the other to the outside of the leg, they having been previously rendered flexible by being well soaked in boiling water. These splints should be cut so as to cover the sides of the foot, as in Fig. 165, but yet leave the heel and toes exposed. A third roller being then carried round the limb, and well starched to keep the splints in position; a fourth applied over the whole, completes the dressing. The limb should then be laid in an empty fracture-box, the foot made fast to the foot-board, and the whole kept at perfect rest until the starch becomes firm, which it does in the course of two or three days, dextrine hardening more readily than starch. Should the patient complain of the above apparatus after it has hardened, or should the condition of the skin of the toes and heel present evidence that the bandage has been too tightly applied, or that it has shrunk, it should be slit down in front with a pair of scissors to relieve the constriction, and another starched bandage applied over the whole to secure it at the proper point, and prevent it from becoming too loose. On the other hand, should shrinking of the muscles, or a diminution of the swelling leave the bandage too loose, as will not unfre-

¹ See Phila. Med. Examiner, vol. ii., 1838.

quently be the case, another well starched bandage may be applied over the whole to make the requisite degree of compression.

Another immovable apparatus, which, with the same precautions as the above, may be used in similar cases, is the apparatus of Laugier. Having applied the French spiral of the lower extremities as described in connection with the starched bandage, coat it well with common glue; and cutting a number of strips of coarse brown paper of the proper length, apply them regularly up the limb like the bandage of Scultet. This being done, coat them also with glue, and apply another set in the same manner; repeating this operation four times, till the limb is securely supported by a coating of intermingled paper and glue, which when dry will make a solid splint and answer the same indications as the starch bandage.

Various other dressings have been suggested to enable the patient to leave his bed by the second or third week of his confinement. One is the splint known as the perforated splint, which is made



VIEW OF THE PERFORATED TIN SPLINT.—A, the inner splint, being a little shorter in the foot, the two fastening together by means of straps. B is the splint for the outside of the left leg. (After Nature.)

of tin or flexible metal, perforated so as to render it light. This having been moulded to fit the limb (see Fig. 162), is fastened in place by means of straps and buckles. Two of these splints are required, one (A, Fig. 162) having a continuation along the side of the foot to keep the ankle-joint at rest, and both having orifices corresponding in position with the malleoli. Before putting them on, the bandage of Scultet should be applied, and wadding interposed at points between the splint

and the limb if it chafes anywhere.

Another apparatus for fractures of the leg consists of two similarly shaped wooden splints, one carved to fit the shape of the foot, and the other extending merely from the knee to the malleolus,

which answers the same purpose as the perforated splint, though not so well adapted to warm weather. It should, however, be borne in mind that neither of these splints is intended for the earlier stages of the treatment, but for a later period when a certain amount of consolidation has already taken place, or when the first inflammatory action has been overcome, and callus begun to form.

Splints or frames made of wire to fit the leg, as well as the other limbs, have also been recommended by Mr. Mayor, of Lausanne,¹ whilst "wove wire" has recently been advised for the same purpose by Dr. Nott, of Mobile.

A very admirable splint, although one adapted like the perforated and carved splint rather for the latter than for the early stages of the treatment, is made of the ordinary felt from the hat-makers. A sheet of this article may be cut into a shape approximating that of the limb, and having been soaked in boiling water till rendered perfectly flexible, and cooled sufficiently to avoid vesicating the cuticle, applied to the limb, carefully moulded to suit all inequalities, and held in position by means of a roller. After having been allowed to harden, it may be taken off, coated three or four times with copal varnish, which will give it a firmness almost equal to that of the carved wooden splint, and then being carefully padded with cotton wadding, may be reapplied.

Fig. 163.



§ 1.—FRACTURE OF THE FIBULA.

The Fibula, like the Tibia, may be broken at any point of its length.

The symptoms of this fracture in the upper part of the bone are so readily recognizable, and the treatment is so similar to that laid

¹ Bandages et Appareils, par Mathias Mayer. Paris, 1838.

down in connection with fracture of both bones, that further reference may be omitted. But a fracture of this bone which deserves attention from the fact that it demands a special treatment, and presents a train of symptoms of a peculiar character, is that seated in the lower fifth of the bone, or within two inches of the external malleolus.

Functions of the Malleoli.—The chief resistance to a lateral dislocation of the ankle-joint during flexion and extension of the foot is the two malleoli, and the external and internal lateral ligaments of the ankle which are attached to them. It will, therefore, be perceived that if, from any cause, there is a solution of continuity in the fibres of the fibula, the functions of the external malleolus will be destroyed, and nothing can prevent a violent eversion, or even dislocation outwards of the foot, and the production of such a strain upon the internal lateral ligament as may rupture it entire, or break at least a part of it. Or the force thus brought to play through the ligaments upon the bone may rupture the fibres of the latter, and split off the internal malleolus from the tibia, so that both malleoli may be simultaneously fractured, a condition of which there are numerous specimens.

It will be easily conceived that the inflammation accompanying such an injury, attended as it very frequently is by laceration of the capsular ligament and of the synovial membrane lining the joint, may result in effusion into the articular cavity, and thus create more or less perfect ankylosis, thus interfering with the patient's motions, and producing a well-marked and inconvenient deformity.

Etiology.—The causes exciting this injury are often apparently slight; thus, a patient walking hastily, treads upon a stone, or upon uneven ground, and turns his foot, or falls from a moderate height upon an irregular surface, turning the foot and bringing such a force to bear upon the external malleolus as produces the fracture.

Symptoms.—When the fracture occurs, great pain is experienced in the articulation, particularly when the foot is flexed or extended, but crepitation cannot readily be perceived in the majority of cases, because the firm character of the ligaments which bind the fibula to the tibia prevents that ready play of the fragments upon each other which would be likely to produce it. That a fracture exists, however, may, in the majority of instances, be ascertained by a simple manipulation; thus, pass the fingers carefully along the line of the fibula on the outside of the limb—in most patients it can readily be traced—and when the seat of fracture is reached, not only will

the patient complain of pain, but the bone may be felt to give way under the finger.

Diagnosis.—The diagnosis, however, is sometimes a point of considerable difficulty, and requires patience and attention in order to prevent mistakes. A surgeon, for example, may be called to attend a patient who has stepped suddenly off a curbstone, and struck the sole of the foot upon some inequality in the ground, as a pebble or some similar substance, and find him unable to walk, and complaining of a great deal of pain in the joint, which is increased by flexion and extension of the foot. The ankle being also much swollen, especially laterally and anteriorly, the injury may readily be mistaken for a sprain or for a rupture of some of the fibres of the internal or external lateral ligaments; but knowing the probability under the circumstances of a fracture of the lower fifth of the fibula, he at once proceeds to a more minute examination with special reference to this injury, and finds that the function of the external malleolus is destroyed, that the foot can readily be made to fall preternaturally outward, and then passing his fingers carefully along the line of the fibula as above directed, feels the bones give way, and thus recognizes the existence of the fracture.

There is, however, in some cases, considerable and characteristic deformity; the upper end of the lower fragment being thrown into the interosseous space, leaving, as a general rule, the lower end of the upper fragment very nearly in position. If this deformity is not produced by the force which caused the fracture, it will often occur a short time afterwards as the result of the contraction of the peronei muscles, whose tendons pass immediately behind the external malleolus. As a consequence of these changes, the foot falls outwards, or may even be partially dislocated laterally, producing changes in the appearance of the limb which are quite characteristic.

Prognosis.—The prognosis will generally be favorable if the surgeon recognizes the injury and treats it properly.

Treatment.—In the treatment the first step is to guard against inflammatory action. The limb should therefore be laid on a pillow in a fracture-box and leeches freely applied; cloths wrung out of warm water, or the cold water dressing if preferred, lead-water, and other antiphlogistic measures being resorted to; and it is not until the third or fourth day, when inflammatory action has much abated, that the surgeon should proceed to set the fracture. This may be done simply by coaptation, and turning the toes inward, more so,

indeed, than in their normal position, they being then held by means of a roller attached to the end of the box.

After four or four and a half weeks the limb may then be taken out of the box, and some supporting splint applied, as the carved splint, the perforated, or the felt splint (Fig. 163), the patient being allowed to sit up or to walk about his room with a crutch. In about five weeks passive motion should be commenced by the surgeon, to guard against ankylosis, and the limb be gradually brought into use. It will often, however, be seven weeks before a patient can walk upon it without the use of a cane. There is, moreover, a class of fractures of the fibula at this point which are not so simple as those above laid down; in which, owing to the fact that greater force has been employed in the creation of the injury, the deviation of the foot outwards is more marked, and in which, therefore, a more decided force is necessary to draw the foot inwards to its proper line and keep it in position. It is in such cases that the dressing known as *Dupuytren's splint* for fractures of the lower part of the fibula is particularly applicable. This apparatus consists of a long wedge-shaped pad, Fig. 164, long enough to go from the knee to the internal malleolus, and of a splint long enough to go from the knee to some three or four inches below the foot. The pad being applied with its thick end downwards on the inner side of the limb, the splint is to be laid upon the pad, so that, by means of this apparatus, and of the turns of a roller, the foot may be drawn much more powerfully inwards than with the fracture-box, as above described; the thick end of the pad acting as a fulcrum, while the roller around the foot supplies the power.

In applying this roller, the rule is precisely the reverse of that ordinarily obeyed in applying a roller to the lower extremities. Instead of beginning below and going upwards, this roller begins above and comes downward. The initial extremity of it is therefore to be laid upon the limb just below the knee, and two or three circular turns made to fix it; then, with spiral turns—reverses being seldom desirable or necessary—the bandage should be made to descend towards the foot with moderately firm turns. When the seat of fracture is reached, it should be left uncovered, so as not to cause the fragments to encroach upon the interosseous space, and thus counteract the very purpose for which the apparatus was intended, and when the foot is reached the turns of the bandage should be more firmly applied, in order to draw it forcibly in-

wards. By means of this dressing, the tendency of the peronei muscles to draw the foot outwards is completely overcome.

Still, there are objections to this dressing of Dupuytren. The firm pressure made upon the internal malleolus is not well borne, ulceration and sloughing may result if it be too long persevered in, and the patient, moreover, generally complains so much of it, that it is often necessary to take it off, rub the parts with liniment and reapply it, or abandon it altogether within twenty-four hours after

Fig. 164.



A side of Dupuytren's Pad and Splint for the treatment of fracture of the lower fifth of the fibula as applied to the right limb. (After Nature.)

its first application. Fortunately, however, even twenty-four hours' use of the apparatus is generally sufficient to overcome the great tendency to eversion of the foot for which it was required, and the dressing, with the fracture-box given above, will afterwards be sufficient.

SECTION IV.

FRACTURES OF THE TARSUS.

The bones of the tarsus are sometimes the seat of fracture, and any of them may be broken. Generally, however, the force producing the injury is so great as to create extensive laceration of the soft parts, and the fracture is therefore usually a compound one. Still, simple fractures of the bones of the tarsus sometimes occur: thus the *Astragalus* is occasionally broken by falls upon the foot, the force being transmitted from the os calcis to it, and meeting with the resistance offered by the articulating surface of the tibia, it gives way, thus increasing the apparent width of the joint, and lacerating the articular cartilage and the synovial membrane. The results of such an injury are apt to be synovitis, effusion of lymph, and partial or complete ankylosis.

The injury can generally be recognized by the tendency to displacement when the foot is flexed or extended, and but little can be done towards repairing the mischief by setting the fragments. The treatment will, therefore, rather consist in the employment of leeches and antiphlogistic measures to combat the inflammation, than in the means calculated to keep the fragments in position.

Fracture of the Os Calcis.—The os calcis is occasionally the seat of fracture, generally the result of falls in which the feet of the patient strike the ground. The most frequent point at which the fracture occurs is through the posterior third of the bone, at some point intermediate between the articulation with the astragalus and the insertion of the tendo-Achillis. When such a fracture takes place the deformity which ensues is marked and easily recognizable, the contraction of the gastrocnemius and soleus muscles acting through the tendo-Achillis inserted into the fragment, causing it to be drawn up to a position posterior to the articulation of the tibia with the astragalus.

Symptoms.—The symptoms will be pain, swelling, and all the ordinary symptoms of fracture elsewhere; besides which there will be loss of motion in the foot, destruction of the natural prominence of the tendo-Achillis, and the deformity consequent upon the elevation of the fragment which has been described.

Treatment.—In the treatment it will be necessary to extend the foot upon the leg as much as possible, and to apply force in such a manner as to overcome the resistance of the gastrocnemius and soleus muscles, so as to bring the fragment down into position. The dressings by which these indications can be carried out are varied; perhaps the best, however, is that suggested by *Boyer*. A

Fig. 165.



A side view of Boyer's Dressing for Fracture of the Os Calcis, the splint on the top of the foot and leg keeping the foot extended, and thus approximating the body of the os calcis to the fragment which is drawn up by the action of the muscles of the calf. (After Nature.)

wad of lint, charpie, or raw cotton, being laid over the toes to protect them from the pressure, a strip of broad bandage or of muslin is carried from the instep down over the toes, up along the sole of the foot and back of the leg, and retained in position by an assistant.

The upper fragment of the bone being then drawn down and held in position as well as possible, two or three circular turns should be made around the ankle with a view of fixing the bandage, which is then to be carried over the front of the instep to the toes, and made to ascend the foot by the ordinary spiral turns. When the heel is reached a number of figure of 8 turns should be made to retain the fragment in position, and as soon as it is sufficiently secure the roller may ascend the leg as in the ordinary spiral reversed bandage of the lower extremity. This latter part of the bandage not only serves to fix more securely the muslin strip which was carried down over the toes, but by compressing the muscles on the back of the leg diminishes the probability of their contracting in such a manner as to reproduce the displacement of the upper fragment. The dressing is completed by placing a straight splint well padded along the front of the limb, and retaining it in place by means of a roller so as to keep the foot firmly in the extended position in which it was placed. (Fig. 165.)

It will be observed in this connection that the principles carried out in the treatment above described, are precisely the same as those laid down in connection with fractures of the olecranon process of the ulna and fractures of the patella. In both these cases, as well as in fracture of the calcis, the figure of 8 turns, or some modification of them, are required to draw the fragments down into position; in all, compression is required to counteract the action of those muscles whose contraction would produce separation of the fragments and reproduction of the deformity, and in all the use of a splint or some substitute is necessary to give greater firmness to the dressings.

After this dressing has remained upon the limb for two or three days, it should be removed, and the fragments carefully held in position while the limb is rubbed with soap liniment to obviate any evil effects from compression or from obstruction of the capillaries, after which the whole dressing may be reapplied as before. After six weeks this apparatus may be laid aside, and a simple and lighter dressing substituted, which may consist in a slipper such as that used for a side-saddle, or an ordinary slipper cut down so as to resemble it (see Fig. 169), which being put upon the toes, and a piece of bandage fastened to it and brought up over the heel, the band should be attached to a handkerchief made fast around the calf, so as to keep the foot in position. In a week or two more, passive motion

may be practised, and the limb cautiously and gradually brought into use.

Fractures of the other bones of the *tarsus* or of the *metatarsus* and *phalanges* sometimes occur; and are generally due to some

Fig. 166.



A view of the Apparatus applicable to the treatment of Fracture of the *Os Calcis*, as well as to Rupture of the Fibres of the *Gastrocnemius* Muscle. (After Miller.)

great violence of a crushing character, as the passage of a wagon-wheel or railroad car. In consequence of the character of the causes these fractures are, therefore, most generally of the compound class: tendons being torn and lacerated, ligaments ruptured, inflammation set up, and the patient fortunate should union occur with ankylosis. Besides which it should not be overlooked that the injury thus done to these bones often results in necrosis or caries, which gives trouble for many months, and not unfrequently necessitates amputation. All that can be done, therefore, in such cases, is to coaptate the parts as accurately as possible, to put the limb in a fracture box, and to combat inflammatory action by the use of the cold water dressing.

There is one point, however, in connection with fractures of the phalanges of the foot which demands attention. It will be seen by reference to the subject of the treatment of fractures of the

phalanges of the superior extremities, that it was recommended in that place to endeavor, when ankylosis between the phalanges seemed inevitable, to cause it to occur in a flexed position, so as to obtain the greatest amount of usefulness that circumstances would permit. Now the rule to be laid down with regard to the phalanges of the foot is precisely the reverse. Should ankylosis occur in this case in the flexed position, the prominent knuckle presented by the bent phalanx would soon, from the pressure of the boot or shoe when the patient began to walk about, become the seat of a painful corn; or ulceration would occur, and the toe become such a source of suffering and annoyance that more than one case has occurred in which the patient has submitted to amputation rather than endure

it any longer. To avoid this, the rule laid down in the case of fractures of the phalanges of the foot is, to endeavor to induce ankylosis in the *extended position*, by which all such inconveniences are avoided.

SECTION V.

COMPOUND FRACTURES.

A *compound fracture* is one in which there is a wound communicating with the ends of the fractured bones. This wound may be caused either by the force which originally produced the fracture, or by the sharp ends of the fragments themselves. The presence of the wound alone distinguishes it from simple fracture, and any bone which may be the point of simple, may therefore become the seat of a compound one. Thus, a patient may fall from a height and break his thigh; whilst the same force which produced the fracture may drive the sharp ends of the fragments through the skin, so as to cause them to protrude externally; a compound fracture being thus created. In such a case, in addition to the ordinary dangers of the fracture we must note those resulting from the wound of the soft parts, from the probable injury to great blood-vessels and nerves, and from the fact that the contact of atmospheric air with the fractured bone produces certain changes highly unfavorable to speedy union. These various inconveniences and dangers are to be combated upon those general principles which have been heretofore laid down.

To prevent the injurious effects of the contact of atmospheric air with the cavity of the wound, the parts should be closed as speedily as possible. If the muscles have spasmodically con-

Fig. 167.



View of a Compound and Comminuted Fracture of the Leg. (After Miller.)

tracted around the protruded fragments, the patient may be etherized, in order that the muscular relaxation thus induced may permit the fragments to be restored to their place. If this is not sufficient, the orifice through which the bone has protruded should then be judiciously enlarged by the surgeon; and if that fails to secure the desired object, the ends of the fragments may be sawed off, an operation from which the surgeon should not shrink, as nature will perform the same process, though more slowly, and with more danger to the patient, by exfoliation, if the parts are let alone.

Having reduced the fracture, and coaptated the fragments as well as possible, the entrance of the atmosphere may be prevented by means of the artificial scab of Sir Astley Cooper. This is simply a piece of lint well soaked in the albumen of an egg, and laid over the wound; it dries speedily, and effectually excludes the atmosphere.

An admirable dressing for compound fractures, especially of the leg, is the *bran dressing* of Dr. J. Rhea Barton, of Philadelphia. This excellent plan of treatment consists of a fracture box with fixed sides, at the superior extremity of which a piece of bandage is fastened with tacks to prevent the bran from escaping; a little bran being placed in the box so as to form a bed for the limb, which is laid upon it, and the fracture carefully coaptated, after which bran is poured into the box so as to cover the limb completely. No other dressing is required. The discharges from the wound are absorbed by the bran, and can be removed from day to day, the soiled bran being replaced with fresh. This dressing is very comfortable and easily obtained, and at the same time serves to exclude the atmosphere. It will be found very useful in hospitals, and especially where there is a tendency towards the production of erysipelas.

SECTION VI.

PSEUDARTHROSIS, OR UNUNITED FRACTURE.

When a fracture fails to unite, a condition results which is designated as pseudarthrosis, or false-joint, but which is better indicated by the appellation of *united fracture*.

Ununited fracture is the condition of parts found when the

natural process fails to accomplish union between the extremities of a broken bone.

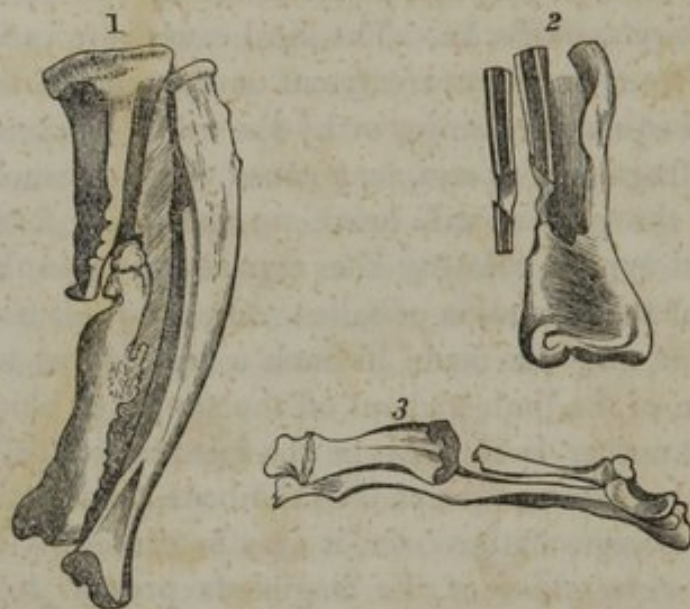
Etiology.—The causes of this condition may be classified as constitutional and local. Among the constitutional causes will be observed certain depraved conditions of the system, such as that found in scorbutus, in purpura, in certain low forms of fever, pregnancy, secondary syphilis, &c. The local causes are varied. Thus, it may result from improper treatment on the part of the surgeon, who, by too frequent dressings, or by the use of such means as do not keep the fragments at rest, may cause or allow such a degree of motion in the part as will break up the newly-formed vessels of the effused lymph, destroy the organizing granulations, and finally prevent the formation of callus. Or, the pressure of a bandage or a splint may be made in such a manner as to interrupt the circulation of the limb, and cut off the supply of blood from the fragments. Another cause may be the introduction of a fibre of muscle or tendon between the ends of the bone, these acting, in such situations, as foreign matter. Or, it may be caused by the manner in which the extremities of the fragments present towards each other; as when an external periosteal surface is presented to the internal periosteum, or two external periosteal surfaces are presented to each other. It will be understood, therefore, that the condition called false-joint, is simply that condition in which, from want of action, or from over-action, the lymph effused for the repair of a fracture is not sufficiently organized to result in osseous union.

Condition of the part.—Under these circumstances, the ends of the bones will be rounded off and covered by a dense fibrous or osseous strata, which is sometimes polished upon its surface, so as to resemble the articular cartilage of a true joint, although, in fact, no true cartilage or true synovial membrane exists. At the same time, from the irritation caused by the rubbing together of the fragments of bone, a quantity of watery lymph is sometimes effused, which, being changed by the absorption of its more liquid portions, finally simulates somewhat the synovia of a true joint. The inflammatory action set up in the surrounding tissues, moreover, not unfrequently develops an amount of thickening in the neighboring cellular substance which causes it to resemble a capsular ligament, and a condition of parts is thus created which is analogous to the appearances of a joint. At other times the bones are simply united by liga-

ment, or changed in their shape, and without any appearance of fibrous tissue. (Fig. 168.)

Treatment.—In accordance with the various views taken by different surgeons of the pathology of the complaint, different plans

Fig. 168.



A VIEW OF THE DIFFERENT CONDITIONS OF THE BONE IN UNUNITED FRACTURE.—1. Ununited fracture of the tibia, with increased thickness of the fibula, the ends of the fractured bones being coated with a compact layer and surrounded by some irregular callus. 2. Ununited fracture of the ulna, showing the ligamentous union between the ends of the fracture. 3. Ununited fracture of the radius, showing the great enlargement of one fragment and the wasting of the other. (After Hines.)

of treatment have been proposed, all having for their object the creation of such an amount of inflammatory action as would result in the effusion of lymph, in its organization, and in the final development of osseous matter. Thus where, from any circumstance, compact matter has been presented to compact matter, and false-joint has resulted from such a relation of parts, it has been recommended to cut down upon the seat of fracture, saw off the ends of the bone, bring the two fresh surfaces into contact, and then treat the case as one of compound fracture. The same practice has also been recommended in cases where ligamentous union has occurred, surgeons having cut down upon the ends of the bone, excised the new ligamentous matter, brought the fresh surfaces together, and then treated the case as one of compound fracture.

Where a certain amount of callus has been thrown out, but not enough to produce complete union, they have also sometimes tried

counter-irritants, near the seat of the injury, as blistering the limb, forming issues, &c., as was suggested by the late Dr. Hartshorne, of Philadelphia, with a view of stimulating the parts into completing the action they had begun. Yet another plan was that originally suggested and practised successfully, by Dr. Physick, of passing a seton between the ends of the bone, and retaining it there as long as was necessary to develop such an amount of inflammatory action as should result in the formation of callus. Another method is that of Dieffenbach, who drilled holes in the extremity of the bones, and, inserting little pegs of ivory, kept them there until such an amount of inflammatory action was developed as resulted in union. Dr. Brainard, of Chicago, has also proposed to drill a number of holes in the end of the bone with an awl, with the same view. But in order to make use of any of these modes of treatment, it becomes necessary that the patient should for a long time retain the recumbent position; whilst he is exposed to the risks of the creation of a compound fracture, in which suppuration may take place, and where the pus travelling up and down the limb in the intermuscular cellular substance, will establish a drain upon his vital energies, which may cost him his life. Or, if these dangers are escaped, erysipelas may be set up, and he will be exposed to all its evils. It has also happened more than once, that, after submitting to one of these painful operations and perilling his life, he has subsequently been obliged to submit to amputation.

With a view of avoiding these dangers, I some time since called the attention of the profession¹ to an apparatus, consisting of an artificial limb (Figs. 169, 170), which formed a complete casing for the affected member, and by means of which union was hastened, and a tolerable amount of usefulness at once obtained in any limb affected with false-joint.

These limbs, to act well, should be varied in their length and circumference, so as to fit accurately the part on which they are to be applied, the patient being carefully measured, whilst a moderate degree of extension and counter-extension is kept up in order that any subsequent shortening during the use of the apparatus may be guarded against.

In ununited fracture of the femur, the chief point of support in these limbs will be the conical shaped piece which surrounds the

¹ Am. Journ. Med. Sci., vol. xxix., N. S., p. 102, Jan. 1855.

thigh, and which also makes pressure at the seat of the false-joint, the weight of the body being also sustained by the belt which surrounds the pelvis and is united to the thin bars of steel which go down under the foot. (Fig. 169.) In order to protect the knee, the

Fig. 169.



Fig. 170.



Fig. 169.—A view of Smith's Apparatus for the treatment of ununited fracture in the femur of the right leg—the inside piece terminating in a little padded head, I, which rests against the perineum. (After Nature.)

Fig. 170.—A side view of the Apparatus for the treatment of ununited fracture in the bones of the leg. (After Nature.)

splint is guarded by a padded plate on the side of the joint, whilst a padded band surrounding the head of the tibia tends to distribute the weight of the patient, and strengthen the supports. The shoe should be made to lace all the way down the front, so as to facilitate the introduction of the foot. With such an apparatus, a patient even with an ununited fracture will be enabled to walk—after a little practice—almost as well as with a sound limb, and much better than he could do with an artificial one.

When the ununited fracture is in the leg, there is no occasion for

the pelvic band, the apparatus being made like Fig. 170, the support in this case being chiefly furnished by the conical-shaped leg piece which buckles around the calf and the seat of fracture, the band around the middle of the thigh being merely intended to add to the steadiness of the patient in walking.

In the treatment of false joint in the Humerus, the same principles are to be carried out by surrounding the arm at the seat of the disorder, as well as the forearm—with a similarly shaped splint, the two being united by means of a joint at the elbow.

By the use of these limbs, a patient laboring under false joint in the femur can walk about *immediately after their application*, if not as well as in a state of perfect health, yet at least better than he could do with an artificial limb after amputation. In the paper just alluded to it was also shown, that by the motion and friction created in the bones through the use of this apparatus, such inflammation had been developed in several cases, as caused a large amount of ensheathing callus to be thrown out, several obstinate cases having thus eventuated in perfect cures. Since this period, various others embracing all the bones of the extremities have been similarly benefited. An additional advantage of this plan is to be found in the fact that if it fail in accomplishing union in any case, it will yet be less dangerous than other modes which are not more certain, and also expose the patient to the risk of amputation. Not the least recommendation of these limbs is that by means of them the patient can obtain plenty of fresh air and exercise, these adjuvants being most important in the treatment of such cases.

In order to exhibit the results of such cases as have been already treated, I add the following list, as published in the Journal.¹

Case 1. Under the care of Dr. Wm. Waters, of Fredericktown, Md. False joint in both bones of the leg, of eighteen months' standing, cured in five months.

Case 2. False joint of both bones of the leg, of four months' standing, cured in nineteen weeks, by Dr. Waters, of Maryland.

Case 3. False joint in the femur, of five months' standing, cured in seventeen weeks, under my own care.

Case 4. False joint in the femur, of six months' standing, cured in nine weeks, under my own care.

¹ For a full account of these cases, see Am. Journ. Med. Sciences, vol. xxix., N. S., p. 117. Also, vol. xxi., N. S., 1851, p. 108.

Case 5. False joint in the femur, of twenty weeks' standing, cured in six weeks, under the care of Dr. R. J. Levis, of Philadelphia.

Case 6. False joint in the humerus, of six months' standing, under treatment, and at present relieved, by Dr. G. Dock, of Harrisburg.

Case 7. False joint in the humerus, under the care of Dr. C. W. Ashby, of Alexandria.

In addition to these, I had previously noted a case of false joint in the femur of a man of upwards of seventy years of age, which failed to unite, but which was made so firm by the apparatus that the patient walked only with the assistance of a cane. One case of false joint in the leg also failed, but though the bones did not unite, the patient is yet able to walk; and I have now from Mr. Rohrer, the cutler, reference to two other cases in the leg, cured by surgeons at a distance, who have failed to respond to my communication respecting them. We have, therefore, a total as follows:—

	Cases.	Cured.	Relieved.	Failed, but able to walk.
False joint in the femur . . .	4	3		1
“ “ “ leg bones . . .	8	7		1
“ “ “ humerus . . .	2		2	
Total . . .	14	10	2	2

Experience, up to this date,¹ has only tended to show me the perfect success in numerous instances in all sections of the United States, of this plan of treatment, and the impropriety of amputating limbs for a condition which can under most circumstances be thus remedied sufficiently to give the patient the use of his limb even if union does not ensue upon the application of the apparatus.

CHAPTER VI.

DISEASES OF THE CONTINUITY OF THE BONES.

THE important influence of the periosteum in the repair of fractures having been already alluded to, it is unnecessary now to recapitulate what was then said, in order to show that the bone chiefly owes its vitality to its connection with this membrane.

¹ July, 1856.

When the periosteum takes on diseased action, the result will be exhibited not only in the change of structure noticeable in the membrane itself, but also in that portion of the bone which it nourishes, whilst, as this membrane is a fibrous tissue, we can trace in its changes the general character of diseased action noted in the fibrous structures elsewhere.

SECTION I.

PERIOSTITIS.

Etiology.—Inflammation of the periosteum, or *periostitis*, is a sufficiently common disorder, which is due to the ordinary causes of inflammation, and is in its earliest stages very difficult to recognize. These causes may be local mechanical injuries, as blows and wounds, or the extension of ulcers, or it may result from constitutional disease, as rheumatism and gout, syphilis, tubercles, cancer, &c.

Seat.—Periostitis may occur in all the bones of the body, but is most common in such as are superficial, and therefore more directly exposed to local causes; such as the tibia, clavicle, femur, sternum, and cranial bones.

Result.—Periostitis, like all other inflammations, may terminate by resolution, or by effusions of lymph or pus, or in ulceration, mortification, or sloughing. It may also, like other inflammations, be either acute or chronic in its character. When examined at different periods, an inflamed periosteum will be found to offer at first all the usual appearances consequent on inflammatory action elsewhere, as increased vascularity or redness, and exquisite sensibility, whilst subsequently we can note such results of inflammation as create effusion and organization of lymph, or the formation of pus with ulceration and other degenerations of tissue.

Symptoms.—The existence of *acute periostitis* is first shown by pain in the course of the bone, this being generally increased on pressure. In its earlier stages, it is, however, difficult to distinguish periostitis from inflammation of the bone itself. After the development of pain, the part soon becomes swollen and hot, the swelling being circumscribed, firm, and resisting, seldom attaining any size, but softening slowly and suppurating, though it gives little evidence of fluctuation. As suppuration is developed, the pain

becomes more severe, owing to the effusions being circumscribed, and stretching the inflamed and closely-adherent membrane. Fever is, therefore, often present at this period, and accompanied with great restlessness, insomnia, and the other signs of sympathetic excitement. In *chronic periostitis*, the progress of the disorder is less rapid, the tendency of the inflammation being rather to an effusion and organization of lymph than to suppuration. Consequently, chronic periostitis more frequently results in thickening of the membrane and hypertrophy of the bone, than in abscesses.

Prognosis.—The result of periostitis is usually favorable if promptly and properly treated, but otherwise, it is very apt to be followed by such a diseased action in the proper bony tissue as may result in osteitis, caries, or necrosis.

Treatment.—The indications for the treatment of periostitis are the same as those required in other inflammations, the means being varied occasionally, in accordance with the peculiar action of the cause which produces it. In the acute variety, the ordinary local antiphlogistic measures will usually be demanded, as leeches, cups, the warm water dressing, with anodyne frictions, such as those made with aconite and lard in the form of ointment, or with the saturated tincture of aconite, belladonna, or opium. At the same time, free purging, combined with the moderate use of mercurials, will prove useful. When there is reason to think that pus has formed beneath the periosteum, this membrane should be incised by cutting directly down to the bone, so as to give free vent to the matter, and prevent its accumulation from elevating the membrane from the bone, and thus impairing the vitality of the latter. In these cases, the pain will also be promptly relieved by the incision permitting the expansion of the previously confined liquid effusions, and so great has been this relief, that Velpeau, Malgaigne, and others have advised that it should be made in all cases of acute periostitis at an early period, or before there is evidence of suppuration.

After the evacuation of the matter which has formed beneath the periosteum, the wound should be treated on the general principles already detailed in connection with abscesses.

In chronic periostitis, there is a marked tendency to an effusion of lymph, which, becoming organized, soon results in a permanent thickening of the part, which is designated as a *node*. It is also apt to result in hypertrophy of the bone, and thus serves as one of the exciting causes of certain bony tumors, as exostoses, osteophytes,

&c. In the early stages of chronic periostitis, the application of repeated blisters is sometimes exceedingly useful, anodynes being also required for the relief of pain. But, as the chief source of the trouble is the effusion of lymph, nothing serves so good a purpose as the use of mercurials both internally and externally, pushing them far enough to induce moderate ptyalism. This treatment, by destroying the plasticity of the effusion, will often check the progress of the disorder, and prevent the development of bony tumors, by bringing about a more healthy condition. The treatment of chronic periostitis, when the result of syphilitic disease, will be again alluded to in connection with syphilis.

SECTION II.

OSTITIS.

Ostitis, or inflammation of the proper structure of the bone, is a disorder which is generally found in the young or middle-aged, and in the long bones, especially the tibia. At its commencement it is difficult to recognize ostitis as a distinct disorder, and as it sometimes results in ulceration, it has not unfrequently been alluded to as identical with caries. But every inflammation of a bone does not result in ulceration, and there are therefore certain changes which can only be justly regarded as the effects of the inflammatory process as modified by the bony structures. Thus, inflammation of a bone by creating increased vascularity, may result in a deposit of osseous matter exterior to the true compact layer of the bone, so as to create spiculæ and great deformity as well as loss of motion in a joint (Fig. 171), or in hypertrophy of either its compact or cancellated tissue or both, rendering them more dilated, and expanding the lamellæ of the compact as well as the cancellated tissue, so as to produce a marked augmentation, either in a part or in the entire volume of the bone. (Fig. 172.) Or suppuration and a true abscess of the cancellated tissue may ensue (Fig. 173), and be followed by the ordinary results of abscesses elsewhere; but as the tissue which becomes distended under the influence of an abscess in a bone, is hard and unyielding, the sides of the cavity do not collapse when the pus is evacuated, as was the case in abscess of the soft tissues.

In examining by section, a bone which has been acutely inflamed,

there will generally be seen a certain amount of bloody serum in its cancellated tissue with a diminution of its natural hardness, the

Fig. 171.



Fig. 172.



Fig. 173.



Fig. 171.—Chronic Ostitis, marked changes in the exterior of the tibia and fibula. (After Liston.)

Fig. 172.—A view of the ordinary enlargement of both the compact and cancellated tissue of a Tibia as the result of ostitis. (After Liston.)

Fig. 173.—A representation of the condition of the Head of the Tibia after the formation of a chronic abscess, the bone being much thickened as well as enlarged around the cavity. (After Miller.)

structure being soft and somewhat pulpy, whilst after the development of an abscess, a circumscribed cavity surrounded by increased vascularity will often be found.

Etiology.—The causes of ostitis may be the extension of inflammation from the periosteum, or the direct application of irritants, as blows, caustics, &c., or it may ensue upon the deposition of tuberculous or carcinomatous matter, which passes through the stages of these deposits elsewhere, thus inducing inflammation of the bony tissue in the progress of the deposit towards the surface. Tertiary syphilis, by developing an internal periostitis, is not unfrequently a prominent cause of ostitis.

Symptoms.—At the commencement of ostitis, the patient may

complain of deep-seated and indescribable pain, which is increased by jars or violent movements of the bone; this pain being often permanent for many days or weeks without its source being recognized. Then the pain becomes marked on pressure; the part swells; the integuments become livid, hot, and swollen, and there is an evident extension of the inflammatory action from the cancellated tissue of the bone to the periosteum and the other tissues around it, the case being subsequently characterized by the symptoms just mentioned in connection with periostitis.

Diagnosis.—The diagnosis of ostitis is usually very difficult, but its presence may be suspected from the deep character of the pain, the slow progress of the disorder, the absence of the circumscribed swelling of periostitis and the peculiar seat of the suffering, as described by the patient.

Prognosis.—The ordinary result of ostitis is the formation of an abscess, with caries or necrosis, and the prognosis is therefore favorable as regards life, the disorder resulting in the evils which ensue upon the evacuation of the abscess, or the existence of caries or necrosis, as will be subsequently alluded to. Sometimes it develops such an hypertrophy of the bone as creates a marked elongation of the limb, the bone becoming convex forwards in the efforts of nature to obviate the evil. (Fig. 174.)

Treatment.—The treatment at first should consist in the use of local and general anodynes, with the application of counter-irritants to the part, or the free use of warm emollient dressings; after which mercurial plasters, and the means directed for the relief of periostitis will be demanded. When the symptoms of an abscess in the long bones, especially the tibia, are so marked (as intense pain, swelling, fever, &c.), as to justify it, the surgeon should cut down and expose the bone at or near the seat of the pain, and perforate the compact tissue as far as the medullary canal by means of a trephine, so as to give vent to the pus, a mode of treatment which has sometimes proved most useful, and is not followed by any serious consequences in the event

Fig. 174.



ENLARGEMENT AND CONVEXITY OF THE TIBIA FROM OSTITIS.—In this patient this limb was half an inch longer than the other. (After Nat.)

of an error of diagnosis, though caution should, of course, be exercised in the examination of the case before resorting to the operation.

SECTION III.

CARIES.

Caries (κεῖρω, to abrade) is a peculiar condition of a bone, which may be defined as that solution of continuity in this tissue which is the result of unhealthy inflammatory action and interstitial absorption. It is especially characterized by the destruction and softening of the *cancellated tissue*, resembling in this respect the sloughing of the cellular structure, and the condition of the soft parts described under the head of the Irritable Ulcer. Caries differs from ulceration of bone in the same way that the simple healthy ulcer differs from the irritable. In ulceration of bone, there may be a partial loss of substance as the result of an abscess, but the tendency of this ulcer is to heal by the deposit of lymph and the formation of healthy granulations; whilst in caries the tendency of the diseased action is to spread, the dead portions being thrown off in scales or particles like the minute shreds or sloughs of the soft tissues, whilst the reparative effort is unable to check the disorder for some time, the progress of the disease being characterized by very much the same symptoms as were described in connection with the irritable ulcer of the soft parts.

Symptoms.—Caries, like ulceration of bone, is usually preceded by an inflammation of the bony substance, and is shown by the same symptoms as were detailed in connection with osteitis, such as deep-seated pain, inability to sleep, enlargement of the part, tenderness on heavy pressure, loss of appetite, and fever; whilst the skin, which at first preserves its natural color, subsequently becomes hot, swollen, livid, and ulcerated in various points, these ulcers being accompanied with depression of the edges from the loss of the subcutaneous cellular tissue. As soon as the integuments give way, there escapes through these ulcerated points a thin grayish sanies, mingled with shreds of the subcutaneous cellular tissue, as well as with little scales of the cancellated tissue of the bone. On passing a probe into this opening, it will prove to be the orifice of

a fistulous canal, at the end of which the bone will be felt, soft, porous, and broken down into a semi-pulpy, or lardaceous structure, from which dark venous blood will escape under the action of the probe, this examination being often exquisitely painful to the patient. As the disease progresses, the matter becomes more brown or greenish in its tint, has a peculiarly offensive odor, and is so irritating that it develops inflammatory action on that part of the integuments over which it flows; hence it is not unusual to find *eczema* scattered around the neighborhood of the integuments which cover a carious bone. When the caries attacks deep-seated bones, as those of the vertebræ and pelvis, its course is much more tardy, the matter escapes with difficulty through the superimposed soft parts—travels, therefore, along the sheaths of muscles, and is apt to discharge in the line of the groin or loins, creating such symptoms as have been alluded to in connection with the subject of cold abscesses, hectic, or the typhoid condition there alluded to, often becoming established. The constitutional disturbance is also very marked when caries invades the articulating surfaces of bones, as in the ankle and tarsal or carpal articulations.

Etiology.—Caries may be created by any cause which will develop unhealthy inflammation in the cancellated tissue of a bone: thus it may ensue on periostitis, osteitis, ulcers of the soft tissues which destroy the periosteum, as well as upon syphilitic or mercurial irritation of the fibrous structures when accompanied by a destruction of the plasticity of the reparative lymph by which nature checks the progress of inflammatory action.

Diagnosis.—The disease with which caries is most apt to be confounded is Necrosis, and the distinctive signs between them will, therefore, be given hereafter.

Prognosis.—The prognosis of caries is generally serious, the result depending especially on the age and constitution of the patient. When developed by injury in the young and healthy, the progress of the destruction may be checked after a time by the simple efforts of nature, leaving a condition somewhat analogous to the indolent ulcer of the soft parts. But when it is the result of syphilitic, tuberculous, or mercurial contamination, and when it is seated near, or in the bones of an articulation, as those of the tarsus or carpus, it will be very apt to exhaust the patient's strength, and cause death, unless arrested by amputation of the limb. When it is superficial, and in bones which have but a limited amount of

cancellated tissue, as those of the cranium, the prognosis would be less serious, the disorder being ultimately amenable to treatment.

Treatment.—The general indications in the treatment of caries are: 1st, to remove, if possible, the cause of the disorder; 2d, to bring about a healthy condition in the diseased bone and favor the cicatrization of the carious ulcer. These indications are to be fulfilled on general principles; thus, if caries is the result of syphilitic or tuberculous contamination, administer such remedies as are appropriate to these conditions, whilst the local treatment should vary in accordance with the nature of the part affected. In all cases, the exterior inflammation should be checked as directed in the general and local treatment of inflammation, whilst the diseased bone should be removed by instruments, as scoops, gouges, &c., if it is so situated as to be anatomically safe.¹ When the carious surface is exposed, and the reparative process is not readily established, some modification of the local action may be obtained through the action of topical applications, as alkaline ointments, which will sometimes modify in a marked manner the ichorous character of the discharge, or stimulants, as the tinctura ferri chloridi or the nitric or muriatic acid carefully applied on lint for a few moments; or caustic solutions, as of potash or chloride of zinc; whilst the actual cautery has sometimes been freely used with advantage, the separation of the eschar being followed by the development of healthy granulations. In fact caries, like the irritable ulcer of the soft parts, requires that the destructive action should be checked and the reparative effort established; but whether this is to be effected by exciting or reducing the vascular action of the part, must depend on the peculiarity of the case. As a general rule, when caries is sufficiently superficial and limited in its extent, the best plan of treatment is resection of the diseased part either by scooping it out until sound healthy tissue is reached, or by cutting off the diseased end of the bone.²

§ 1.—CARIES OF THE CRANIUM.

Caries of the bones of the head may affect any part of the cranium, though most liable to be developed in the upper and

¹ See Operative Surgery, vol. i. p. 244, and vol. ii. p. 379, 2d edit.

² See Resections, in the Operative Surgery.

lower portions, as the frontal, parietal, and occipital bones, the temporal and sphenoidal escaping.

Etiology.—Caries in this locality is usually the result of syphilitic or mercurial contamination, and ensues upon periostitis or pericranitis, which, by creating osteitis, gradually develops the unhealthy action of carious ulceration.

Symptoms.—After the existence of the symptoms of nodes—as described under the head of periostitis—a soft fluctuating tumor forms in the scalp, which when opened either by ulceration or by puncture, gives exit to some healthy looking pus, but is soon followed by the sanies of carious bone, as previously described. This opening is now apt to spread until it creates an ulcer of the size of a shilling and upwards, and, owing to the peculiar character of the integuments, is liable to develop erysipelas. In the centre of this ulcer the outer table of the skull is usually found in a necrosed as well as a carious condition, until, as the compact lamina is thrown off, the diploë exhibits the ordinary condition of caries as seen in the cancellated tissue of other bones. If the disease progresses slowly, as it is apt to do, the edges of the ulcerated scalp may become thickened and inverted, sometimes also becoming closely adherent to the subjacent pericranium. At the same time the patient suffers pain and all the symptoms of inflammatory fever.

Diagnosis.—The superficial character of the parts affected renders the diagnosis easy.

Prognosis.—Caries of the bones of the cranium, when limited, is more readily susceptible of cure than any other seat of caries; but as it is generally the result of syphilitic osteitis or pericranitis, it is apt to invade a considerable portion of the bone, and to require either many months for its cure, or ultimately to exhaust the patient by the hectic fever which supervenes. The cicatrix that remains after the existence of caries of the cranium is always depressed, and deprived of hair, so that it generally creates a marked deformity.

Treatment.—In the treatment of caries of the cranium constitutional remedies—especially the use of the iodide of potash—often exhibit considerable power in checking the phagedenic tendency of the disorder. When the disease is circumscribed, the best applications are the mineral acids, painted on the diseased bone after the scalp has been shaved around the ulcer, and its edge protected from the action of the acid by covering it with simple cerate spread

directly on the scalp. The removal of the diseased portion, as far as the internal table, is also highly serviceable, the remaining ulcer of the integuments being treated on general principles or cured by a plastic operation.¹

SECTION IV.

CURVATURE OF THE SPINE FROM DISORDERED ACTION IN THE BONES AND MUSCLES.

§ 1.—DISEASE OF THE VERTEBRÆ.

Under the name of *caries of the vertebræ*, the older surgical writers described such a condition of the vertebral column as re-

Fig. 175.



Fig. 176.



Fig. 175.—A view of the Antero-posterior Deformity or Curvature of the Spine, often seen as the result of *caries* of the bodies of one or two vertebræ. (After Liston.)

Fig. 176.—A view of the Deformity created by a Lateral Curvature of the Spine as caused by the excessive action of the muscles on the right side. (After Pirrie.)

sulted in giving way of the bodies of the bones, in an encroachment on the natural caliber and line of the spinal canal, and in

¹ See Operative Surgery, vol. i. p. 319, 2d edit.

such a deviation from the natural line of the back as created a marked deformity, generally in an antero-posterior direction. This deformity, by causing a prominence of the spinous processes of the vertebra, creates a lump, and hence is popularly known as "hump-back," or "broken-back," the bones being supposed to be fractured.

Another deviation of the line of the spinal column, which is here mentioned to point out the comparative deformity of the two, is that due to the excessive muscular action of one side, in consequence of which the spine is inclined to that side, this deformity being designated as "*Lateral Curvature*," as will be subsequently alluded to, the shoulder blade being raised up on one side, and the spine inclined, though the bones themselves are not diseased. As the direct local treatment of curvature from disease of the vertebræ cannot be accomplished, owing to its deep situation, it and lateral distortion may be advantageously studied together, as both present the common object of obviating or modifying the deformity.

There are two varieties of diseases of the vertebræ which may result in curvature of the spine; these varieties being very often confounded with each other. The first is that due to a true caries of the bodies of the bones, in which we have all the symptoms already stated as characteristic of caries elsewhere, whilst the second is created by the deposit softening, and changes of the bony tissue consequent on tubercular deposits in the cancellated tissue of the spinal column. This latter affection is ordinarily spoken of as "*scrofulous disease of the spine*," a vague term, which indicates nothing positive in regard to the pathology of the disorder, and which is much better expressed by the title of tubercles of the vertebral column. In both the symptoms are at first somewhat indefinite, whilst in both there may be such changes of structure as will involve the spinal marrow. Thus, after a fall or some other accidental cause capable of developing inflammation, the patient will experience a constant deep aching pain in the part, which is subsequently followed by symptoms that are due to alterations in the cavity of the spinal canal and secondary disorder in the spinal marrow or its membranes, all of which may be created either by caries or tubercles in the vertebræ.

1. *Caries of the Vertebræ*.—Caries of the vertebræ generally affects the bodies of the bones, causing them to break down by their front faces, the pus which attends the progress of the disorder passing

either beneath the anterior vertebral ligament until it reaches the origin of the psoas magnus muscle, whence it travels beneath the sheath of this muscle towards its insertion, opening in the groin and constituting "psoas abscess;" or it follows the posterior line of the vertebræ and the sacro-lumbalis muscle to a point just above the posterior edge of the brim of the pelvis, thus creating "lumbar abscess." Caries may affect the bodies of any of the vertebræ, but is most commonly met with in those of the dorsal or lumbar region, being rare in the neck. As the reparative effort is imperfect, the entire bodies of one or two vertebræ may be removed by the disease, in consequence of which the weight of the head and shoulders causes

Fig. 177.



Caries of the Vertebræ, showing the destruction of the bodies of two of the dorsal vertebræ, the approximation of the adjacent ones by the weight of the head and shoulders acting on the upper part of the column, and the prominence in the back caused by the spinous processes. (After Liston.)

the approximation of the adjacent vertebræ, and creates a deformity like that shown in Fig. 180, nature subsequently solidifying the part by ankylosis, the inflammation of the periosteum leading to the deposit of new bony matter.

2. *Tubercles of the Vertebræ*.—This disease, consisting in a true tubercular deposit similar in all its characteristics to tuberculous deposits in the lungs and elsewhere, is usually the result of the tuberculous, or as it was formerly called, the scrofulous diathesis. Tubercles of the vertebræ are generally deposited in the cancellated structure of the bodies of the bones, where they may be found either as little distinct masses, or generally infiltrated throughout the cancellated tissue, the latter being of the miliary form, and analogous to miliary tubercles in the lungs, and when once deposited, pursuing a course which is similar to that seen in the lung.

The subject of the deposit of tubercles in the cancellated tissue of these bones, as well as in others, has only been properly understood within the last twenty years; Nélaton, of Paris, having first called the attention of the profession to it, in a distinct treatise in 1837.¹ In order to

¹ Recherches sur l'Affectiion Tuberculeuse des Os. Par A. Nélaton, D. M. Paris, 1837.

understand the true course of this disorder, it is only necessary to recollect that an aggregation of tuberculous matter deposited in the centre of the body of one vertebra of a patient who previously has labored under the tuberculous diathesis, must find its way out when the tuberculous mass softens; but why this particular spot should have been selected for the deposit we are unable to state. Perhaps some local congestion may have preceded it, or the same causes which determine the deposit of tubercles in the glands or lungs, may also create it in the vertebræ.

Once deposited, however, the morbid structure acts like any other foreign body, by inducing congestion, inflammation and supuration in the surrounding tissues, and as more or less of the cancellated structure of the bone is thus destroyed, little morsels of it loosen and are cast off mixed with the pus, and with the softened tubercle, and is sometimes discharged externally, mingled with the purulent mass. The pus of the little abscess which forms around the softened tubercle, does not travel directly to the surface of the bone through the cartilage which covers its epiphyses or articulating surfaces, probably on account of the great vascularity of this part, allowing a free effusion of lymph to take place, so as to limit the extension of the abscess in that direction; but escapes by perforating the body of the vertebra anteriorly (Fig. 178), destroying a portion of the bone, which is quite limited as compared with the destruction created by caries. After passing out beneath the anterior vertebral ligament, it takes a course downward, as the matter from caries did, between the ligament and the vertebræ, so as to point below in the form of psoas or lumbar abscess, though most frequently the discharge is not so profuse as that created by caries.

Tubercles of the vertebræ, as thus briefly described, are to be regarded rather as evidences of a peculiar diathesis, or as the result of peculiar constitutional disturbance, than as a complaint resulting from external violence or excited by it. And the recollection of this fact will often aid the surgeon materially in diagnosing them from caries, the latter being often—indeed, generally—the result of external violence. The tendency of caries, it should be remembered, is to spread—to involve neighboring parts, and gradually to destroy the whole bone; whilst the progress of a tuberculous abscess in the bone is to a discharge of its matter and the formation of a simple ulcer, the tendency of which is towards reparation, though this is

generally rendered of no effect by the fresh deposits of tuberculous matter in the neighborhood, which runs a similar course and thus keeps up and propagates the disease. Tuberculous deposits in the vertebræ seldom, however, cause the destruction of substance or the deformity that follows caries, the upper and lower plates of the affected vertebra assisting in preventing the caving in of the bone as shown in Fig. 178.

Fig. 178.



A VIEW OF THE APPEARANCES created by the softening of Tubercles in the Bodies of the Vertebræ, showing the amount of the destruction of the bones, the epiphyses remaining perfect.—1, 1, 1. Points where the tubercles have softened and created the death of the cancellated tissue. The bony spines which strengthen the parts after the escape of the tubercles is also shown. (After Nature.)

Symptoms of Spinal Curvature from either of these Disorders.—After the existence of caries or tuberculous disease of the vertebræ, the symptoms of spinal curvature may be arranged under two distinct heads, the first including those which precede the deformity, and are due to the extension of inflammatory action to the contents of the spinal canal; the second embracing those subsequent to its production, as the displacement of the spinous processes, compression of the spinal cord, &c.

1. *Of the symptoms which precede the actual occurrence of any deviation from the proper line of the spine.*—When the affection of the spine is due to disease of its bones, the patient complains first of a certain amount of pain in the part, this pain being heavy, deep-seated, and aching. There is, moreover, tenderness upon pressure, and this tenderness will very often be found to be limited to certain spots, which spots are generally noted in the dorsal or lumbar vertebræ, though occasionally seen in the case of the ver-

tebræ of the neck. Soon after this the patient begins to experience a sense of weariness in the back, with an indisposition to exercise, and after exercise suffers more severely from the dull, heavy, aching pain already alluded to, especially when that exercise has been accompanied by some amount of accidental jarring of the spine, such, for example, as having made an incautious step when walking, or taken a long step in descending from a carriage, &c. Under these

circumstances, the patient soon assumes the horizontal position, as he obtains in this way temporary relief by taking the weight of the head off the spinal column. The pain, however, returns so soon as he again becomes erect; and as this condition may continue for many weeks, he is often said to have "a weak back."

Thus far, the symptoms just detailed apply equally to disease of the bones arising from tubercles, as well as to that which is the result of caries. But certain differences can now be noted which will point out with more or less certainty the special character of each disease. Thus, if the pain be due to a tuberculous deposit, there will be more or less evidence of the tuberculous diathesis in the general appearance of the patient and in the general symptoms of the case, with more or less tendency to diarrhœa, or to cough, according as the irritation also affects the mesenteric glands or the lungs, either of these being symptoms which are not usually present in caries of the spine.

2. *Symptoms consequent on the yielding of the bodies of the vertebræ.*—When the disease has gone so far as to break down the bodies of the vertebræ, whether due to tuberculous or carious disorder, such changes will be noticed as are directly connected with loss of substance; thus, the bodies of the vertebræ will give way, and the spinal column will fall forwards, producing more or less antero-posterior deformity, and the condition to which the term *hump-back* is ordinarily given. If deformity goes on to such an extent that the curvature results in more or less compression of the spinal cord, paralysis will ensue to a greater or less extent, and if the curvature be in the cervical vertebræ the termination will generally be death.

As the yielding of the vertebræ progresses, more or less change will be noticed in the relative position of the ribs, with alteration in the cavity of the chest, the result of which will be difficulties in respiration, shortness of breath, dyspnœa, &c. At the same time there will be changes in the normal condition in the circulatory organs, as shown by palpitation of the heart, &c.

The position which the patient most frequently assumes is also quite characteristic of disease of the bones; thus, when seated he sits doubled up with his knees towards his chest, and when he walks his motions generally indicate more or less loss of power in the lower extremities, tripping over the slightest obstacle, and becoming much fatigued after short walks. As the disease progresses, other signs

connected with loss of nervous power become apparent, the patient losing his control over the sphincters of the bladder and anus, in consequence of which the urine and feces are passed involuntarily, precisely as happens in paraplegia from any other cause, whilst the functions of digestion are weakened, costiveness, flatulency, and eructations showing the disordered action of the muscular coat of the alimentary canal.

Diagnosis.—It is a matter of some importance in regard to the treatment of the complaint, to be able to make a diagnosis between caries and tuberculous disease of the spine, as the treatment which is perfectly appropriate to the one will be useless if not injurious in the other, and attention to the signs above given as peculiar to tubercle and caries, will generally suffice. The symptoms just described are also liable to be confounded in females with an apparently similar condition, to wit, neuralgic irritation and spinal tenderness, though this special disorder is usually the result of uterine disorder. This neuralgic irritation of the spinal column may, however, be diagnosed from the diseases under consideration, by the fact that pressure rather diminishes than increases the uncomfortableness or pain in neuralgia, and in some cases affords positive relief. The diagnosis from lateral curvature, or that due to muscular distortion, can be made with readiness, from the fact that, in muscular distortion the curvature is generally lateral instead of antero-posteriorly; whilst the symptoms described as due to tubercles or caries, are absent, such as tenderness upon pressure, pain, paraplegia, etc. etc.

Prognosis.—The prognosis of spinal curvature, whether due to caries or tubercles, should be guarded, the disease being a slow one, and if its progress be not arrested, resulting in serious permanent organic changes of the bones of this portion of the body. The cure, when it can be accomplished, is only to be effected by means of ankylosis, a process always tedious and uncertain, but which sometimes occurs, *post-mortem* examination occasionally revealing the vertebræ fused together by true bony matter. The patient, therefore, even under the most favorable circumstances, should not be encouraged to expect a cure before twelve or eighteen months—whilst the deformity, if well marked, will always continue, though it may be slightly modified by judicious treatment.

Treatment.—In the treatment of spinal curvature, whether due to caries or tubercles, the indications are, first, to prevent displacement

and the formation of a curvature as much as possible. Secondly, to pay attention to the patient's general health, with a view of removing, if possible, the peculiar constitutional condition upon which the local disease often depends. But these indications are to be carried out in different ways, according to the character of the cause which excites it. Thus, if the pathological condition is due to tuberculous deposit, the first duty of the surgeon is to employ, so far as it is in his power, such means as will tend to limit the further deposition of tuberculous matter. If, for example, in the earlier stages of the disease, some tenderness upon pressure be noticed in the bodies of any of the vertebræ indicating more or less irritation or inflammation of the parts concerned, it should be treated precisely as we would treat irritation or inflammation elsewhere. Thus, local depletion may be employed with advantage, such as that by means of leeches, &c., but care must be taken not to carry these local depletory measures too far, lest, by inducing depression, they result in an augmentation instead of a diminution of the tuberculous deposit.

If the signs of curvature have begun to show themselves, we may find it, in these tubercular cases, desirable to take the weight of the head and shoulders from off the spinal column, so as to prevent them from adding to the congestion in the bodies of the vertebræ at some point where they are most diminished in strength by disease. At the same time that this is desirable, fresh air and exercise are imperatively indicated. Now, these two indications may be well carried out, in the case of children—from whom everything is to be expected from exercise and fresh air—by means of a swing, the supports of which are of wood, instead of cords, and in which the patient can stand, the weight of the head and shoulders being taken off the column by means of a band which passes under the chin, or by means of "go-carts," &c.

If the disease is specially seated in the dorsal vertebræ, some such mechanical contrivance may be applied as that ordinarily sold by the cutlers, and which consists of a band of sheet-iron, padded, and covered with leather (Fig. 179), and made to surround the body just above the hips, whilst bands on each side present a crutch-shaped pad, which, passing under each shoulder, supports the weight of the arms. With such an apparatus, the patient may take gentle exercise in the open air, from time to time, and thus improve his general health.

Meanwhile, the treatment proper for the tubercular diathesis is

to be adopted. Chalybeates, such as Vallet's carbonate of iron, or the ferri pulv., may be freely administered, the whole class of remedies being employed, with these patients,

Fig. 179.



A FULL VIEW OF A "SHOULDER-BRACE," OR SPINAL SUPPORT, adapted to the treatment of Curvature of the Spine, when due to disease of the bodies of the Dorsal or Lumbar Vertebrae. The lower band fastens around the hips, whilst the crutch-like pieces pass under the armpits, and thus take the weight of the upper extremities off the spine. (After Nature.)

which are ordinarily given in cases of tubercular disease, in the lungs or elsewhere.

Benefit is sometimes obtained in cases of tuberculous deposit in the bodies of the vertebrae, from the use of counter-irritants, and one of the best that can be employed is a very simple one. Select an iron, such as that used for the application of the actual cautery, having a linear shape; dip it in boiling water, and then draw a line along both sides of the vertebral spinous processes from one end of the column to the other. As thus applied the iron will not vesicate, but will thoroughly redden the skin, and is a better application than a mustard plaster blister, or any similar substance.

The means thus briefly described embrace most of these that will be found necessary in ordinary cases, and present the only plan from which good can be expected.

In Caries, however, the treatment must be varied, as the condition of things is here entirely different, and it is to this class of patients that the plan laid down by Mr. Pott is especially applicable; this disorder being due to a phagedenic ulceration of the bone, which is the result of inflammation. This inflammation should consequently be treated promptly, like inflammation elsewhere, by antiphlogistic measures, as depletion, purgation, and counter-irritants, these remedies being patiently combined with perfect rest in the horizontal position. If possible, the patient should be made to lie upon his belly, and not be allowed to make the slightest exertion. He should also be briskly purged twice a week with the compound powder of jalap. By this plan of treatment, judiciously persevered in during a greater or less period, the disposition to ulceration and breaking down of the bodies of the bones will often be checked, ankylosis will ensue, and the patient recover, though probably with some deformity. The mode recommended

by Mr. Pott for the treatment of caries of the spine is, I fear, too often and thoughtlessly resorted to in all cases of disease of the bodies of the vertebræ, whether due to caries or to tuberculous deposit, and that is the active use of counter-irritation. According to his plan, a seton, or an issue or two, should be maintained upon the back, directly over or alongside any point of tenderness which may be noticed, but this plan is liable to one very serious objection, to wit, that it increases to an inconvenient, if not to an injurious extent, the irritation of the integuments, caused by the pressure of the hump or angle of the deformity. The same objection would also apply to moxæ, but with more force. The only true way of employing counter-irritants, if they are to be made use of, either in caries or tubercles of the vertebræ, is to apply them at a distance, say some four or five inches from the seat of the injury. But in tuberculous disease of the vertebræ anything like a drain on the system is apt to prove injurious by weakening the powers of life.

In order to prevent the patient from suffering from the want of fresh air and exercise, during the treatment of caries, a little coach may be made for him, in which he should be dragged about, whilst he yet enjoys all the benefits arising from the horizontal posture.

§ 2.—MUSCULAR CURVATURE OF THE SPINE.

Lateral curvature of the spine is a distortion of the vertebral column due to muscular action. It is generally seen in young girls and boys of from five to fifteen years of age, especially in girls who are improperly educated physically.

Etiology.—The causes of this disorder are to be found in the relaxing influences of luxurious beds and over-warmed houses; in the ridiculous rules of certain fashionable boarding-schools, such as those which require growing girls to stand for two or three hours during a recitation, or to use seats without backs, under the impression that the little sufferer will thus acquire grace and an erect carriage; or in the absurd directions of certain writing masters, compelling the child to sit with one side to the table, thus encouraging the use of one set of muscles. Another very common cause is dressing female children with low necked dresses, so as to cause them to hitch and turn themselves with a view of keeping

up their clothes, thus not unfrequently developing the muscles of one shoulder more rapidly than those of the other. It will also be sometimes found in growing boys, as in those who carry a strap full of school-books on one shoulder, or who work at some trade which compels them to use one side of the body more than the other, such as blacksmiths' apprentices, who blow the bellows, &c. In these cases, the muscles involved are most frequently those connected with the scapula, such as the trapezius, rhomboideus, levator anguli scapulæ, &c. muscles, the tendency of which is to draw the scapula towards the spine, or elevate it, but muscles, the action of which would serve equally—one scapula being made a fixed point—to draw the spine from the scapula. In some patients the creation of lateral curvature as the result of muscular action is also favored by a want of firmness in the bones, the latter presenting a tendency towards the condition described under the head of osteo-malacia, or mollities ossium.

Symptoms.—The presence of lateral curvature, from these causes, may generally be at once recognized by a simple inspection of the naked back; the true line of the spinous processes of the vertebræ being considered, under ordinary circumstances, so far at least as its lateral inclination is concerned, as a plumb-line. Inspection in the case of lateral curvature will at once show the deviations from this line, these deviations being greater or less in degree according to the point to which the disease has progressed. Usually, it is rare to find disease of the bones in connection with muscular distortion.

As a consequence of the distortion of the vertebral column, changes may also be noticed in the position and relations of the ribs: the length of the chest being sometimes very much shortened on one side, and the distance between the lower rib and the top of the ilium occasionally diminished to such an extent that it may be spoken of as not existing; or the chest may be flattened in its shape, the condition of the "chicken-breasted" being not unfrequently created by muscular distortion.

Prognosis.—The prognosis of curvature of the spine from the excessive muscular action of one side should be guarded. If the case is seen early, it may be remedied by judicious exercise of the set of muscles opposite to those which have hitherto been called into play; but the process is a tedious one, and, if the disease has existed any length of time, will generally be but very partially successful.

Treatment.—The indications for the treatment are the development

by exercise, by frictions, etc., of the weaker set of muscles; thus, if the curvature has its convexity towards the right side, the muscles of the left are those the development of which should

Fig. 180.



Fig. 181.



Fig. 180.—A view of the Deformity seen in Lateral Curvature from an inspection of the back. (After Miller.)

Fig. 181.—A view of the Condition of the Vertebrae and Ribs in the same disorder. (After Miller.)

be attempted. Besides exercise and frictions, electro-magnetism has also been recommended, and will often prove serviceable if judiciously applied, by increasing the circulation in the weakened muscles.

An attempt was made some years ago to bring into credit a mode of treating these curvatures by section of the contracted muscles, Mr. Guerin, of Paris, having operated extensively in this manner upon all cases of spinal curvatures which presented themselves, but the result has never created any marked professional favor. As a general rule, the bones and ligaments of bad cases have accommodated themselves to their new positions, and few, therefore, can be permanently benefited by such operations.

The same general remark will apply to mechanical contrivances, with which the stores are filled, and the power of which is lauded for the cure of this deformity. As a general rule, they are entirely useless if the disease has been of long standing. Something may, perhaps, be accomplished by gradual extension, but it must be very carefully applied, lest it result in evil rather than in good.

SECTION V.

SPINA BIFIDA.

Spina Bifida, or Hydrorachis ($\nu\delta\omega\rho$, water, and $\rho\alpha\chi\iota\varsigma$, the spine), is a congenital malformation of the spinous processes and posterior part of the vertebral column, in consequence of which an orifice is left, through which the spinal membranes protrude. Sometimes, indeed, the spinal cord itself escapes, though this is by no means generally the case. The disease, as might be supposed from the fact that it is congenital, is generally seen in infants, and those cases upon record in which it is spoken of as first appearing one, two, or three months after birth are generally such as have escaped attention at an earlier period. As a general rule, the child in whom the disease occurs is in other respects well formed, and free from all other deformity except a marked predisposition to hydrocephalus. The formation of the tumor is generally at some point in the lumbar region, and the symptoms are as follows:—

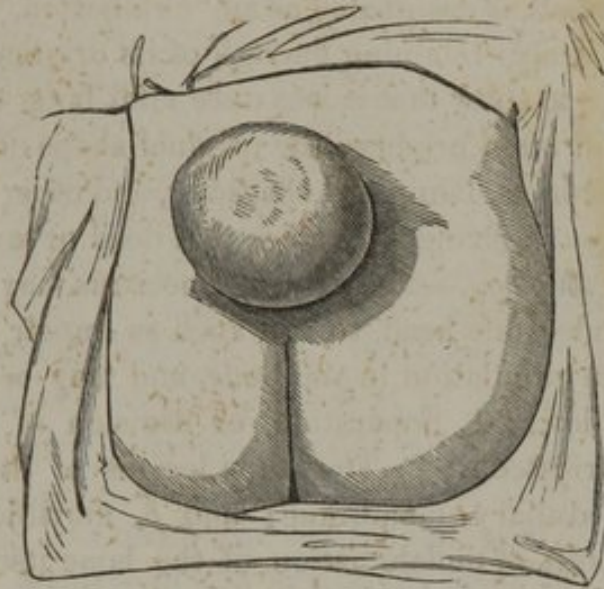
Symptoms.—Soon after birth, there is noticed in the region mentioned a tumor of variable size, which is thin and diaphanous, and evidently contains fluid (Fig. 182). Usually, it is uncovered by the ordinary integuments of the part, or if they cover it, they are sometimes extremely attenuated. If gentle pressure is made upon the tumor, its contents will pass up into the spinal canal, and the swelling disappear more or less completely; but any such effort as this should be made with great caution, for if too violent or sudden pressure be made, the spinal marrow may become involved, and paralysis be induced. The disease is often combined with hydrocephalus, and sometimes with idiocy.

Diagnosis.—The diagnosis of this affection does not present much difficulty, the size of the tumor, its translucency, its position, the

age of the patient, and the history of the case being quite sufficient to determine its nature.

Prognosis.—With regard to the prognosis, it is unfavorable.

Fig. 182.



A full view of Spina Bifida of the lower part of the Lumbar Vertebrae. (After a cast from Nature.)

The disease is not readily relieved, and generally terminates fatally, though occasionally cures have been obtained.

Treatment.—The treatment consists in evacuating the contents of the tumor by means of acupuncture needles, after which various plans have been proposed for inducing the adhesion of the sides of the cavity, such as injecting the cavity of the spinal cord with tinct. of iodine in aqueous solution.¹

SECTION VI.

NECROSIS.

Necrosis (from *νεκρω*, to kill) is a mortification of the bony tissue, and corresponds in its general character and results with mortification—not sphacelus—of the soft tissues, there being generally

¹ For an account of various operations for the relief of spina bifida, see Operative Surgery, vol. ii. p. 183, 2d edit.

sufficient vitality in the surrounding structures to separate the dead from the living portions. In mortification of the soft parts the dead portion, when of limited extent, was designated as a slough, this portion retaining enough of the elements of the dead structure to show that it had belonged to a soft tissue. In the bones the dead portion, if small, is designated as an "exfoliation,"—if larger as a "sequestrum," it also retaining enough of its original characteristics

Fig. 183.



A lateral view of a Sequestrum from the inner surface of a long bone, showing its surface. (After Liston.)

ties to show that it was once vital bony tissue; thus it will often preserve the original shape of the bone, its hardness, laminated character, and other peculiarities, though changed in color to a dead or tawny white.

Etiology.—The causes of necrosis may be all placed under one head, to wit, such as impair the power of the circulation in the bone, and may be arranged as follows: 1. Separation, or division of the external periosteum; 2. The same lesions of the internal or medullary membrane; and 3, mortification as the result of inflammation of the bone itself or the injury of its nutritious artery. Through all these causes one general process may be noted, to wit, the death of one portion, and increased vascularity of adjacent parts, this increase being in proportion to the loss of vitality or size of the dead portion. This increased action amounts often to true healthy inflammation in both the internal and external periosteal membranes.

Symptoms.—In its commencement necrosis is generally preceded by sufficient inflammation to create a change either in the action of the external or internal periosteum, or both; hence, the earliest symptoms are those of inflammation of the bone or its membranes, such as pain of a variable degree of intensity, which is often most marked during the night, with the other symptoms of periostitis. After the duration of these, for a longer or shorter period, a flattened uncircumscribed enlargement will be noted at the painful spot, without any change being perceptible in the color of the skin, until fluctuation is more or less evident, when the skin will redden, ulcerate, and give vent to pus through one or more orifices, the pus often bringing away some particles of the sloughing periosteum. These ulcerated points in the integuments over a necrosed bone are nearly always elevated, with a minute orifice in the centre,

and hence are designated as *papillæ*. If the necrosis is superficial the bone will be readily felt denuded of its periosteum, the dead lamina will exfoliate and be thrown off by nature, healthy granulations and new bone will be formed, and over this the integuments will adhere and form a dense white but *depressed* cicatrix.

If the diseased bone involves the greater part of the thickness or length of a long bone, as the tibia or femur, all the symptoms will be more marked, the swelling embracing most of the circumference of the limb. The ulcerations will also be numerous, the pus more thin, fetid, and ichorous, whilst a probe passed through the ulcerated integuments will enter a hypertrophied layer or shell of bone, and touch the denuded and necrosed portion within it. At first this fragment or sequestrum will be more or less firmly adherent to the new bone thrown out around it, but in the latter stages of the complaint it becomes loose and movable, yielding to the force which touches it, and sometimes becoming so loose as to move readily with the motions of the patient. The constitutional symptoms are those of irritative fever, this being due to the pain and discharge from the part, and the severity of the symptoms being in proportion to the extent of bone affected. Throughout necrosis of a flat or part of a long bone the continuity of the bone is often unimpaired, and its functions are, therefore, more or less perfectly performed.

State of the Tissues during Necrosis.—It being admitted that necrosis is generally preceded by inflammatory action, and that this action creates the destruction of one portion of the structure that is involved, it will be seen that the death of the bone or a portion of it, is created by very much the same steps as the death of the soft parts when mortifying, the reparative effort in both instances being analogous. Without recapitulating what has been said in connection with the subject of mortification of the soft parts, or repeating the allusion previously made to the action of the periosteum in the repair of fractures, we may now simply note the condition of parts around the necrosed portion, and the manner in which it is thrown off by nature. From the extended observations of Mr. Stanley,¹ as well as from those of Mr. Paget,² it appears that the phenomena in necrosis which illustrate the process, are—

1. A permanent and increased vascularity of the structures adjacent to the necrosed bone, this being indicated not only by the

¹ On Diseases of the Bones.

² Lect. Surg. Pathol., p. 301, Phil. ed.

condition of its vessels but by the numerous enlarged Haversian canals.

2. A reparative process, due, as in mortification of the soft parts, to a limiting effusion and organization of lymph, on the border of the living tissue, the latter, by interstitial deposit and absorption, forming "a line of demarcation," the groove around the dead bone being augmented until, as in mortification of the soft parts, it forms "a line of separation," the earthy matter being washed away in the pus, and not absorbed, as was thought by Mr. Hunter, whilst the animal matter retains its connection with the living bone, probably in consequence of its greater vitality.

The removal of portions of the earthy matter, when followed by the subsequent destruction of the animal and cancellated tissue, generally gives to the necrosed portion or the sequestrum a porous, spiculated, irregular surface and margin, as shown in Fig. 184.

Fig. 184.



View of a Sequestrum as detached after an amputation of a femur, showing the character of its surface as well as its terminal connection with the living bone. (After Liston.)

3. The inner surface of the periosteum is usually the agent of these changes, its face becoming covered by granulations, which, as in the ordinary growth of bone, creates the nucleated cells from which new bone is formed. Hence, whilst one portion of the bone is being separated by degeneration, another is being formed by the reparative effort, the new material being thrown out around the old so as to incase it and preserve the continuity of the member.

4. The shell of new bone formed by the external periosteum around the necrosed portion, is usually found perforated in numerous points, so as to give exit to the pus, without materially weakening the part. These perforations are, it is thought, the result of the death of limited points of the external periosteum in consequence of which there is no nidus for the growth of new bone in those openings which originally ulcerated through the periosteum. When the loss of periosteum is extensive, an orifice termed "cloaca," is formed, through which the necrosed bone may be withdrawn from its shell.

5. The points of difference noted in the condition of parts between necrosis and mortification of the soft tissues is found in the

duration of the process, necrosis being slow and often requiring six, twelve, or eighteen months for its completion.

Fig. 185.



Fig. 186.



Fig. 185.—Necrosis of the Tibia, showing the perforations in the shell of new bone, as alluded to in the text. (After Miller.)

Fig. 186.—Necrosis of the Tibia, showing a large cloaca with the sequestrum protruding. (After Miller.)

Diagnosis.—Necrosis, when once developed, may be readily recognized from caries by an examination with a probe, the necrosed bone being denuded, hard, rough, and often movable as a fragment, whilst caries is soft, porous, friable, and without distinct shape, seeming rather as a broken-down mass of tissue.

Prognosis.—The prognosis of necrosis will vary with the position of the bone that is affected, but the disorder is seldom fatal to life; when the necrosis is circumscribed and superficial, the sequestrum will be thrown off more quickly than when the disease is more extensive and deep-seated. The prognosis, as regards the period of separation of the sequestrum, may be rendered more certain by examining the part carefully with a probe or director, in order to judge of its mobility and the amount of its attachments to adjacent parts. When free, and so situated as to be amenable to an opera-

tion, the prognosis as to the time of cure will be more favorable than it would be under different circumstances.

Treatment.—Little can be done for the relief of necrosis until nature has accomplished the separation of the dead from the living portion, except to regulate the inflammatory action. When the necrosis is the result of syphilitic periostitis, the constitutional remedies demanded in syphilis may prove useful, whilst in all cases the use of anodynes, with mild purgatives, will allay pain, and diminish the irritative fever. If a wound has denuded the bone of its periosteum, replacing the integuments and favoring their adhesion will often serve as a prophylactic measure, whilst the warm-water dressing, rest, &c., will aid in diminishing the inflammation of the soft parts. When the necrosed bone is loosened by the process of nature, its removal, if it is of limited extent, may be accomplished by drawing it out with strong forceps, and treating the wound as a simple ulcer. But when the sequestrum is larger, and the dead bone is inclosed in a thick casing of new bone, the latter must be cut away sufficiently to permit the removal of the necrosed portion. The details of the process belong to operative surgery, but may here be generally stated as consisting in perforating the shell of new bone at two points with a trephine, and then chiselling out the intervening portion¹ until an opening of sufficient size is obtained, the wound being subsequently made to heal by granulation.

SECTION VII.

BONY TUMORS.

The bones, like the soft tissues, are liable to such changes in the process of growth and repair as create a modification of their natural condition, and result in the development of tumors, which may be classified as those due to hypertrophy, atrophy, and fatty degeneration of structure.

¹ See Operative Surgery, 2d edit., vol. i. p. 232, *ut supra*.

§ 1.—EXOSTOSIS.

By an exostosis (ἐξ, out of, and ὀστέον, a bone) is meant a bony growth or tumor which is due to a true hypertrophy, and which may arise either from the compact or cancellated tissue of the bone.

Varieties.—Various kinds of exostoses are met with, that which is hard and solid being designated as the “*eburnated*” or ivory-like; that which is formed of superimposed layers, as the *laminated*; and that which is formed chiefly of cancellated structure, as the “*spongy*.” Exostoses are also named from their shape, as the *circumscribed*, *tuberculated*, and *spinous*. A circumscribed exostosis is a mere projection from the bone of a limited extent; the tuberculated or knotted is an irregular knob or excrescence; whilst the spinous resembles in shape the thorn of the rose-bush, or some similar blunt-pointed growth, all of which are more or less solid in their structure.

Seat and Result.—Exostoses vary much in their position, all the bones being liable to them, but especially those which are superficial, as the cranium, clavicle, tibia, lower jaw, sternum and ribs. The tuberculated and laminated varieties are chiefly found in the flat bones, as those of the head; whilst the spinous and circumscribed are seen in connection with the long bones. Exostoses are followed by results which vary in accordance with their position; thus an exostosis from the interior of the cranium would be liable to compress the brain, and an exostosis on the long bones of the extremities would create inconvenience by interfering with the play of tendons and muscles, or acting on the coats of the blood-vessels, or irritating the nerves.

Pathological Changes.—In all exostoses the periosteum or endosteum is liable to be more or less changed, the development of the growth being generally due to the action of these tissues either directly or indirectly. Generally, the periosteum is thickened, injected, or sometimes softened around the exostosis, especially in the tuberculated and spinous varieties, whilst in the spongy it may be unchanged, the chief action being at the expense of the cancellated tissue, which expands the compact layer without creating any marked change in the periosteum over it. The soft parts around an exostosis are often but slightly affected by it if it is small, whilst, when it is large, they may be so distended as to be very

much thinned, the muscles sometimes disappearing to such an extent as to leave only a thin layer of muscular fibres. The color of an exostosis is usually that of healthy bone.

Causes.—Exostoses may be produced by any cause which will induce increased action in the bone, or its investing membrane, and often follow the development of tubercles in the bone, or secondary or tertiary syphilis, or rheumatism and gout. In the tibia they sometimes supervene on the long continued irritation of ulcers or nodes, or from repeated contusions of the skin.

Symptoms.—The development of exostoses is characterized by various symptoms, especially in their commencement by those which have been detailed as due to periostitis or ostitis. The symptoms, after the growth attains a certain size, are those due to the compression of adjacent parts—as swelling, redness, lividity, heat, and inflammation, with ulceration of the skin; abscesses of the cellular tissues; neuralgia, from irritation of the nerves, and aneurisms or obliteration of the arterial channels. When seated near joints, they may impair the motion of the articulation, or develop synovitis, with effusions within the joint, and subsequent ankylosis. When seated on the vertebræ, they often impair the flexion and extension of the spinal column. When liable to press on the brain or spinal canal, they are also apt to be followed by general or local paralysis; whilst in the pelvis they may interfere with the birth of the fœtus, or with the functions of the bladder and pelvic viscera.

Diagnosis.—The diagnosis of exostoses may be readily made if superficial, by the sense of touch, as they present the characters of firm and hard tumors, of a shape which varies in accordance with the variety.

Prognosis.—The prognosis of exostoses is generally very slow and tedious. They may disappear, or, after having reached a certain point, cease to grow, and ultimately become somewhat diminished, though they seldom disappear entirely. The result to life, or the usefulness of adjacent structures, will depend upon their position, as they are dangerous in accordance with the importance of the parts pressed on by their growth.

Treatment.—The treatment of these growths should consist both in local and constitutional measures, the internal remedies being addressed to the supposed cause of the disorder, and being such as are appropriate to the constitutional treatment of syphilis, rheuma-

tism, or the tuberculous diathesis. As a general rule, the administration of mercurials is useful, whilst diaphoretics and purgatives are often demanded, with the free use of anodynes if neuralgic symptoms are developed.

The local treatment may consist in the employment of blisters, in the neighborhood of the exostosis; in incisions on the tumor when it is superficial, the periosteum being divided around the base of the growth, so as to create a limited necrosis; or in a resection of the substance of the bone, or of a portion of the exostosis when it interferes with the play of the tendons. After the removal of an exostosis, by an operation, the wound should, if possible, be made to unite by the first intention, in order to prevent exfoliation of the adjacent bony tissue.

SECTION VIII.

SPINA VENTOSA AND OSTEO-SARCOMA.

Spina ventosa is an old term, which was employed to designate a peculiar sharp tumor of bone, which resulted in a thin porous structure, that felt elastic and as if filled with air (*spina*, a thorn; and *ventosa*, windy).

Osteo-sarcoma, or the bony and fleshy tumor, is another ancient term, sometimes indiscriminately applied to an analogous tumor. Both these tumors are malignant in their character, and would be better designated as *Enchondromata*, or as *Cancer of bone*, the growth being generally due to a deposit of carcinomatous matter in the bone, causing an expansion of both its cancellated and compact tissue. In *spina ventosa*, the greatest development is of the cancellated structure; whilst in *osteo-sarcoma* it is rather the compact layer and the external periosteum that are involved, the cancellated tissue being filled with a fleshy carcinomatous structure, whilst the enlarged cells are sometimes also filled with limited effusions of blood, or a lardaceous, soft, and pulpy deposit.

Seat.—These tumors may affect any of the bones, but that of *spina ventosa* is most common in the long bones, as those of the extremities, whilst *osteo-sarcoma* especially attacks the jaw, clavicle, and pelvis.

Symptoms.—These growths, when of any size, produce changes

in the integuments, covering them by impeding the circulation; hence they often present congestion of the veins, and pulsate or throb when the arteries are likewise involved. In the earlier stages, we have all the symptoms of deep-seated abscesses in bone as alluded to in connection with osteitis, accompanied by intense pain and difficulty in the performance of the ordinary functions of the affected bone.

Sometimes these tumors acquire considerable volume, and ultimately pursue the course and give rise to the same symptoms as have been already described in connection with carcinomatous deposits in the soft tissues. The tumor usually presents more or less rotundity, has an irregularly depressed and lobulated surface (Fig. 187), over which the venous congestion is very marked, and, when

Fig. 187.



the skin ulcerates, is accompanied by hemorrhage and the development either of a cancerous ulcer or of a fungous growth.

Diagnosis.—It is often very difficult to recognize the precise character of these tumors at their commencement, but at a more advanced period they may readily be distinguished from caries, necrosis, or exostosis, by the character of the swelling, its elastic and sometimes pulsating feeling, and by the absence of the peculiar symptoms which have been stated in connection with these disorders.

Prognosis.—The prognosis of these tumors is always serious, the termination of the case being similar to the result of carcinomatous deposits elsewhere. When removed by amputation of the limb, or extirpation of the tumor, the constitutional disorder may be checked apparently for the time, but sooner or later it will carry

off the patient, the disorder showing itself elsewhere—hectic being the usual cause of death.

Treatment.—Resection of the bone, extirpation of the tumor, or amputation of the limb may retard the progress of the disease; whilst the constitutional treatment, as detailed under the head of Cancer, presents the best chances of prolonging the patient's life.¹

SECTION IX.

MOLLITIES AND FRAGILITAS OSSIIUM.

An examination of the general constituents of bones shows the presence of two principles to which they owe the proper performance of their function—one the lime, or earthy matter, giving them hardness, whilst the animal matter adds to their tenacity. Under certain congenital or acquired peculiarities, the proper proportion of one of these elements is sometimes wanting, and a diseased condition is established. When the earthy matter is deficient, the bones bend, and are incapable of supporting the patient, or sustaining the perfect action of the muscles; hence it has been designated as *Mollities ossium*, or softening of the bones. When, on the contrary, there is a deficiency of the gelatinous or animal matter, or when the lime is in excess, the bones want their proper tenacity and become brittle, this condition being designated as *Fragilitas ossium*.

§ 1.—MOLLITIES OSSIIUM, OR OSTEO-MALACIA.

According to the more recent views of pathologists, as Virchow, Redfern, Goodsir, Paget, and others, mollities ossium is an example of that degeneration of tissue which has been designated as the “fatty degeneration,” and is shown in the corpuscles of the bone, on the interior of which small fatty molecules appear. These gradually disintegrating, create a liquefaction and separation of the proper bone substance immediately surrounding and including each corpuscle.

¹ For the operations required by these tumors, see *Operative Surgery*, vol ii. p. 387, 2d edit., under Resection of the Bones and Amputations.

In examining the bones when thus disordered, they will be found to be more spongy than usual, the cancellated tissue being especially enlarged, and filled with a pink or sanious liquid, which is sometimes almost pulpy, the medullary canal being also much enlarged and filled with this matter. The periosteum is usually thickened, softened, and as if infiltrated with a somewhat similar pulpy matter; the action of the surrounding muscles, or the weight of the body, causing the bones to bend in various degrees of curvature.

Patient.—This condition is most common in females, being sometimes seen at puberty, but more frequently in adult life, or at the critical period. It is, however, a rare disorder.

Causes.—The causes are not well known; frequently the disorder has been hereditary, though often the patient has suffered for a long time from chronic diseases, which have weakened the powers of life, as the low forms of fever, or uterine hemorrhages; but little is positively known in regard to these points, the amount of our knowledge of the true causes creating the condition being limited.

Symptoms.—Mollities ossium generally shows itself by symptoms similar to those of rheumatism, especially when the patient has been exposed to cold and moisture; thus there are pains in the joints, and vague pains often in all parts of the skeleton. After a period which varies, the bones which are affected swell around the articulations, and the movements of the patient become imperfect, each attempt at motion increasing the pain; after which the bones begin to yield to the muscular action, and become curved in various directions, the limbs being shortened, and the position of the patient strongly inclined to a stoop, which creates marked deformity; the legs showing a marked tendency to that curve, which is often designated as "bandy legs." The spine, ribs, and pelvis participating in the curvatures as the disease progresses, the whole figure of the patient becomes crooked and misshapen.

Prognosis.—The prognosis is decidedly unfavorable, nearly all the cases recorded having died in a variable period of time, from the subsequent degeneration of other organs, especially the lungs, the function of the latter being sometimes impaired by the changes created in the cavity of the chest.

Treatment.—Little can be done to arrest the progress of this disorder; the indications being to add to the powers of life by the

administration of tonics and chalybeates. Phosphate of lime has been employed, but little benefit has been noticed from its use.

§ 2.—FRAGILITAS OSSIUM.

Brittleness of the bones is the result of a degeneration of tissue consequent on the opposite condition to that seen in osteo-malacia or mollities, the animal matter being removed, and the lime thus left in excess. This condition predisposes the patient to fracture from the most trifling causes, and is generally the result of some congenital peculiarity which is not accurately known. The number of fractures in the same patient under this peculiarity of constitution is sometimes wonderful, one case having been reported of a woman who had twenty-three fractures in the course of two years and a half. One of a lady, who has suffered about eight fractures in as many years, is well known to me; and within three years I have had occasion to treat her for fracture of the humerus, of the radius, and of the femur, all created by trifling forces, she having been previously treated for others in the same limbs.

Treatment.—The treatment of the fractures created in these patients is usually the same as is required by fractures arising in those of sound constitutions, though, as far as personal observation has gone, it has seemed to me that the union was much more rapid and perfect than under ordinary circumstances, requiring, in the case of the lady alluded to, about one-third less time than that usually employed in the cure. The constitutional treatment should consist in the administration of chalybeates and tonics, aided by the cold bath and general hygienic measures to improve the patient's strength and powers of digestion.

PART VI.

INJURIES AND DISEASES OF THE JOINTS.

CHAPTER I.

LUXATIONS.

AMONG the most important of the injuries which affect the articulating extremities or the contiguity of the bones is that due to their displacement, and designated as a Luxation or Dislocation.

A Luxation (*luxare*, to put out of place) may be defined as the removal of a bone from its natural articulating surfaces. It is a frequent result of the application of certain forces to the parts adjacent to the joints, and has been variously classified for the purposes of study.

Varieties.—Luxations may be classified either according to the position of the displaced bone, as *primitive* and *consecutive*; according to the nature of the injury, as *simple*, *compound*, and *complicated*; and, according to its duration, as *old* or *recent*.

1. A *primitive luxation* is one in which the articulating surface of a bone is driven out of its natural articulating cavity, to take up some new and false position.

2. A *consecutive luxation* is one in which the head of a bone leaves its new and abnormal position for some other unnatural one.

3. A *complete luxation* is one in which the articulating surface is driven entirely out of its natural position.

4. An *incomplete luxation* is one in which the bone is displaced, but not entirely so, some portion of its articulating surface still remaining in the natural cavity or upon its edge. Under this variety would come a luxation of the humerus, where the head of the bone rested upon the edge of the glenoid cavity.

5. A *simple luxation* is one in which there is merely a displacement, without any greater injury to the surrounding parts than is necessary to permit such an accident; the injury being accompanied by no external wound.

6. A *compound luxation* is one in which there is a wound, communicating with the articulating surfaces of the displaced bones.

7. A *complicated luxation* is one in which the patient suffers simultaneously from any disease or injury; thus, a dislocation may be complicated with fracture, with anemia, or with aneurism, &c.

Etiology.—The causes of these injuries may be classified as *predisposing* and *exciting*, or as constitutional and local.

Among the predisposing or constitutional causes, may be enumerated diseases of the articulating surfaces of the bones, relaxation of the ligaments, and paralysis of the muscles. The exciting causes are mechanical violence or muscular contractions, of such a character as to force the bone from its position. Luxations are produced in various joints with different degrees of facility, the ball and socket joints being more liable to the accident than the ginglymoid. The nature of the joint, also, affects the direction of the luxation. In a ball and socket joint, luxations may occur in four directions, upwards, downwards, forwards, and backwards. In the ginglymoid joints, on the other hand, they occur most frequently laterally, though sometimes backwards or forwards, as in the case of the knee or ankle-joint.

Post-mortem Appearances.—A *post-mortem* examination, in a case of recent luxation, reveals more or less effusion of blood, and laceration of the tissues surrounding the displaced bone, as the capsular ligament and muscles. Lacerations of bloodvessels, and of nerves of considerable size, are also sometimes found. If the luxation has remained unreduced for some time, other changes appear, which are due to the progress of inflammation; thus it will be found that lymph has been effused and organized so as to form various adhesions, which thus bind together the parts surrounding the joint. Large nerves or vessels may then be caused to adhere closely to the displaced bone, as is sometimes the case with those of the axilla in old luxations of the shoulder-joint. If the head of the displaced bone has been in contact with a bony surface for any length of time, in its new position, it will also sometimes be observed that the effusions in this locality have resulted in the formation of callus, thus producing a new articulating cavity, more or less com-

plete, many specimens of which are to be found in most cabinets. Such new articulations often possess a considerable degree of mobility.

Symptoms.—The symptoms of luxations are often well marked. There is *pain* caused by the stretching and laceration of nerves, or by pressure upon them, in consequence of the new position of the head of the bone. There is *change in the appearance* of the joint, its natural rotundity and fulness having disappeared, and deformities resulting, as will be fully described in connection with the special luxations. There will be *impaired mobility* in the joints, and changes in the condition of the surrounding muscles, some being put preternaturally upon the stretch, and some preternaturally relaxed.

Diagnosis.—The diagnosis requires great care, and a good anatomical knowledge of the parts concerned; luxations being liable to be confounded with sprains, fractures, lacerations of the ligaments of the injured articulation, chronic diseases of the joints, as hip-joint disease or white swelling, and displacement of the articular cartilage. The diagnosis from these diseases and injuries will be given in connection with the special luxation.

Treatment.—The treatment of luxations may be arranged under two general heads, the *constitutional* and the *mechanical*. The constitutional treatment consists in the use of such means as will result in the production of complete muscular relaxation, and will be found detailed in connection with the subject of luxation of the hip.

The mechanical means are such as are necessary to the application of force, for the purpose of accomplishing the reduction.

Compound Luxations.—When a luxation is compound, the injury is not only more dangerous and difficult to treat than a simple luxation, but even more so than a compound fracture, the inflammation resulting from the entrance of atmospheric air into the cavity of the joint, being generally violent, and terminating in suppuration and hectic fever, so that amputation may be necessary to save life. The prognosis, therefore, should be guarded.

CHAPTER II.

LUXATIONS OF THE BONES OF THE HEAD AND TRUNK.

SECTION I.

LUXATION OF THE INFERIOR MAXILLARY BONE.

Luxation of the lower jaw is produced by causes similar to those which produce fracture of this bone; but, the former, as has been previously stated, is much more common than the latter accident on account of the mobility of the jaw.

Anatomical Relations.—The articulation of the lower jaw is formed by the condyloid process of the inferior maxillary bone, which articulates with the glenoid cavity of the temporal bone. It is surrounded by a capsular ligament, and has within its cavity a structure known as the inter-articular cartilage, which equalizes the two surfaces in the various positions which the bone assumes. The joint presents also an external and internal lateral ligament, and two synovial membranes.

Etiology.—Any force applied to the front of the jaw, while the mouth is open, may produce this luxation, by driving it back until the mastoid process of the temporal bone becomes a fulcrum, whence the condyloid process is thrown forward, and brought to bear against the anterior surface of the capsular ligament. This giving way, the head of the bone slips out so as to take a position in advance of the glenoid cavity. Luxation of the lower jaw may affect either the articulation of one side, or both; and occurs most frequently in persons of middle age, though sometimes seen in early life and in old age. There is also a condition of parts, which permits the production of what is described as a spontaneous luxation of the lower jaw, this being due to a relaxation of the muscles and ligaments of the part permitting the luxation to occur at pleasure, or from trifling causes. Persons, accordingly, are sometimes found, in whom the simple act of gaping is sufficient to induce the

luxation. Fortunately, however, the same relaxation which permits the ready occurrence of the luxation, renders it also very easy of reduction.

Symptoms.—The symptoms of luxation of the lower jaw vary; if it be of one side alone, the jaw will be twisted towards the opposite side, the chin slightly protruded, and the mouth held permanently more or less open. If it affects both sides, the mouth will be held forcibly wide open, the chin will be thrust forward, speech and deglutition rendered impossible, the saliva dribble from the mouth, and the appearance of the patient be so characteristic that the accident will be readily recognized.

When such a condition occurs, the temporal as well as the masseter and pterygoid muscles are put upon the stretch, and often spasmodically contracted, while the muscles on the front of the neck are relaxed.

Treatment.—In the treatment, therefore, it becomes necessary to exert such a force as will overcome the contraction of the extended muscles, particularly the temporal and masseter, and draw down the jaw, so as to enable its condyloid process to clear the prominence of the anterior edge of the glenoid cavity, until it can be slipped back into its true position. The patient should therefore be placed upon a low seat, and the thumbs of the operator—unless he be willing to rely upon his dexterity in slipping them out of the way—be wrapped in a handkerchief or towel, and then introduced so as to bear upon the molars of the inferior maxillary bone, these being depressed by the thumbs whilst the chin is elevated with the fingers, until the contracted muscles begin to yield, when the bone will suddenly slip backward into its place, and create an audible snap. Generally when the surgeon feels the jaw begin to yield to his forces, he should slip his thumbs off the teeth out into the cheek, to avoid having them bruised by the spasmodic closure of the jaw which ensues. When the luxation is reduced, the jaw should be bound up with a handkerchief to keep it at rest; but for some days, after the bandage is dispensed with, the patient should refrain from biting upon hard substances, or opening his mouth widely, lest he reproduce the luxation.

§ 1.—SUBLUXATION OF THE INFERIOR MAXILLARY BONE.

Symptoms.—Cases sometimes occur in which the patient complains that, whenever he moves the lower jaw, he hears a peculiar crackling noise in the articulation, and that it causes him pain. This is generally due to the condition described by writers as subluxation of the inferior maxillary bone.

Pathology.—The true condition of parts in this affection is generally more or less deficiency in the synovial secretion of the joint, together with such a relaxation of the ligaments as enables the interarticular cartilage to slide forwards and be pinched between the bones.

Prognosis.—The case is one rather of annoyance than of danger to the patient.

Treatment.—The most effectual plan of treatment is the use of means calculated to give tone to the parts: shower-baths and cold douches proving highly serviceable; but, perhaps, the most successful treatment is the repeated application of blisters in the neighborhood of the articulation.

SECTION II.

LUXATIONS OF THE BONES OF THE TRUNK.

§ 1.—LUXATIONS OF THE VERTEBRÆ.

Luxations may occur in any part of the spinal column, but the injury is not a common one. Generally, it is the result of a force applied to one portion of the spine while the rest is fixed, and requires a considerable amount of mechanical power for its development, being seldom produced by muscular contraction, except when aided by weights on the head. The part of the spinal column most likely to suffer is the cervical portion (see Fig. 188), especially the articulation between the atlas and dentata. When the latter luxation takes place, sudden death commonly results from pressure upon the spinal cord, which indeed is by no means an uncommon termination in luxations of any of the cervical vertebræ.

In luxations of the cervical (see Figs. 188, 189), dorsal or lumbar vertebræ, if the luxation is complete, pressure upon the spinal cord

Fig. 188.



Fig. 189.



Fig. 188.—A FRONT VIEW OF A LUXATION OF THE SPINE BETWEEN THE FOURTH AND FIFTH CERVICAL VERTEBRÆ, the patient having fallen backwards over a high paling and alighted on his head. The spinal cord was torn, and there was complete paralysis, followed by death in a few days. (After Miller.)

Fig. 189.—A side view of the same, the spinal canal being laid open in order to show the compression and laceration of the spinal cord. (After Miller.)

at the seat of the injury, and more or less paralysis of the parts supplied by nerves given off below the seat of compression, will generally ensue, this being followed by death if the pressure is long continued.

Symptoms.—The symptoms in those cases which have not at once terminated fatally, have generally been those of compression of the spinal cord, paralysis of the extremities, &c. Besides which, a careful examination of the spinal column will sometimes reveal the displacement of one or more of the spinous processes at the seat of the injury.

Diagnosis.—The permanency of the deformity, the immobility and twisted direction of the column, with the sudden paralysis, generally suffice to show this injury, and to distinguish it from a fracture.

Prognosis.—The prognosis is always grave, the patient rarely recovering completely from the effects even of a partial luxation. With regard to the probability of a fatal issue, it may be stated, as a general rule, that the higher the seat of the injury the greater will be the danger to life.

Treatment.—The treatment requires great care. If the case has not immediately terminated in death, it may sometimes be possible by moderate extension and counter-extension to reduce the luxation, and this is especially the case in those instances in which the accident occurs to children from injudicious manœuvres on the part of parents or friends, such as lifting a child up by its ears to make it "see London;" when, as it struggles violently to free itself, a dislocation is produced, children having been known to drop dead under these circumstances. In such a case, if life is not extinct, it will be justifiable to make a moderate amount of extension by promptly drawing on the head with the hands, whilst counter-extension steadies the pelvis, the parts being at the same time coaptated laterally with a view to the reduction of the luxation. But, before the surgeon makes such an attempt, he should inform the friends of the little patient of the possibility of the manipulations increasing the lesion and causing instant death. A *partial* luxation of the vertebræ, or a luxation of an oblique process on one side, occasionally occurs, which can sometimes be reduced in the same manner. The after-treatment consists in rest in the horizontal position and the employment of means calculated to counteract and subdue the inflammation which will probably arise in the spinal cord or its membranes. Where paralysis occurs after such an accident, it will be requisite to attend carefully to the condition of the bowels and bladder, as in any other case of paralysis of the lower parts of the body.

§ 2.—LUXATION OF THE RIBS.

Luxation of the *head of a rib* from its articulations with the vertebra, though a rare accident, so rare, indeed, as to be denied by some very respectable surgeons, sometimes occurs, as is shown by the specimens to be found in some cabinets. The difficulties in the way of such an accident are apparent when the strength of the articulation of the ribs with the vertebræ is borne in mind, augmented as it is by the interarticular ligament, and the articulation with the transverse processes of the vertebræ, and supported by the mass of the muscles of the back. When the accident occurs, however, it is generally the result of such violence that the constitutional, rather than the local symptoms, become of importance,

and very little can be done in the way of reduction beyond mere coaptation by the fingers of the surgeon. The eleventh and twelfth ribs are those most likely to suffer from this luxation.

Luxation of the *sternal extremity of the ribs* sometimes occurs, and produces a well-marked deformity, which, if the cartilages on both sides are displaced, sometimes produces a prominence of the sternum resembling the condition ordinarily known as "chicken breast;" a condition sometimes found in children as dependent on the bending or displacement of the cartilages of the sixth, seventh, and eighth ribs.

Treatment.—In the treatment of these luxations, after reducing the displacement and overcoming inflammatory action, if the deformity is reproduced, compresses and a circular bandage may sometimes be required; but usually little can be done to remedy the deformity, the treatment being confined to the relief of the injuries of the internal organs of the chest consequent on the application of the force which created the luxation.

§ 3.—LUXATION OF THE CLAVICLE.

Luxation of the clavicle may occur at the humeral, or at the sternal extremity.

The *sternal end* may be luxated in three directions, forwards, backwards, and upwards. When a luxation forwards occurs, there is a prominence upon the front of the sternum due to the presence of the head of the clavicle which can be felt distinctly beneath the skin, a shortening of the pectoral space, and an inability on the part of the patient to raise the arm in the natural manner. The cause is generally some force applied to the shoulder in such a manner as to force the outer end of the clavicle towards the sternum. In the luxation backwards, there is also diminution of the pectoral space and inability to raise the arm, but instead of a prominence, there is a hollow where the head of the clavicle should naturally be found. The luxation upwards and towards the opposite clavicle can also be recognized by the position of the head of the bone.

Treatment.—In all these luxations of the clavicle the treatment is simple, the arm being used as a lever to draw the clavicle out to its proper length, whilst the shoulder is carried in a direction which

will correspond with the displacement, extension and counter-extension being made, and the shoulder so acted on as to throw the head of the bone back into place. Thus, in the luxation forwards, the shoulder should be carried forwards, in order to force the head of the bone backwards into its natural position. If the luxation is backwards, the shoulder should be carried backwards so as to throw the head of the bone forwards into position; whilst in the luxation upwards the shoulder should be carried upwards and outwards so as to throw the sternal extremity down into its position. The luxation being reduced, the after-treatment consists in the application of some apparatus suitable for the treatment of fracture of the clavicle, as Fox's, Dessault's, &c., but it is extremely difficult to keep the parts in position, and, in spite of every care, more or less deformity generally results, a fact which the surgeon should bear in mind in his prognosis.

There may also be a dislocation of the *scapular extremity of the clavicle*, and as its articulating surface is of small size, any force which ruptures its ligaments will prove capable of producing the luxation. This may occur in two directions; in the one the extremity of the clavicle slips above, and in the other it slips beneath the acromion process of the scapula. Both these luxations are extremely easy to reduce. If the scapular extremity of the clavicle rests on top of the acromion process of the scapula, by elevating the shoulder, at the same time that it is drawn outward, the bone will be brought into its place. So when the scapular extremity of the clavicle has slipped under the acromion process of the scapula, by drawing the shoulder outwards and depressing it slightly, the end of the bone will start into its place. But the difficulty which will be experienced in the treatment will be found in the fact, that, although comparatively easy to reduce, the bone will again slip out of place so soon as the reducing force is relaxed, and it is often extremely difficult to contrive such a dressing as will retain it in position until union occurs in the lacerated ligaments. Fortunately, however, even should the treatment fail to retain the bone in its original position, the usefulness of the limb will only be impaired to a very limited extent. All the motions of the arm can readily be performed except extreme elevation, and the patient will be able to use the limb in all the ordinary avocations of life. In a female, however, and particularly in a young female, the trifling deformity which results being apparent whenever she wears a low-

necked dress, it becomes a matter of some importance to correct it; and even in a man, the surgeon will always desire to make as complete a cure as possible. There are but two bandages capable of holding the bone in position; one is the bandage of Velpeau for

Fig. 190.



A FRONT VIEW OF THE SPICA BANDAGE OF THE SHOULDER AS APPLIED FOR THE RETENTION OF A LUXATION OF THE HUMERAL END OF THE CLAVICLE.—In its application, commence by applying the Spiral Bandage of the upper extremity, covering in the whole limb from the fingers to the shoulder so as to protect the skin of the arm from the congestion of its veins. On reaching the shoulder, carry another roller obliquely across the chest round under the sound axilla over the luxated end of the clavicle; thence under the axilla of the injured side, over the point of the shoulder, and then under the sound axilla to follow the same course, each turn covering in two-thirds of the preceding turn, and forming a spica on the shoulder as shown in the cut. (After Nature.)

fracture of the clavicle, the arm being bound to the chest by oblique turns, whilst the hand of the patient grasps his sound shoulder; the other, that of the spica of the shoulder (Fig. 190), which is, perhaps, the best of the two for those cases in which its pressure can be borne.

§ 4.—DISPLACEMENT OF THE LATISSIMUS DORSI MUSCLE FROM THE LOWER END OF THE SCAPULA.

There is an injury sometimes alluded to in connection with these luxations, although it does not come within the definition assigned to such injuries, and this is the displacement of the latissimus dorsi

muscle. As the tendon of the latissimus dorsi plays over a triangular surface at the outer side of the inferior angle of the scapula to which it is more or less firmly attached, it sometimes happens, in consequence of a fall or some other violence, that the muscle slides off this surface and slips down beneath the scapula, in consequence of which the patient loses more or less the power of this muscle in depressing the arm.

Symptoms.—This injury may be recognized without any great difficulty by the change in the power of the arm when elevated, and by the unusual prominence of the point of the scapula.

Treatment.—To reduce it, draw the arm back so as to relax the muscle as much as possible and coaptate the parts with the fingers, after which the arm should be retained against the side of the body by circular turns of a bandage until adhesion of the displaced muscle occurs.

CHAPTER III.

LUXATIONS OF THE UPPER EXTREMITY.

SECTION I.

LUXATION OF THE HUMERUS.

Anatomical Relations of the Shoulder-Joint.—In the shoulder-joint the spherical head of the humerus plays against the comparatively superficial glenoid cavity of the scapula, which, although deepened by the glenoid ligament, is yet so shallow that the head of the bone may readily be brought to bear against the capsular ligament; and, if sufficient force is applied, lacerate it and escape from its natural articulating position.

Such an accident would be of daily or hourly occurrence were it not guarded against by the great mobility of the scapula which gives way before every force in such a manner that it might seem almost impossible to displace the head of the humerus. Statistics, however, show that this luxation is of comparatively frequent occurrence; most probably because sudden forces take the muscles by

surprise, and act before they have time to accomplish that adaptation of parts which might prevent the displacement. In considering the anatomy of this joint, with a view to the correct understanding of the manner in which these luxations occur, it should not be forgotten that the surrounding muscles exercise a considerable influence upon the joint by adding greatly to its strength; thus the tendon of the long head of the biceps passes through the joint within the capsular ligament in its course from its origin from the upper edge of the glenoid cavity to its insertion into the tubercle of the radius, while the supra-spinatus muscle stretches from its origin above the spine of the scapula to its insertion in the greater tuberosity of the humerus, thus passing over the top of the joint and strengthening it above; the function of this muscle being to assist in the extreme elevation of the arm. More superficially the joint is covered above by the deltoid, while below and laterally are the two teres, the sub- and infra-spinati, and the coraco-brachialis muscles.

Etiology.—The luxation of the head of the humerus may be caused by two classes of forces; first, those applied directly to the head of the bone, as falls or blows upon the shoulder-joint; and, secondly, indirect violence, such as that resulting from falls upon the hand or elbow, whilst the arm is carried off from the body, the force being transmitted through the bones of the forearm or arm to the shoulder, and the resistance made by the weight of the body.

Varieties.—Luxations of the head of the humerus occur in three directions:—

1. The inferior part of the capsular ligament may be lacerated, and the head of the bone escape down into the axilla, putting all those muscles upon the stretch, which, like the supra-spinatus and deltoid, tend to hold it up in its natural position. This is the luxation *downwards*.

2. The capsular ligament may be lacerated in front, and a luxation of the head of the humerus *forwards* ensue.

3. The capsular ligament may be lacerated posteriorly, and the head of the bone slip out to take a position below the spine of the scapula, this being described as a luxation *backwards*.

Besides these entire or complete forms, there may be an incomplete luxation, in which the head of the bone will rest upon the extreme edge of the glenoid cavity.

Symptoms.—The first symptoms which should be looked for in

order to establish the presence of these injuries are those which may be classified under the general head of deformity. In order to understand this deformity, and to recognize it when it exists, the natural rotundity and fulness of the shoulder should be borne in mind, as well as the fact that the acromial extremity of the clavicle, and the two tuberosities of the humerus, are naturally on the same level. Bearing these facts in mind, the presence of the various deformities will be readily recognized.

§ 1.—LUXATION OF THE HUMERUS DOWNWARDS INTO THE AXILLA.

Symptoms.—When luxation of the head of the bone into the axilla occurs, there is a flatness of the shoulder, the natural rotundity of the joint being destroyed, and a depression created; the surgeon being able, in thin patients, to hook his fingers under the acromial process of the scapula. As the deltoid muscle is put upon the stretch by the displaced bone, the arm is usually carried off from the side, whilst, if the surgeon feels in the axilla, he will there find the head of the humerus, forming a smooth round tumor, which, in thin subjects, is even readily perceptible to the sight. Generally there is, in addition, a marked change in the length of the limb, as may be proved by measuring it and the sound limb between two fixed points, as from the acromion process of the scapula to the external condyle of the humerus, measuring first the sound side and afterwards the injured one. In a case of luxation downwards in a full sized adult, the limb will be found lengthened an inch or an inch and a half. Besides the lengthening of the limb, there is also loss of power; the patient not being able to hold the limb by its own muscles, and therefore resting the elbow upon his knee, or supporting it with the hand of the opposite side. If the surgeon seizes the arm and attempts to elevate it, great pain will be caused in consequence of the pressure of the head of the bone upon the axillary plexus of nerves. For the same reason, if the luxation continues unreduced for several hours, the patient will often experience a tingling sensation in the fingers, whilst a certain amount of cedematous swelling will ensue in consequence of the pressure made by the head of the bone upon the axillary bloodvessels.

Diagnosis.—These symptoms, when taken collectively, are so marked, that a case of luxation downwards into the axilla can gene-

rally be recognized with but little difficulty. Still, cases are occasionally presented in which, from the swelling caused by effusion into the surrounding tissues, the diagnosis cannot be certainly made; or difficulty may result from the fact that the luxation is combined with fracture. In the first case, the measurement of the length of the limb becomes peculiarly useful. In the second, the symptoms of fracture of the neck and head of the bone must be borne in mind.

§ 2.—LUXATION OF THE HUMERUS FORWARDS.

Luxation forwards presents a very different condition of parts. The capsular ligament, in this case, is ruptured anteriorly, and the head of the bone escapes forward to take a position on the front of the chest, a little distance below the clavicle, and directly beneath the great pectoral muscle. There is another luxation which sometimes occurs, and which is a secondary one, in which the head of the bone leaves this new position, and assumes one higher up and nearer the clavicle.

Symptoms.—When the head of the bone gets into this position, the elbow is carried off from the side more strongly than in the dislocation downwards, and any effort to bring it in towards the chest gives great pain. The arm, also, projects more or less backwards. The deltoid muscle is not put so much upon the stretch as in the last variety, nor is the shoulder so much flattened; but in a thin person, the fingers of the surgeon may now also be readily hooked under the acromion process, whilst the roundness caused by the head of the bone may be seen near the position of the coracoid process of the scapula, as is shown in Fig. 191.

§ 3.—LUXATION OF THE HUMERUS BACKWARDS.

If the force is applied whilst the arm is carried across the body, the capsular ligament will give way posteriorly, and a dislocation backwards ensue. This deformity is entirely different from the last variety. In luxation backwards, the elbow goes forwards and against the body; whilst in luxation forwards it went backwards and from the body. The head of the bone, also, forms a tumor upon the inferior fossa of the scapula, resting upon the infra-spi-

natus muscle, where, if the patient is comparatively thin, it may be distinctly felt.

Fig. 191.



A front view of the flat appearance of the Shoulder seen in Luxation of the Head of the Humerus forwards. (After Miller.)

Mechanism of Luxations of the Head of the Humerus.—In order to understand the manner in which the force is to be applied to reduce these luxations, their mechanism and the muscular attachments concerned should be thoroughly understood.

When the head of the bone is luxated downwards into the axilla, the supra-spinatus muscle is put upon the stretch; it is also spasmodically contracted, and its spasmodic contraction in the new position of the bone serves to draw the head of the humerus firmly up against the inferior edge of the glenoid cavity; hence, the spasmodic contraction of this muscle is one of the obstacles which must be overcome in the reduction. Another muscle put upon the stretch and spasmodically contracted, to some extent, is the deltoid, which acts similarly. The other muscles are but slightly changed, the latissimus dorsi and the pectoral being a little relaxed. In the reduction of the luxation downwards, means must, therefore, be used to overcome the spasmodically contracted muscles, in order to draw the head of the bone clear of the lower edge

of the glenoid cavity; after which, the humerus can readily be carried off from the body, so as to ride clear of this edge back into its place. In so marked a manner does the contraction of the supra-spinatus aid in retaining the bone in its unnatural position, that in a *post-mortem* examination of a patient who died whilst laboring under an unreduced dislocation of the humerus downward, Sir Astley Cooper, cutting away the muscles one after another, found himself unable to reduce the bone until he had divided the tendon of the supra-spinatus muscle.

In the dislocation forwards, the supra-spinatus is also put upon the stretch, but not so much as the infra-spinatus. The latissimus dorsi is also slightly stretched or entirely unchanged, while the pectoralis major is much relaxed, and would be still more so, were it not for the tumor formed beneath its belly by the head of the bone. The chief obstacles to the reduction are the contractions of the supra and infra-spinatus with the deltoid, and the force must, therefore, be applied in such a manner as to overcome these muscles, in order to accomplish the reduction.

In the dislocation backwards, the latissimus dorsi, the supra-spinatus, the sub-scapularis, and the teres major muscles with the pectoralis major, will be stretched, and the deltoid and infra-spinatus relaxed.

Diagnosis.—Besides the ordinary points of diagnosis which apply equally to all luxations, such as the diagnosis from diseases of the bones, from fracture, &c., it sometimes happens that in consequence of a sprain or blow, or an injury of the circumflex nerves, or of causes not precisely understood, an atrophy of the deltoid muscle takes place, in consequence of which a flatness of the shoulder is produced, simulating somewhat the appearances presented by a dislocation downwards. The diagnosis, however, is easy, as the limb retains almost its natural length; and although the shoulder is flattened, the fingers cannot be hooked under the acromion process as perfectly as they can be in cases of luxation, nor can the head of the bone be felt in the axilla. The disease is to be treated on the principles required for the development of the muscles, as friction, cold douches, and electricity, the current being made to pass through the deltoid, by applying one pole of the current in the axilla, and the other to the muscle.

Treatment.—As muscular contraction is the chief obstacle to the reduction of these luxations, whatever aids in inducing muscular relaxation must facilitate the replacing of the head of the bone in

its true position; and there is no better method of inducing this complete muscular relaxation than by means of anæsthesia as produced by ether, or ether combined with chloroform, in the proportion of one part of chloroform to three of ether *by weight*. In the application of any mechanical force for the reduction of this luxation, even when the patient is insensible, the variety of the luxation must be taken into consideration.

In the luxation downwards into the axilla, if the patient is

Fig. 192.



A front view of the Position of the Surgeon and Patient in a Reduction of a Luxated Humerus, by placing the knee in the patient's axilla, and bending his arm over it whilst counter-extension is made at the scapula. (After Cooper.)

completely etherized, it will generally be sufficient, if he is reclining, for the surgeon to make counter-extension with one hand against the axilla, whilst extension is made at the elbow of the injured side with the other, the arm being gradually extended at right angles to the body, so as to free the head of the bone from the inferior edge of the glenoid cavity; or, if the patient is seated or held up, by depressing the arm over the knee placed in the axilla. (Fig. 192.) But should these means fail, or should any circumstance prevent the use of ether, the following plan may be adopted. Place the patient in the recumbent position, and, protecting the axilla by a wad of cotton, carry the arm off, at an obtuse angle, from the body, in order to relax the supra-spina-

tus and deltoid. Then the surgeon, drawing off his boot, should sit down by the patient, and place his foot on the pad in the axilla, where it will make counter-extension while he makes extension with his hands by drawing on the wrist, or by drawing on a band made fast by a clove hitch to the arm above the elbow, as shown in Fig. 193. When the muscles begin to yield to this force, bend the arm suddenly over the foot towards the body, and, relaxing the extension, the head of the bone will generally return into its place with an audible snap.

But where ether cannot be obtained this plan will often fail,

especially if the patient be a muscular man. In such a case, it may become necessary to use pulleys, attaching them to the limb by the clove-hitch, in the manner that will be hereafter described in connection with luxations of the femur. Counter-extension may be made by means of a folded sheet or towel placed in the axilla,

Fig. 193.



A side view of the mode of reducing a Luxation of the Head of the Humerus into the Axilla, by extension at the elbow, whilst counter-extension is made by the foot of the surgeon pressing against a pad in the patient's axilla. (After Cooper.)

or by a nicely padded buckskin band. But even when the pulleys are employed, much of the success of the treatment will depend upon the use of such manipulation as will rotate the head of the humerus free from the edge of the glenoid cavity.

The same general rules will be applicable for the reduction of the luxation backwards and the luxation forwards, but with some modification in the direction of the force applied. In both cases, as in that just described, the extending force is to be employed in the line which is naturally taken by the luxated limb; thus in the luxation forwards the line of the extending force should carry the limb off from the body, and in the luxation backwards carry it towards the body.

After-Treatment.—Having reduced the luxation, the after-treatment will consist in any means, such as Fox's apparatus, &c., which will keep the parts at rest until union of the lacerated capsular ligament has occurred; the patient being advised for some length of time to abstain from any motions which would be likely to bring the head of the bone to bear upon the injured portion of the capsular ligament.

Occasionally the injury to the parts surrounding the joint resulting from the force which produced the accident, or from that which is employed in the reduction, causes such a degree of inflammatory action as requires the use of active antiphlogistic measures. Thus it may be necessary to cup or to leech around the part, or to apply cold cloths, cloths wrung out of lead-water, &c.

Should paralysis of the limb, either partial or complete, result from pressure of the head of the bone upon the axillary plexus of nerves, those measures must be resorted to which are adapted to local paralysis; as stimulating liniments, blisters, or blisters dressed with strychnine. Should these measures fail, much may be done by the judicious employment of electro-galvanism; by cold douches, etc., and in the majority of cases the judicious employment of these measures will ultimately restore the usefulness of the limb.

§ 4.—COMPOUND LUXATIONS OF THE SHOULDER-JOINT.

A compound luxation of the shoulder is a dangerous injury, more so even than compound fractures of the neck of the bone. In its treatment, the parts should first be cleansed thoroughly of all foreign matters, after which the bone should be returned into place, and inflammation actively combated. Should the head of the bone protrude from the wound, and the muscles around it become spasmodically contracted so as to prevent its reduction, the orifice through which it protrudes should be enlarged with a scalpel, sufficiently to enable the bone to be returned into its place as directed in the case of compound fractures, or the head of the humerus may be sawn off, as in a resection of this bone for disease of the shoulder-joint.

SECTION II.

LUXATIONS OF THE ELBOW-JOINT.

Anatomical Relations.—The elbow-joint is composed of the articulating surfaces of the condyles of the humerus, the head of the radius and the sigmoid cavity of the ulna, the part of the articulating surface of the humerus which the olecranon and coronoid pro-

cesses of the ulna play, being called the trochlea, or sometimes the epitrochlea. The articulation of the ulna with the humerus is strengthened by the anterior, posterior, and lateral portions of the capsular ligament of the joint; by the shape of the olecranon and coronoid processes, and by the attachments of muscles, particularly the biceps, which is inserted into the tubercle of the radius, whilst the brachialis anticus is inserted into the coronoid process of the ulna. The radius which articulates with a little head near the external condyle of the humerus, is bound to the ulna by the orbicular ligament into which many of the fibres of the external lateral ligament are inserted. This joint presents, therefore, an excellent specimen of the ginglymoid variety of articulations.

Varieties.—When a sufficient force is applied to produce a luxation of the elbow-joint, it may occur in three different directions. In the first, both bones of the forearm go backward, and the coronoid process of the ulna rests in the greater sigmoid cavity of the humerus. In the second, both bones go outwards, and in the third, both bones go somewhat inwards. It is nearly impossible that a dislocation of the bones of the forearm forwards should occur independently of fracture of the olecranon process. In the lateral luxations, although both bones are displaced from their natural articulating surface, both are not entirely removed from their connection with the humerus. Thus, in the luxation outwards, the radius is entirely removed from the humerus, while the ulna, though displaced from its position in the epitrochlea, is still in contact with the humerus, resting at a point corresponding with the articulating face for the radius. So in the luxation inwards, the ulna may be driven entirely off the articulating surface designed for it, while the radius, though luxated from its natural position, will still remain in contact with the humerus at a point corresponding with some part of the epitrochlea.

§ 1.—LUXATION OF BOTH BONES OF THE FOREARM BACKWARDS.

The *luxation of both bones of the forearm backwards*, may be produced by force applied to the hand while the forearm is extended upon the arm, so that the head of the humerus may be brought to bear against the anterior face of the capsular ligament, as when a patient falling forward extends his hands to save himself.

Symptoms.—The symptoms are marked. There is a deformity which is quite characteristic, and which may be described as having a general resemblance to the shape of the heel of the foot, the triceps being put upon the stretch and its tendon brought into a position comparable to that of the tendo-Achillis, while the olecranon projects backwards after the manner of the os calcis. (Fig. 194.) There is pain, which is often very severe from pressure upon

Fig. 194.



A side view of the appearance of the Elbow-Joint when both bones of the forearm are luxated backwards—showing the lengthening of the elbow and the shortening of the forearm. (After Liston.)

the ulnar nerve, this being sometimes pinched between the two bones, whilst there is also laceration of the fibres of the muscles and ligaments on the front of the articulation. In addition, there is more or less loss of motion in the joint, the arm being held in a semiflexed position which admits neither of complete flexion or extension. There is also a change in the length of the forearm, as may be proved by taking the measurement of the sound forearm from the internal or external condyle of the humerus to the styloid process of the radius or ulna, and applying the same measurement to the injured limb, when that in the side which is luxated will be found to be shortened to the extent of an inch or an inch and a half.

If a circular line be drawn around the joint through the condyles of the humerus, as was directed in fracture of the condyles, it will

also be found that it no longer cuts the point of the olecranon, this being usually found some distance above its normal position.

Diagnosis.—The injury most likely to be confounded with this luxation is fracture of the condyles, and particularly such a fracture as allows the bones of the forearm to slip backwards. The latter case sometimes requires nice discrimination; but a diagnosis can generally be made, because the signs of fracture are superadded to those of dislocation. Thus the pain of fracture is present, this being described by the patient as sharp and cutting, while that of luxation is dull and obtuse; and in drawing the circular line around the elbow-joint it will be observed that one of the condyles is out of line as well as the olecranon process. But the most satisfactory diagnostic mark is, that while the luxation when combined with fracture can be reduced with ease, yet upon removing the extending and counter-extending force the deformity is at once reproduced. A simple luxation also requires more force to reduce it than one consequent on a fracture, whilst it also retains its position after the reduction, which one due to a fracture does not.

Treatment.—In the luxation of the bones of the forearm backwards, as the contraction of the biceps and brachialis anticus pull the coronoid process of the ulna violently against the humerus, thus preventing the reduction, force must be employed to draw the bones off from the humerus, that they may be slipped forward into place. This may be done by etherizing the patient thoroughly, and then seizing the forearm with one hand, draw off the humerus with the other so as to make counter-extension, and flex the forearm, when reduction will generally be accomplished. But if this is not sufficient, or if from any cause ether cannot be employed, two towels may be folded and placed one around the arm and the other around the forearm, and be confided to two assistants, the strongest assistant seizing that attached to the forearm. Then, while the surgeon makes extension by the hand of the patient and forcibly flexes the forearm, traction is to be exercised simultaneously by both assistants, when the luxation will hardly fail to be reduced. In many instances, however, even without etherization, all that is necessary to reduce this luxation will be for the surgeon to make extension and counter-extension with his hands at the same time that he flexes the forearm forcibly over his knee, or around a padded bed-post, which answers the same purpose.

§ 2.—LATERAL LUXATION OF THE ELBOW.

The *lateral luxations of the elbow* are of rare occurrence.

Etiology.—They are produced generally by a force applied laterally while the arm is flexed.

Symptoms.—There is an increased width of the joint, distinguishable from that of fracture of the condyles by the fact that the olecranon process, or the head of the radius can be felt projecting abnormally on one side of the articulation, and being also unaccompanied by the acute pain which always attends a fracture.

Prognosis.—The prognosis in lateral luxations of the elbow-joint should be guarded; for, although, if the character of the injury is recognized, it can generally be reduced and deformity avoided, yet ankylosis more or less complete is very liable to occur, from the laceration of the ligaments of this close articulation. To prevent dissatisfaction, the patient should always be informed of this fact at an early period.

Treatment.—The lateral luxations are to be reduced by the application of force in a lateral direction, whilst the forearm is flexed upon the arm. The force may be produced by a towel passed around the forearm and confided to the hands of an assistant, sufficient extension and counter-extension being kept up at the same time to prevent the bones binding against each other.

§ 3.—LUXATION OF THE HEAD OF THE RADIUS.

The head of the radius may be luxated without involving the articulation of the ulna with the humerus. This luxation is described as occurring forwards or backwards. When it occurs backwards the biceps, which is inserted into its tubercle, is put upon the stretch, whilst in the luxation forwards this muscle is relaxed.

Etiology.—The luxation backward is generally caused by falls upon the hand when in extreme pronation, while the luxation forward occurs when the hand is in extreme supination, or sometimes the backward luxation has been produced by violent muscular efforts, as in the case of washerwomen wringing clothes. Both accidents are of rare occurrence, so much so that their existence

has been denied by some surgeons. The luxation backward is perhaps the more common.

Symptoms.—A careful examination of the elbow-joint will generally reveal the nature of the accident; in the luxation backward the hand will be found strongly pronated, while after luxation forward forced supination of the hand will be observed.

Treatment.—The reduction is accomplished as follows: In the luxation backward flex the forearm upon the arm to relax the biceps, and bring the hand from pronation into forced supination; but in the luxation forward the forearm should be extended, and the hand carried from supination into forced pronation. It is evident, therefore, that it is a matter of considerable importance to distinguish between these two accidents, for nothing but failure could be anticipated should the surgeon attempt to reduce the luxation backward with the manipulations appropriate to the displacement forwards.

§ 4.—LUXATION OF THE ULNA.

Luxation of the ulna, by itself, from its articulation with the humerus, is a rare accident; though it sometimes occurs. When it is created, the symptoms so precisely resemble those of the luxation of both bones backward, and the treatment is so much the same, that no further reference than the mere mention of the possibility of the accident is required.

SECTION III.

LUXATIONS OF THE WRIST.

Anatomical Relations.—The wrist-joint is formed by the articulation of the radius and ulna with the first row of the carpal bones. Although it is not necessary to go minutely into its anatomy in this place, yet it may be mentioned that the capsular ligament, which is loose and comparatively feeble, is strengthened by the internal and external lateral ligaments, by the sacciform ligament, and by the presence on the palmar surface of the flexor, and on the dorsal surface of the extensor tendons. Special luxations of

the radius or of the ulna alone at the wrist-joint are, moreover, somewhat guarded against by the attachments of the pronator quadratus muscle, which binds the two bones together, and tends to prevent such an accident.

Varieties.—Four luxations of the wrist-joint are usually described by writers; thus we are told of luxations forward and backward, as well as of two lateral luxations. These accidents, when met with, are so generally created by extreme violence, that the opinion has already been expressed, in connection with the subject of Barton's fracture, that they are rare when unaccompanied by fracture, if, indeed, they ever occur, except from the application of great force. The remarks now made refer, therefore, less to such luxations as are the result of simple violence than to a class which are the effect of a peculiar train of circumstances. Thus, if certain predisposing causes, as paralysis, or preternatural relaxation of the ligaments of the wrist exist, or if an individual has labored for a considerable length of time under a spasmodic contraction of certain muscles, or if sudden force is applied to the hand, a luxation may undoubtedly ensue and be unaccompanied by fracture, and this may occur in any of the four directions above alluded to.

When a luxation forward occurs, that is, when the bones of the forearm go forward, and those of the carpus go backward, the hand is violently extended, the flexor tendons stretched, and there will be a considerable prominence on the back of the wrist. Such a luxation is readily reduced by carrying the hand forward, while a moderate degree of extension and counter-extension is made. In the luxation of the bones of the forearm backward, in which the bones of the *carpus* are displaced forward, the hand will be flexed, the extensor tendons put upon the stretch, and the tumefaction be upon the front of the hand. In such a case, extension and counter-extension should be made, and the hand carried in the opposite direction to that given for the last injury. After the reduction in either injury the parts should be kept as much at rest as possible, and inflammation be actively combated. Should the luxation have resulted from violence, as is usually the case, the inflammation will often run so high as to induce sloughing of the integuments over the joint, or caries of its bones.

§ 1.—LUXATION OF THE LOWER END OF THE ULNA ONLY.

Luxation of the inferior extremity of the Ulna by itself is an injury which sometimes occurs as a result of violence, or is caused by falls, &c. In order to permit it the sacciform ligament must be considerably lacerated or entirely ruptured.

Treatment.—Extension and counter-extension, properly applied, will be sufficient to reduce the injury, and a compress and roller will retain the displaced bone in position.

SECTION IV.

LUXATION OF THE CARPAL BONES.

The *bones of the carpus* are sometimes luxated. Generally, however, the force which displaces one of these little bones produces also such an injury in the soft parts as induces a degree of inflammation which renders attention to the latter the most important part of the treatment; and nothing in the way of reduction, except a moderate degree of coaptation, can be effected.

§ 1.—LUXATION OF THE OS MAGNUM.

The *os magnum*, however, is sometimes the seat of a simple luxation. The head of the magnum, when luxated from its articulation with the first row of carpal bones, presents a small tumor on the back of the wrist, and is to be reduced by making moderate pressure with the thumb upon the bone, while at the same time the surgeon makes flexion and extension of the hand; after which the parts should be kept at rest, and inflammation combated.

§ 2.—LUXATION OF THE OS PISIFORME.

The *os pisiforme* is also sometimes luxated, an accident which becomes important, on account of its relaxing the tendon of the

flexor carpi ulnaris, which is inserted into it. This luxation is to be reduced by simple manipulation, but, like the accident last described, is comparatively rare.

SECTION V.

LUXATION OF THE METACARPAL BONES.

The *metacarpal bones* may be luxated from their connection with the carpus. The metacarpal bone of the thumb is, however, the only one which would be likely to be displaced, except as the result of such a force as would produce a compound luxation. They may also be luxated at their phalangeal articulations.

§ 1.—LUXATION OF THE METACARPAL BONE OF THE THUMB.

Luxation of the metacarpal bone of the thumb at its superior end upon the carpus is sometimes quite troublesome. It may be caused by a fall, or any similarly applied force; and, when it occurs, happens generally in one of two directions, either forwards or backwards. This fact, also, is to be noted in luxations between the inferior end of the metacarpal of the thumb and its first phalanx, as well as in the phalanges of all the fingers; the great strength of the external and internal lateral ligaments, as compared with the capsular ligament on the posterior and anterior face of the joint, preventing lateral displacement.

Fig. 195.

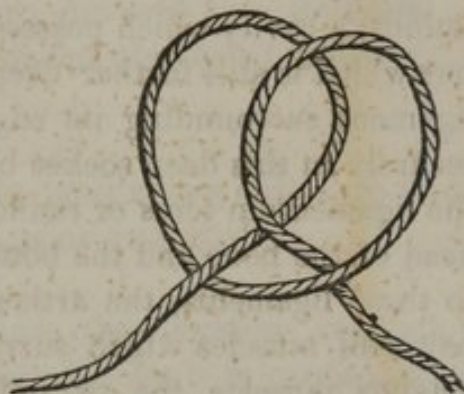


When the luxation occurs at the metacarpo-phalangeal articulation of the thumb, the end of the phalanx, corresponding in its general shape with the head of the tibia, rides over the head of the metacarpal bone, comparable in shape to the rounded head of the condyles

of the femur, and the inequalities of the surface prevent reduction, unless the two bones are separated by a proper extending and counter-extending force, and the lower bone is made to describe the arc of such a circle as will free these prominences. (Fig. 195.)

Treatment.—In order to reduce this luxation, it is necessary to obtain perfect control of the finger or thumb, and this is best done by means of what is known as the *clove hitch*, a knot which may be made for the metacarpo-phalangeal luxations out of a piece of tape. (Fig. 196.) In making this knot, two loops should be formed in reverse directions, and then brought up the one behind the other, as in the figure. For other luxations, such as the arm or thigh, the *clove hitch* may be made of a towel, sheet, handkerchief, or any proper material. Having attached this knot to the luxated member, extension should be made in the case of the thumb by giving its phalanx a circular movement, so as to enable the projecting surfaces to pass each other, when the reduction will be ultimately accomplished, though it may require repeated trials, owing to the difficulty of acting on so short a piece as a phalanx.

Fig. 196.



CHAPTER IV.

LUXATIONS OF THE LOWER EXTREMITIES.

LUXATIONS of the articulating surfaces of the bones of the lower extremities present a class of injuries which are much more serious than the luxations previously described, the reduction being more difficult, the accompanying symptoms more severe, and the consequences, when they are improperly treated, more important.

SECTION I.

LUXATION OF THE HIP-JOINT.

Anatomical Relations.—The *hip-joint* is formed by the articulation of the round head of the femur with the deep cavity of the acetabulum; a cavity which possesses considerable depth in the skeleton, but which is still further deepened in the patient by the cotyloid ligament surrounding its edge. The head of the femur is held securely in this deep socket by a strong capsular ligament, and by the ligamentum teres or round ligament which passes between the head of the bone and the bottom of the acetabulum. In addition to these ligaments, the articulation is materially strengthened by powerful muscles which surround it, such as the glutei and psoas magnus muscles, the pyramidalis, gemini, obturators, quadratus femoris, and the powerful muscles of the front and inside of the thigh, as the rectus, adductors, &c. &c. All these render this articulation so firm that the femur is seldom displaced unless the muscles are taken by surprise, and the force producing the luxation is not only great but sudden; or unless the head of the femur or the articulating cavity of the innominatum are altered by disease so as to permit the action of the muscles to create the displacement.

Varieties.—Luxations of the head of the femur may occur in four different directions, and these may be arranged into two classes for the purposes of study. Thus, the four varieties of this luxation may be divided into two—1, those in which the head of the bone goes backwards, and 2, those in which the head of the bone goes forwards of the acetabular line, thus making two of each class.

This classification, it must be admitted, is not strictly accurate, yet is it sufficiently so to facilitate the investigation of the symptoms of each variety, and aid the memory in recalling them. It may also be stated—although, like the classification given above, it must be taken with some modification—that all the luxations backward, turn the toes and the foot of the injured side, more or less inwards, whilst all those in which the head of the femur passes forwards, or in which it takes a position anterior to

the acetabulum, turn the toes more or less outwards; in the one the foot is inverted, in the other everted.

The varieties above alluded to may then be enumerated as follows:—

Backwards.—1. *Luxation upwards and backwards upon the dorsum of the ilium*, the head of the femur resting just behind the anterior-inferior spinous process.

2. *Luxation downwards and backwards into the ischiatic notch.*

Forwards.—3. *Luxation upwards and forwards upon the pubis.*

4. *Luxation downwards and forwards into the thyroid foramen.*

§ 1.—LUXATION OF THE HEAD OF THE FEMUR UPWARDS AND BACKWARDS UPON THE DORSUM OF THE ILIUM.

Etiology.—The causes which produce this luxation are such as apply force from below upwards, while the limb is carried across its fellow. It is accordingly found to result from falls, and particularly from falls upon the knees while carrying heavy weights, &c.

Symptoms.—The symptoms of this luxation are as follows: There is shortening, which is sometimes inconsiderable at first, but becomes very marked in a few hours, varying then from an inch and a half to two inches and a quarter, as ascertained by measurement made in the manner directed under the head of fracture of the thigh; or, if the force producing the luxation also forcibly adducts the limb, the shortening will be marked from the first moment after the accident. The foot is strongly inverted, the toes pointing towards the instep of the opposite foot, or resting upon it. (Fig. 197.) The limb is also very much adducted, and carried towards its fellow so that the knee rests upon the inner and under side of the opposite thigh. There is, moreover, an unnatural prominence upon the dorsum ilii, caused by the presence of the head of the bone beneath the muscles; a deficiency in the prominence of the trochanter major, and an unnatural flatness over the cavity of the acetabulum, which in a lean individual may be distinctly felt. The trochanter major can also be felt much closer to the anterior superior spinous process of the ileum than it is in the normal condition of the joint.

There is a total absence of crepitation, though sometimes a crackling can be heard in the neighborhood of the injured joint,

which might mislead a young surgeon; but experience will recog-

Fig. 197.



A front view of the Appearances in a Luxation of the Femur upwards and backwards on the Dorsum of the Ilium. (After Cooper.)

nize at once that it is the soft crackling of synovial or other liquid effusions, and totally different from the crepitation of fracture.

The patient usually complains of considerable pain, particularly when the parts are put upon the stretch by any motion such as that made by the surgeon in examining the parts.

Diagnosis.—With such symptoms there can hardly be any difficulty in making out a diagnosis under ordinary circumstances. From fracture of the neck of the femur, which is the only complaint likely to be confounded with it, this luxation upwards and backwards can be at once distinguished by the fact that in fracture the shortening is readily reduced, though it is reproduced so soon as the extending and counter-extending forces are removed; whereas in dislocation the deformity is reduced with much greater difficulty, the bone being

likely when reduced to remain in place. The diagnosis from the luxation which sometimes occurs in *morbus coxarius* as a result of change of structure will be given under that head.

Mechanism.—With regard to the manner in which the muscles concerned are affected, it will be readily understood, that the glutei muscles arising from the ilium and inserted into the trochanter major are very much relaxed, while the small rotatory muscles are put upon the stretch, or even more or less lacerated. The iliacus internus and psoas-magnus are violently stretched, and the lower adductors are more or less relaxed.

Treatment.—Few surgeons of the last two hundred years have probably ever been called on to attempt the reduction of a luxation of the femur without having vividly brought before their minds the powerful muscles, the spasmodic contractions of which it was admitted kept the luxated bone in its unnatural position.

Impressed with this idea, the necessity of resisting muscular contractility by mechanical force, and augmenting it until the power of the muscles was sufficiently overcome to permit the reduction of the displaced bone, was always strongly insisted on as the prominent indication in the treatment, though from time to time suggestions were made of the efficiency of certain manipulations in facilitating the extension and counter-extension in the reduction of the bone. It remained, however, for Dr. Wm. W. Reid, of Rochester, in the State of New York, to give such ideas a definite shape, and to prove that a luxated femur even in muscular individuals, and when displaced for several weeks, could be easily reduced in a few minutes by gentle manipulation, with but little pain to the patient, and with great ease to the surgeon, as compared with the heavy labor of thirty minutes or an hour formerly required of him. In consequence of this valuable suggestion of Dr. Reid, the practice of surgeons prior to the year 1850 will probably be entirely laid aside; pulleys, straps, hooks, sheets, &c., placed upon the shelf, and the former means of reducing luxations of the femur be hereafter looked on with the same feeling that a traveller regards the instruments of torture in the old Spanish inquisitions. In fact the 19th century in surgery will be sufficiently noted for its improvements if nothing else is developed than the inhalation of ether, and the admirable mode of reducing luxations of the femur suggested by Dr. Reid, both of which it should be remembered are improvements due to the surgery of the United States, though Europe begins to show a desire to appropriate them to herself.

Reid's Plan of Reducing a Luxation of the Femur upwards and backwards on the Dorsum of the Ilium,¹ solely by Manipulation.—“Place the patient on his back, on a low firm table, or what is better, upon a quilt folded and laid on the ground. Let the operator stand or kneel on the injured side and seize the ankle with one hand and the knee with the other. Then flex the leg on the thigh; next strongly *adduct* it, carrying it over the sound one, and at the same time upwards over the pelvis by a kind of semicircular sweep as high as the umbilicus. Then *abduct* the knee gently, turn

¹ Transactions of the Medical Society of the State of New York, at its Session, Feb. 1852, p. 25, but previously presented to the Monroe County Medical Society, May 8, 1850, and published in Buffalo Medical Journal, Aug. 1851, as well as in the Boston Journal.

Fig. 198.



A VIEW OF THE POSITION OF THE SURGEON AND PATIENT, IN THE ACT OF REDUCING A LUXATION OF THE FEMUR UPON THE DORSUM OF THE ILIUM.—The thigh being flexed on the pelvis, and the leg bent on the thigh, the surgeon is in the act of drawing the knee towards him with one hand, whilst with the other at the ankle he rotates the head of the femur into the acetabulum by the gentle oscillatory movement described in the text. (After Nature.)

the toes outwards, the heel inwards, and the foot across the opposite and sound limb, making *gentle oscillations of the thigh*, when the head of the bone will slip into its socket with a slight jerk, or an audible snap, and the whole limb will slide easily down into its natural position beside the other. In a recent case the whole operation can be accomplished in less time than it can be described."

The advantages claimed by Dr. Reid for this method are such as my experience of it in several instances strongly confirms.

1. It is simple; 2. The movements are natural; 3. There is little or no pain; 4. There is neither tonic nor involuntary spasms to contend with; 5. It is better adapted to and more certain of success in cases of long standing than extension by the pulleys; 6. It is free from danger under all circumstances, *provided* Dr. Reid's directions are accurately observed. "A rocking motion of the leg while the thigh is being brought to the *straight position* and strongly abducted," is objected to by him, as a source of failure in the mani-

pulation, if not of danger.¹ "When the thigh is flexed on the trunk, say at an angle of 45° , and is gently *abducted*, and the head of the bone thus brought close to the lower edge of the acetabulum, if, while gentle oscillations of the thigh are made at the knee, the head of the femur does not immediately enter the socket, the knee should be alternately elevated and depressed, thus varying the angle of the thigh. If by this manœuvre, alternated with the before-mentioned oscillating or lateral movement, the head does not enter, we should then cease all motion and hold the thigh and leg perfectly quiet for a short period, keeping the former still slightly abducted, so that all the muscles, &c., may become quiescent. The foot and leg must be kept still also, and firmly directed towards the opposite thigh; for if we relax or carry it outward we shall roll the head of the femur away from its resting-place and proximity to the acetabulum, and permit or provoke the muscles to draw it into the foramen ovale, ischiatic notch, or dorsum ilii. After a short time we may repeat our attempts, and in all suitable cases of from four to six weeks' standing, confidently anticipate a speedy and favorable issue."²

The importance of carrying out directions accurately cannot be too much insisted on in all operations, but especially in those which are novel, and I have, therefore, given Dr. Reid's own account in order that errors may be avoided. I have, in four instances, employed his method with success, two of the cases being on the dorsum of the ilium, one into the sciatic notch, one into the foramen thyroideum, and in May of 1852 reduced, before the Medical Class of the University of Pennsylvania, a luxation of eleven weeks' standing, in a boy of fourteen years of age. The facility with which a luxation on the dorsum of the ilium could be converted into one in the sciatic notch, first struck me in this case, and it is not the least extraordinary part of Dr. Reid's manipulation that the surgeon can readily convert any one form of luxation of the femur into another and then reduce it. In all instances in which I have resorted to Reid's manipulation, I have first etherized the patient, though I am satisfied that it can be done, as he advises, without inducing anæsthesia. My chief object in the etherization has been to prevent any straining and save the patient inconvenience, believing that the manipulation is so perfect that no muscular action is re-

¹ New York Journ. Med., July, 1855, p. 66.

² Op. citat., p. 66.

quired to replace the bone, the latter being carried into the acetabulum as it would be by similar manipulation on the skeleton.

With a view of contrasting the ease and simplicity of Reid's method with the plan which has been employed for years—each generation having apparently worked in the footsteps of those who preceded them—the position of the patient as he lies stretched between the powerful action of the pulleys and the counter-extending band in his perineum, is shown below. Even with this powerful extension it was often found impossible to stretch the limb, whilst, if the head of the femur hitched on the edge of the acetabulum and was drawn in an incorrect line, fracture of the neck of the femur was liable to be produced.

Fig. 199.



A side view of the Position of the Patient, of the Counter-extending Band (*a*), of the Extending Band (*b*) as made fast by a clove hitch above the knee, and of the Attachment and Position of the Pulleys (*c*) as formerly deemed necessary for the reduction of a luxation of the femur, the patient being at the same time bled *ad deliquium animi*, nauseated with tartar emetic, &c. (After Cooper.)

After-Treatment.—After the reduction of a luxation of the femur, the two limbs should be tied together and the joint kept at perfect rest for ten days or two or three weeks, in order that the lacerated capsular ligament may be allowed to heal. Should violent inflammation show itself around and within the joint, cups or leeches to the part, with the cold-water dressing and purging, may be demanded.

§ 2.—LUXATION OF THE HEAD OF THE FEMUR ON THE PUBES.

In the luxation forwards of the femur upon the pubes the head of the bone takes a position that is easily recognized, though this form of luxation is rare.

Etiology.—The causes of this luxation consist in the application

of a force so that the head of the bone will be forced upwards and forwards, whilst the foot is advanced, as in stepping into a hole, especially whilst carrying a weight on the shoulders.

Symptoms.—The symptoms are very marked; thus, the limb will be thrown into the characteristic position seen in Fig. 200, being carried off from its fellow, the foot everted, the toes especially being turned strongly outwards, so as to bring the heel into such a position that if the leg was slightly flexed upon the thigh, it would rest upon the instep of the sound limb.

The injured limb is slightly shorter than the sound one, the degree of shortening varying according to the circumstances of the case. If the head of the bone rests simply upon the front of the pubis, the shortening will be about one inch, this being most frequently the case; but if the femur has slipped up and taken a consecutive position anteriorly and just below the anterior superior spinous process of the ilium, the shortening becomes greater. This consecutive dislocation is generally accompanied with considerable laceration of the capsular ligament, as well as of the muscles inserted near the neck of the bone. The round ligament is also ruptured in this as in others of the complete displacements of the head of the bone. If the patient is a thin person, the head of the bone may be seen forming a tumor over the pubis, and its movements can be distinctly felt under the skin by the hands of the surgeon.

The patient suffers considerable pain, which is often very severe in its character from the pressure of the head of the bone upon the anterior crural nerves.

Treatment.—The reduction, according to Reid's plan, would be one of simple manipulation; the patient and surgeon being placed as before directed, the limb being strongly abducted in the right position, and the foot rotated still more strongly outward, so as to make the trochanter act as a fulcrum, and pry the head of the bone

Fig. 200.



A front view of the Position of the Limb after a Luxation of the Femur on the Pubes. (After Cooper.)

off from the pelvis, when it will slip into the foramen thyroideum. The thigh should then be strongly flexed on the pelvis, and be carried across its fellow, when, by rotating the leg outwards, so that the sole of the foot will look outwards and upwards, the head will be made to describe a semicircle backwards, till, coming over the acetabulum, it will suddenly slip into its place.

§ 3.—LUXATION OF THE FEMUR INTO THE FORAMEN THYROIDEUM.

Sometimes the head of the bone slips out of the acetabulum, and takes a position lower down than that just described, slipping into the *foramen thyroideum*. This luxation, though also rare, is more common than that just described.

Symptoms.—When it occurs, the limb is lengthened about two inches, the amount of this elongation being just equal to the distance of the centre of the foramen thyroideum below a horizontal line drawn through the centre of the acetabulum. The *foot* is

neither inverted nor everted, as a general rule, though it will be found much easier to evert it than to invert it. The *head of the bone* may be felt in its unnatural position in thin persons, and the thigh is so much abducted that it cannot be brought near its fellow. When the patient stands upright, the injured limb assumes a position which is quite characteristic, being shot out in advance of the body (see Fig. 201), and considerably lengthened. The muscles put upon the stretch are, the glutei, and the small rotatory muscles in the back of the thigh, while the adductors and pectineus are relaxed.

Treatment.—Like the two luxations above described, that into the thyroid foramen may be reduced by simple manipulation, consisting in flexing the thigh on the pelvis, carrying it across its fellow, and giving to it a certain amount of circumduction which slips the head of the bone into its place.

Fig. 201.



A front view of the Position of the Limb in a Luxation into the Foramen Ovale or Thyroideum. (After Cooper.)

§ 4.—LUXATION OF THE FEMUR INTO THE ISCHIATIC NOTCH.

This luxation, which is more frequent than the two preceding displacements, is that in which the head of the bone goes *backwards into the ischiatic notch*.

Etiology.—In order to produce this luxation, the force must be exerted so as to cause the head of the bone to bear against the posterior part of the capsular ligament. In two cases which recently came under my notice, one was the result of the patient slipping whilst rolling a bale of cotton up an inclined plane, the bale rolling back and striking against the knee, while another bale behind the pelvis held him stationary. The other occurred whilst the patient was coupling two railroad cars; the hind car striking the pelvis, whilst the knee was bent and fixed against the bumper of the front one.

Symptoms.—When such a luxation occurs the limb is slightly shortened, being usually from half an inch to an inch shorter than its fellow; and the toes are turned inwards, so that the great toe rests on the ball of the great toe of the other foot. (Fig. 202.) The head of the bone may be felt in a thin patient, if seen early after the accident, but otherwise it is difficult to recognize it, owing to the thickness of the glutei muscles. The chief muscles whose actions are to be overcome in this case are the rotatory muscles, as the pyramidalis, gemini, obturators, &c., the gluteus magnus muscle being relaxed.

Treatment.—To reduce this luxation by manipulation, the thigh must be flexed on the pelvis, and carried across its fellow, when it should be slowly abducted from the body, in a manner very similar to that directed in a case of luxation upon the dorsum ilii.

After-treatment.—In this, as in the other luxations, it will become

Fig. 202.



A front view of the Position of the Limb in a Luxation Backwards into the Ischiatic Notch. (After Cooper.)

necessary, after the reduction is effected, to combat inflammatory action, the two limbs being brought together and fastened, if the patient is restless, with a handkerchief or a bandage, and such antiphlogistic measures employed as the degree of the inflammation demands.

§ 5.—CONGENITAL LUXATION OF THE HIP-JOINT.

Etiology.—Under this designation is described a condition sometimes seen in children, either immediately after birth, when it may have been caused by violence effected during parturition, or not till some time afterwards, the latter coming under the designation of spontaneous rather than under that of congenital luxation. That such a displacement may occur, considerable relaxation of the muscles and ligaments surrounding the hip-joint must be present; and hence the condition generally arises from some want of innervation, or is the result of injury to the spinal cord, or disease within the acetabulum.

Symptoms.—This luxation presents very much the same symptoms as those already described—the position of the head of the femur being most frequently on the dorsum of the ilium.

Prognosis.—A case as thus presented is very difficult to treat, and one for which, indeed, no positive plan of treatment can be suggested. The luxation is generally reducible, but difficult to keep in place.

Treatment.—The treatment consists in reducing the bone as before directed, and in the employment of a splint for a few weeks, the use of such measures as are calculated to improve the general health, as cold bathing, tonics, and chalybeates being most beneficial. If the disease is dependent upon the tuberculous diathesis, as is sometimes the case, those measures which are required in the treatment of morbus coxarius will be necessary.

SECTION II.

LUXATION OF THE KNEE-JOINT.

Anatomical Relations.—The knee-joint is formed by the articulation of the condyles of the femur with the head of the tibia, and

strengthened by the position of the patella anteriorly. It has no proper capsular ligament, as its place is supplied by a structure formed principally at the expense of the fascia to which the term involucrum is applied. As this does not furnish sufficient support for the joint, a strong external and internal lateral ligament aids in binding the bones together, while the strength of the articulation is increased by the flexor and extensor muscles which pass anteriorly and posteriorly to the articulation. Within the joint are the crucial ligaments, two stout ligamentous cords, which, arising from the condyles of the femur, are inserted in front of and behind the spinous process of the tibia, to which also the semilunar cartilages are attached.

§ 1.—LUXATIONS OF THE PATELLA.

Besides the regular luxations of the knee-joint, those of the patella alone sometimes occur.

Varieties.—There are three varieties of this luxation: in the first, the patella is luxated inwards; in the second, outwards; whilst the third, which is sufficiently rare, consists in a rotation of the bone upon its perpendicular axis, so that its anterior face is turned partly in towards the articulation, whilst its posterior surface is turned partly out towards the front of the limb, one of its edges being prominently presented to the condyles or epitrochlea of the femur.

Luxation of the patella upwards or downwards cannot, of course, occur without a laceration of the ligament of the patella, or of the tendon of the quadriceps femoris muscle, unless there is a preternatural relaxation of these parts. Compound luxations of the patella sometimes occur and require, after the luxation has been reduced, the observance of an active antiphlogistic treatment. It is always a very serious injury, and is exceedingly apt to result in amputation or ankylosis.

Etiology.—The causes of lateral luxation of the patella are generally such forces as blows or falls applied laterally, whilst the muscles are relaxed in consequence of the leg being fully extended. The rotation of the patella upon its axis, on the contrary, is generally the result of the application of force whilst the leg is flexed. Three or four cases of this injury are upon record, and of these, two were the result of the knees of dragoons striking each other while

charging in sham fights; while a third, also, happened to an individual on horseback.

Symptoms.—When lateral luxation of the patella occurs, there will be increased width of the joint and a change in its natural contour; a want of the normal prominence of the patella and an abnormal prominence on one side or the other caused by the exposed position of the condyle. There can, therefore, be little difficulty in recognizing the character of the accident. The pain caused by it is extreme, and great swelling due to serous effusion within the joint rapidly occurs.

Treatment.—In order successfully to accomplish the reduction of a lateral luxation of the patella, it is necessary to attempt it while the limb is in the extended position, when little more than judicious lateral pressure will be necessary. The most convenient manner of effecting it, therefore, is for the surgeon to rest the heel of the injured limb upon his shoulder so as to flex the thigh upon the pelvis and extend the leg upon the thigh, thus relaxing the quadriceps femoris muscle as much as possible, and then with the pressure of his fingers push the bone back into its place.

When the patella is rotated upon itself a case is presented which is much more difficult to treat. As the muscles are often spasmodically contracted, it will be necessary to etherize the patient in order to induce their relaxation; but when this complete relaxation is once obtained, the sudden flexion of the limb will often cause such a strain upon the tendon as will rotate the bone into its place. This luxation being, however, extremely rare, the surgeon, fortunately, escapes its treatment; for the difficulty of its reduction is so great that it has been recommended to incise the ligament of the patella in order, by its division, to facilitate the operation. It should, however, be remembered, that such a measure, by opening the knee-joint, exposes the patient to the risk of inflammation and ankylosis, and the patient should always be advertised of this fact before it is attempted.

§ 2.—LUXATIONS OF THE KNEE.

Luxations of the knee-joint may happen in four different directions. In the first, the head of the tibia goes backwards, while the condyles of the femur slip forwards; the second is the reverse of this, the

condyles of the femur going backward; besides which two lateral subluxations are usually alluded to by surgical writers, and regarded as of more frequent occurrence than the anterior and posterior, owing to the great depth of the head of the tibia presenting an extensive support to the condyles of the femur in all the motions of flexion and extension of the leg on the thigh.

These accidents are not uncommon as a result of disease in the bones or of the articulation, but they are rare as a result of the application of force on account of the peculiar formation of this articulation.

Etiology.—In order to produce any of them, a force must be applied which will create a strain upon the ligaments upon that side of the articulation towards which the bone slips. Every luxation, therefore, of the knee-joint, will be accompanied with more or less laceration of the ligaments, and of the synovial membrane, and every complete luxation will be accompanied by a laceration also of the crucial ligaments, in consequence of which the patient will be liable for a considerable period after the injury—or until the ligaments have completely united—to a reproduction of the injury. In consequence of the laceration of the synovial membrane, there will also be more or less inflammation in the joint, and this is extremely liable to terminate in ankylosis, partial or complete, if it does not result in suppuration within the cavity of the joint.

Treatment.—To reduce a lateral luxation of the knee-joint, a considerable amount of extension and counter-extension is necessary, and while this is kept up by assistants the surgeon should accomplish the reduction by judicious lateral pressure.

To reduce the luxation forwards or backwards, extension and counter-extension will also be necessary, but here the surgeon must apply his pressure anteriorly or posteriorly, as the case may be, so as to force the bones into the proper position. It is seldom that any great difficulty occurs in carrying out these principles and effecting the reduction if the patient is thoroughly etherized. The difficulty experienced is of another character, consisting principally in the consequences of the resulting inflammation, which is increased by the laceration of the ligaments and the pinching of the synovial membrane in the efforts made in accomplishing the reduction. Great attention to the after-treatment, therefore, becomes necessary; the inflammation being actively combated by leeches, and the whole antiphlogistic treatment actively carried out, the limb meanwhile

being kept at perfect rest. But, after two or three weeks, when the tendency to inflammation has subsided, and union of the lacerated ligaments has perhaps occurred, passive motion may be gently made and patiently persevered in, to break up any adhesions which may have already formed. Should inflammatory action have run high, and continued for such a period that false ankylosis has already occurred before the surgeon is able to resort to passive motion, such an instrument as is recommended for the gradual production of motion at the joint may be resorted to, as will be described in connection with the subject of ankylosis.

§ 3.—HEY'S LUXATION OF THE KNEE.

In connection with luxations of the knee-joint may be mentioned an injury usually described as Hey's Luxation, or as a sub-luxation of the knee-joint, which consists essentially in a luxation of the internal semilunar cartilage. This injury is often very difficult to recognize unless the surgeon's attention has been specially directed to it; the patient complaining of acute pain, and not showing anything like marked deformity, or a tendency to displacement.

Etiology.—Wrenches of the foot are a common cause of this condition of the knee-joint, but the injury seldom occurs except in those who, in consequence of preternatural relaxation of the ligaments of the knee, especially the internal lateral ligament, are thus predisposed to it.

Symptoms.—The symptoms are sufficiently marked; the individual complaining of intense pain in the knee, and dropping as if shot at the moment of its occurrence. The pain is of a sickening character, and when the patient attempts to rise, he not only finds it much increased, but perceives a stiffness in the limb which renders it incapable of sustaining the weight of his body. There is, however, little or no swelling for several hours after the injury; so much so that but for the difficulty of motion, and the inability to sustain the weight of the body upon the limb, it might be supposed that the injury was nothing more than a sprain. On examining the joint carefully, however, the displaced cartilage can generally be felt making a slight prominence under the skin on the inner edge of the knee—provided swelling has not supervened.

Treatment.—The treatment is simple, and may be practised in most cases of painful sprains of the knee which are at all obscure in their character, as it can do no harm if a sprain only is present, while if displacement of the semilunar cartilage exists, alone or complicates the sprain, the relief will be great and instantaneous. The success of the manipulation depends upon the fact that the position of the internal semilunar cartilage is relaxed when the limb is flexed, and consists in the following efforts: Seating the patient upon the edge of a high table, or bed, and stooping before him, manipulate with the limb gently while his attention is engaged in conversation. When at last he is off his guard, flex the limb suddenly under the edge of the table or bed on which he is seated, and the cartilage will generally slip into its place; the pain being removed in a moment, motion restored in the joint, and the patient rendered comparatively comfortable. Afterwards attention should be given to the condition of the joint, the parts being kept at perfect rest, and inflammation combated as after any other injury of this articulation. When the patient begins to walk he should wear an elastic bandage around his knee, in order to impart additional strength to the articulation.

When this slipping of the cartilage results, as is sometimes the case, from debility and relaxation of the ligaments, a plan of treatment becomes necessary which in principle and practice is precisely that which is required in subluxations of the jaw, consisting in douches, cold baths, blisters, &c., as local measures, accompanied by the use of such means as will improve the general health.

§ 4.—LUXATION OF THE FIBULA.

A luxation of the fibula alone may occur at either extremity of the bone, though it is a very rare event.

Symptoms.—The symptoms are readily recognized, and the luxation, as a general rule, can be readily reduced, after which the parts should be kept at rest until the ruptured ligaments have united.

SECTION III.

LUXATION OF THE ANKLE-JOINT.

Anatomical Relations.—The ankle-joint consists of the articulation of the tibia and fibula with the astragalus, and is naturally a strong joint, the prominent malleoli guarding against lateral luxation, and being aided by powerful external and internal lateral ligaments; and although the capsular ligament anteriorly and posteriorly is extremely imperfect, yet this joint is strengthened by the extensor tendons in front, and by the tendo-Achillis behind.

Varieties.—Luxations of the ankle-joint may happen in four different directions:—

1. Luxation of the bones of the leg inwardly, which is the luxation previously referred to as occurring when there is fracture of the lower fifth of the fibula; many denying that this luxation can occur without being combined with this fracture.

2. Luxation of the bones of the leg outward.

3. Luxation of the tibia forwards, so that it rests upon the astragalus anteriorly to its articulating face.

4. Luxation of both bones backwards upon the os calcis, posterior to its articulation with the astragalus; besides which there is a partial luxation backwards, in which the bones rest posteriorly to the articulating face of the astragalus, but still upon that bone.

§ 1.—LUXATION OF BOTH BONES OF THE LEG INWARDS AT THE ANKLE.

The luxation in which the two bones of the leg go inwards, accompanied with fracture of the lower fifth of the fibula, is the most common of these luxations. The causes are similar to those that will produce fracture of the fibula, which may or may not accompany the accident, though it usually does so.

Treatment.—The treatment consists in making extension at the foot and counter-extension at the leg, while, at the same time, force is applied laterally to bring the tibia into its place, the limb being afterwards kept at rest and the inflammation of the ankle-joint actively combated.

§ 2.—LUXATION OF BOTH BONES OF THE LEG OUTWARDS.

The luxation of both bones of the leg outward is very rare. When it occurs it is usually combined with fracture of the internal malleolus or of the astragalus, but not invariably. It is to be reduced upon the same principles as the luxation inwards, but the force employed to accomplish the reduction must of course be applied in an opposite direction.

§ 3.—LUXATION OF BOTH BONES OF THE LEG FORWARDS ON THE ANKLE.

The luxation forwards of both bones of the leg, it is said always requires that the fibula should be broken, and is therefore rather a luxation of the tibia alone, the front of the capsular ligament being ruptured when the luxation occurs.

Symptoms.—There is more or less shortening of the foot, elongation of the heel, and prominence on the front of the ankle caused by the presence of the two bones of the leg in their unnatural position. It is to be reduced by extending the foot.

§ 4.—LUXATION OF THE LEG BACKWARDS AT THE ANKLE.

Symptoms.—The symptoms of luxation of both bones of the leg backwards are precisely the reverse of those just stated; thus, there is more or less apparent elongation of the foot and shortening of the heel, the tendo-Achillis being put upon the stretch and a prominence formed posteriorly by the position of the two bones.

Diagnosis.—In either of these luxations the diagnosis is easy.

Treatment of Luxations at the Ankle-joint.—The treatment of the luxation forwards consists in the application of strong extension and counter-extension to overcome the contraction of the gastrocnemius and soleus, as exerted through the tendo-Achillis, and while this is kept up the foot is to be strongly extended, which will cause the bones to slip into their proper position.

In the treatment of the luxation of both bones backward, extension and counter-extension must be made, and force applied in a

direction precisely opposite to that in which it was applied in the last case, after which the limb should be placed in a fracture-box, kept at perfect rest, dressed with cold water cloths, and every means employed that will tend to combat the inflammation of the ankle-joint that necessarily supervenes.

§ 5.—LUXATIONS OF THE ASTRAGALUS.

Anatomical Relations.—The *astragalus* articulates below with the *os calcis*, and anteriorly with the *scaphoides*, being bound strongly to these bones as well as to the *cuboides* and *os calcis* by stout ligaments. Nevertheless, Luxation of the *Astragalus* alone is an accident which sometimes occurs, and is described as being possible in four different directions—forwards, backwards, and to either side.

Symptoms.—This accident is generally easily recognizable before swelling comes on, as the bone can be readily felt, and even seen in its new position; but generally a degree of swelling is rapidly developed, which materially obscures the character of the injury.

Treatment.—The treatment consists in attempts to force the *astragalus* back into its position, which, if judiciously made, will sometimes be successful, after which the strictest antiphlogistic measures, with the use of a fracture-box, must be persevered in for some time.

§ 6.—COMPOUND LUXATIONS OF THE ANKLE-JOINT.

Compound luxations of the ankle-joint sometimes occur, the injury being always most serious, and often requiring an amputation. Such success, however, has followed the extirpation of the displaced bone in these cases of compound luxation that it will generally be advisable to attempt this operation before resorting to amputation, for if hectic fever supervenes upon the suppuration which follows the operation, the surgeon can then amputate with quite as good chances of relief, and with as much safety to the patient, as if he had performed the operation in the first place.

Cases of simple luxation of the *astragalus* sometimes resist every attempt at reduction until after the division of the tendons, &c., by

subcutaneous section with a tenotome. This fact should be borne in mind in obstinate cases; but, when this measure fails, the parts should be kept at rest and ankylosis permitted to occur, as it is

Fig. 203.



not considered good surgery to make a compound out of a simple luxation by dividing the parts from without inwards, so as to expose a joint to the action of the atmosphere.

CHAPTER V.

OF THE DISEASES OF THE JOINTS.

THE principal diseases of the articulations, or of the parts contiguous to the bones, are Sprains, Ankylosis, Arthritis, and Morbus Coxarius.

SECTION I.

OF SPRAINS.

A *sprain* is an injury to the ligaments, tendons, bursa, and other parts surrounding the joints, which results from violence, but in which there is no displacement of the articulating surfaces of the bones. The injury to the parts surrounding the joint is of a very varied character; thus there may be more or less laceration of the

fibres of the capsular and other ligaments, laceration of the neighboring bursæ, laceration of bloodvessels, of nerves, of muscles or tendons, and, in consequence of the lacerations of the ligaments surrounding the articulation, there is very frequently more or less laceration and inflammation of the synovial membrane.

Symptoms.—In accordance with these varied injuries there will be a varied train of symptoms in sprains. Thus, in the simpler form of the complaint, the patient will be found to suffer severe pain, this being increased upon motion, and accompanied by more or less swelling around the articulation. In consequence of the laceration of bloodvessels, there is also more or less ecchymosis of the skin, which becomes a good point by which to judge of the extent of the laceration. More or less variation in the natural shape of the joint will also be observed, due not only to effusions around the articulation, but to effusions of lymph or of serum *into* the cavity of the joint itself. Sometimes in the wrist and ankle this tumefaction is due to effusions of serum into the bursa in which the tendons play in the front of these joints. In every case of sprain it should be borne in mind, therefore, that there is more or less laceration of the parts around the joint, and that this laceration will result in such an effusion and thickening of tissue as will impair the natural functions of the joint to a greater or less extent. If the sprain is badly treated, this thickening may take place to so marked a degree that lymph may become organized between the two articulating surfaces and true ankylosis result.

Diagnosis.—In making an examination of a case of sprain, it should be borne in mind that owing to the change in the shape of the joint, sprains may be confounded with luxations, particularly in the case of the wrist and knee-joint. A sprain may also be mistaken for a fracture, and *vice versâ*. Thus, a sprain of the wrist, with more or less effusion into the bursa surrounding the flexor tendons producing a marked swelling on the front of the hand, with pain and loss of motion, might be mistaken for Barton's fracture. On the other hand, every sprain in the neighborhood of the wrist or ankle should be carefully examined lest fracture co-exist.

On account of the manner in which the flexor and extensor tendons of the hand are surrounded by bursæ in the neighborhood of the wrist, such a sprain as produces effusions into these bursæ, may be followed by inflammation of the bursa itself, and if the complaint is not actively treated, adhesions may result, these sub-

sequently interfering materially with the functions of the tendons. The rapidity with which effusions into these bursæ occur, deserves notice, they being sometimes seen within ten minutes after the accident, the swelling having taken place to such an extent as to form a tumor of considerable size before the surgeon sees the case. Usually fifteen to twenty minutes is sufficient to produce a well-marked deformity, which, however, can even then be distinguished by careful examination from fracture or luxation. In this examination, the surgeon should not allow the pain given by his manipulations to deter him from thoroughly learning the condition of the parts; and if the patient is unable to bear the suffering, he should be etherized; for it is of the greatest importance that the precise nature of the case should be understood. The fracture most likely to be confounded with a sprain of the ankle-joint is that of the lower fifth of the fibula, the possibility of which should always be borne in mind when examining the ankle-joint after a sprain, whilst Barton's fracture is frequently conjoined with sprains of the wrist.

Prognosis.—The prognosis in the case of a sprain depends very much upon its being early recognized and promptly treated; but the dangers of inflammation, particularly in the wrist and ankle, are such that the prognosis should always be guarded. The patient should, therefore, be told in all cases of bad sprain, that the accident is a serious one, that it will be necessary for him to keep the parts at perfect rest for at least two weeks, and that six weeks, or even three months may elapse before he will recover the perfect use of the joint, if, indeed, he ever recovers it. Let him understand that a sprain, if neglected, will also prove a more serious accident than a fracture, and that pains about joints of a rheumatic character may, perhaps, trouble him for years on the occurrence of damp weather.

Treatment.—The treatment of a recent sprain should be as follows:—

If the patient is seen five or ten minutes after the accident where there has been little or no time for vascular action, and where there is a simple laceration of ligaments—as shown by the pain—without much swelling, the best treatment will consist in the application of means calculated to prevent vascular excitement, such as the cold water dressing *constantly* applied; lint being spread over the parts, and irrigation of cold water accurately kept up; or the limb may

be thrust into a vessel of cold water, and kept there fifteen, or even twenty-four hours if necessary.

But if six or eight hours have elapsed, and there is marked ecchymosis beneath the skin with swelling, and a tendency towards inflammatory action, a different plan of treatment will be necessary, the joint being now leeches freely, six dozen American leeches being applied all round it; after which the *warm water* dressing should be resorted to, this being preferable to the cold in *this stage*. Much of the discussion which has taken place among surgeons as to the comparative merits of warm and cold water dressings in sprains has doubtless arisen from the fact that they have described different stages of the same complaint. After three or four days, advantage will be derived—provided all inflammatory action has ceased—from frictions with the hand and some liniment, particularly if it be of a stimulating character. These frictions should be gently but patiently made, and continued for half an hour at a time. A very good liniment for this purpose is the following:—

R.—Tr. rad. aconit. f℥j;
Tin. sap. camph. f℥iij.
M. et ft. linimentum.

The parts should also be kept at perfect rest, by the use of carved or felt splints, until motion ceases to be very painful. In every case of a sprain of the ankle, for example, serious enough to require treatment, I would insist upon the patient keeping the limb at rest for at least two weeks.

After having kept the parts at rest during this period, passive motion may be made in order to guard against ankylosis. The inflammatory stage being now passed, and that in which motion is proper having begun, the weakened vessels and tissues debilitated by the injury and inflammation, will derive tone from cold douches, cold bathing and gentle use.

If a sprain is neglected or improperly treated, a condition sometimes results which is described by authors as *chronic sprain*. There are here more or less thickening of tissue and other derangement due to inflammatory action. The treatment should be that which is adapted to any chronic inflammation, more benefit being derived from counter-irritants, as blisters, &c., patiently applied than from any other plan. Rest, by means of a carved splint is, however,

absolutely essential, as, if the inflammatory action is not checked, it may result in caries of the bones of the articulation, especially in cases of sprain of the ankle-joint.

SECTION II.

ARTHRITIS, OR WHITE SWELLING.

The term *white swelling* is an old name which was employed to designate any disease of the ankle, knee, or hip-joint characterized by tumefaction, provided it was without redness and the other usual signs of inflammation. As the disease is not a simple inflammation of the synovial membrane, and the term Synovitis is therefore inapplicable, the best which could be employed to express the real condition of parts is *Arthritis*.

Arthritis is a special disease of the knee or ankle-joint, the somewhat similar condition of the hip-joint being embraced in the complaint known as Morbus coxarius. It is characterized by tumefaction, without any of the ordinary signs of inflammatory action so far as external observation goes. This tumefaction is also different from that of oedema, the skin not pitting upon pressure, nor is there that sense of fluctuation which would be present if the swelling were due to a serous effusion into the cavity of the joint as the result of synovitis. Arthritis occurs generally in scrofulous patients, and is most common in countries in which the climate is moist. Hence, as might be expected, it abounds in the hospitals of London, while it is comparatively rare in those of the United States. It occurs generally in patients between 20 and 30 years of age, avoiding alike the extremes of youth and old age.

Symptoms.—The symptoms are as follows: The patient first notices a certain degree of tenderness about the articulation, which, gradually developing with the disorder, often causes marked suffering; after which the joint becomes stiffened, and there is more or less loss of its proper motions. When the swollen joint is handled, no sense of fluctuation is communicated to the touch, but a peculiar sensation is perceived, which indicates the presence of a thick gelatinous substance beneath the skin. This substance presents a soft pultaceous mass which yields somewhat to pressure, but does not permit the skin to pit as in oedema. The tumefied joint is whitish or

bluish in its color, there is no enlargement of the superficial vessels, and no pinkish hue, as in the tumefaction of joints due to rheumatism or gout.

The disease progressing, the parts become hot, the skin distended and shining, and then a slight vascular congestion may be noticed, which gives a pinkish or purplish tinge to the tumor. By and by ulcerations communicating with the joint are developed in the skin, and discharge a thin bloody ichor; symptoms of hectic are developed; the patient becomes prostrated with colliquative sweats and diarrhoea, presenting not unfrequently evidences of thoracic disease, and finally dies. Or a more favorable change takes place, the patient surviving the exhaustion of the suppuration, and getting well with ankylosis.

Throughout the course of the complaint it should be remembered that there is no distinct sense of fluctuation around the joint, as there is in synovitis; the disease consisting rather in a chronic inflammation and effusion into the cellular tissue and beneath the ligaments surrounding the joint, than in the serous tissue, though occasionally the symptoms of synovitis will be added to it.

Pathological Condition.—In dissections made after death or amputation, the following pathological changes have been observed. The cellular tissue exterior to the joint is thickened in a marked manner and infiltrated with a thick jelly-like substance, which the French have designated as “fongosité,” a term by which they do not mean to designate anything malignant, but simply to indicate the character of its structure. In the latter stages of the disease not only is the capsular ligament thickened, but its tissue is softened, and between that part of the ligament which is lined by the synovial membrane and this membrane a pale yellow semi-transparent matter is deposited, which is several lines in thickness, without bloodvessels, and evidently due to effusions of plasma of a caco-plastic character. By similar effusions partially organized, if the disease is of long standing, the ligaments, tendons, and muscles surrounding the articulation are glued together, producing a considerable amount of false ankylosis.

If the action continues, the disease extends itself to the cartilages, or to the bones themselves, producing ulceration of the cartilages and caries or necrosis of the articulating extremities of the bones.

Diagnosis.—To arrive at an accurate diagnosis in this complaint it is only necessary to bear in mind the symptoms, a synopsis of

which may be thus briefly presented. First, the tuberculous appearance of the patient; next the fact that the disease is usually developed without any marked injury, the patient being often unable to account for its production, or assigning it to trifling causes; then that in its earlier stages at least, it is combined with no marked signs of inflammation; and lastly, that there is no marked fluctuation as in simple synovitis, while the sense of touch gives evidence of the presence of a certain peculiar soft matter deposited beneath the skin.

Prognosis.—The prognosis should be guarded, the result depending in a great measure on the constitution of the patient. This disorder may terminate either in death by hectic, by ankylosis, or by amputation of the limb, the patient often recovering rapidly after the operation, but exhibiting in a few months the evidences of pulmonary consumption.

Treatment.—The first and most important indication in all these cases is to improve the general health, the treatment demanded in every disease resulting from the tuberculous diathesis or complicated, being equally applicable to this one. Tonics are of value in the early stages, particularly chalybeates, with a view of improving the condition of the blood. With regard to the local treatment, much is to be expected from the judicious leeching when the joint is very hot and acutely inflamed, or when the disorder is of a more chronic character, from the use of counter-irritants, as blisters, repeatedly applied in the neighborhood of the joint; or stimulating and mercurial frictions; or plasters, particularly those which combine the two characters, an excellent one being a mixture of the emplastr. galbanum comp. with mercurial ointment, which may be spread and kept constantly on the joint.

The local use of mercurials is especially demanded with a view of diminishing the plasticity of the lymph effused around the joint.

Benefit has also resulted, in some cases, from painting the part well with the tincture of iodine; a plan of treatment which, besides its specific effect, stimulates the vessels of the skin to increased action.

During this treatment, the parts should be kept at perfect rest by means of a carved splint of wood, a felt splint, or one of gutta percha, these being made upon the same principle as those which will be described in connection with hip-joint disease. By such means the joint may be kept at rest without any necessity of confining the patient to bed, a practice which is much to be depre-

cated, as the confinement is badly borne by this class of patients, who need fresh air and exercise quite as much as medical treatment. In permitting a patient to exercise, much will depend upon the means that are selected, such only being resorted to as will permit the general movements of the body, whilst the affected joint is kept at perfect rest, such as riding in a vehicle with the limb carefully supported. In warm weather it will also prove useful, especially in hospitals, to have the patient's bed placed in the fresh air of a yard for a few hours each day.

Should, however, the disease progress in spite of treatment, and hectic supervene, much may be done for the relief of the patient, the necessity of amputation, which would soon become urgent, being in many cases avoided, by a resort to the operation of resection of the joint, a class of operations which are daily growing in favor, and by means of which many limbs have been saved, that, under the old *régime*, would inevitably have been sacrificed by the knife of the surgeon.

SECTION III.

ANCHYLOSIS.

When a joint becomes stiffened, as the result of diseased action either within or around it, and is left entirely to the course of nature, it is most apt to be flexed or bent (*αγκυλος*, crooked); hence this condition of stiffness and loss of motion in an articulation is usually designated as *anchylosis*.

Varieties.—Two conditions of parts are met with in stiffness of the articulations. 1st. *False anchylosis*, or immobility, due to inflammatory action in the parts exterior to the articulation, as in the bursa, fascia, tendons and muscles, with some thickening of the ligaments. 2d. *True anchylosis*, due to the destruction of the interior of the joint and the bony fusion of the two articulating surfaces of the bones which compose it. Anchylosis, it will be seen, therefore, is the result of changes due to inflammatory action, within or in the neighborhood of an articulation. It is also sometimes spoken of as *complete* and *incomplete*, *perfect* or *imperfect*, these terms indicating the amount of motion left in the articulation by either true or false anchylosis.

Pathological Conditions.—The state of the parts in *false ankylosis* presents generally a deviation from the normal condition of the ligaments, tendons, and fascia exterior to the joint; the ligaments being thickened, stiffened, and contracted, especially on the side of the joint which corresponds to flexion, whilst the tendons and fascia are similarly retracted, so that they cannot be readily elongated, even when considerable force is used. Sometimes false ankylosis results from the formation of bands of lymph within the synovial capsule of the joint, where they act the part of adventitious ligaments, and limit the motion of the articulating surfaces. Sometimes a true false membrane is formed within the serous tissue of the joint, similar to that seen on the pleura, in consequence of which adhesions are developed.

Sometimes, in *true ankylosis*, the articulating cartilages and synovial membranes having been removed by suppuration or interstitial absorption, the two bony surfaces are brought in contact and fused one upon the other; whilst in other cases various bony spines and processes, which often correspond with the position of the lateral ligaments, join the bones together, or limit their movements.

Etiology.—Various causes may create ankylosis; sometimes true ankylosis is the result of ossification of cartilages and intervertebral substances, as in the ribs and spinal columns of old persons; sometimes it is consequent on suppurations and caries of an articulation, as is seen in white swelling and hip disease. False ankylosis is generally the result of inflammatory exudation, which, owing to rest, contracts adhesions and creates thickening; hence it results from sprains, synovitis, fractures in the neighborhood of joints, badly treated luxations, &c.

Symptoms.—Ankylosis is rendered evident by loss of motion in the articulation, this loss of motion varying in accordance with the natural motion of the joint, and showing itself in a restricted degree of flexion, extension, or rotation. In false ankylosis there is usually a change in the shape of the joint, and any marked attempt at motion causes more or less marked pain. In true ankylosis there is often marks of inflammatory action around the part, with irregular enlargement of points about the articulation. If inflammatory action still exists in a joint which is partially fused by true ankylosis, the attempts at motion may also prove painful, but usually in true ankylosis, especially if chronic, attempts at motion do not develop the patient's sensibility.

Prognosis.—The prognosis of ankylosis is always dependent on its extent and the position in which the limb has been placed. If the ankylosis is of the false variety, it may be overcome and the joint rendered again useful; but if it has ended in true bony union of the articulating surfaces of the bones, motion in the part cannot be restored except by the formation of a false joint by an operation. The prognosis is also influenced by the position of the limb; thus, ankylosis of the elbow-joint would give a comparatively useful limb if the forearm is flexed on the arm, whilst the knee-joint would be most serviceable if ankylosed in the straight position, patients being able to walk with considerable facility on a limb with a straight, though stiff knee.

Treatment.—The treatment of ankylosis may be classified under four periods: 1, that which is proper during its formation; 2, that required for its prevention; 3, that demanded for its removal; 4, that which is necessary in order to change the position of the joint without the destruction of its immobility, as in a resection.

1. There are many instances in which the surgeon may be glad to obtain ankylosis of a joint, this being preferable to amputation of the limb, as in caries of the carpus and tarsus—wounds involving the knee and shoulder-joints, and in compound luxations of the ankle, &c. In all such cases the treatment should consist in perfect rest of the part in that position which will give the most utility to the limb, and in preventing the exhaustion of the patient's strength, the development of hectic being carefully watched.

2. The prevention of ankylosis is to be accomplished by combating every inflammation which involves an articulation, and hastening, by appropriate means, its termination in resolution, whilst at the same time such motion should be kept up as will prevent adhesions of the adjacent tissues, and stretch those which have a marked tendency to retract. The means of doing this will be alluded to hereafter.

3. After ankylosis, whether true or false, is well established, its removal may be attempted by the use of such means as will overcome the adhesions; such as stimulating and alterative frictions, especially those containing mercurial ointment; or by the use of cold water, so as to stimulate the absorbents; both of these means being specially applicable to cases of false ankylosis, whilst the true bony union of a joint may be overcome either by mechanical extension or by an operation.

4. The change of position in a truly anchylosed joint which has been allowed to stiffen in an inconvenient position, may be accomplished by means of a Resection,¹ or by the application of such forces as will fracture the union, the case being subsequently treated as a fracture. As the means required in the treatment of the anchylosis of different joints require to be varied, they may be better understood in connection with special cases, especially those of the elbow and knee-joints.

§ 1.—ANCHYLOSIS OF THE ELBOW-JOINT.

Without recapitulating what has been mentioned in connection with anchylosis generally, attention may now be given to the treatment of *false anchylosis of the elbow-joint*.

Condition of the Parts.—The elbow-joint being a ginglymoid articulation, is very liable to be affected by false anchylosis, the chief adhesions being found between the coronoid process and the front of the condyles of the humerus, and as the most natural position of the upper extremity is the extended one, this joint is most frequently found to be stiffened in the straight or partially flexed position, thus rendering it useless to the patient for many purposes; because with a straight and stiff elbow a patient cannot bring the hand to the mouth, or perform many of the daily acts of life. As the tendon of the biceps passes in front of the joint and the fascia brachialis receives an expansion from the tendon, these tissues are apt to become involved in the disorder, and to become thickened and tense, whilst the triceps tendon is not unfrequently similarly involved behind. In false anchylosis there is, therefore, considerable adhesion of all these tissues, but often only such as may be overcome by judicious treatment.

Treatment.—The best plan of accomplishing this, is to obtain the relaxation of and increased circulation in these parts by soaking the joint, for a half hour daily, in water as hot as the patient can bear it, and then rubbing the part well with mercurial ointment or some stimulating liniment. Should inflammation exist, the application of leeches and poultices, or the warm-water dressing may also prove desirable. After having thus prepared the part, such mechanical means may be resorted to as will *gradually* elongate the contracted tissues. One of the best of these is the splint shown in Fig. 204.

¹ See Operative Surgery, vol. ii. p. 380, 2d edit.

Fig. 204.

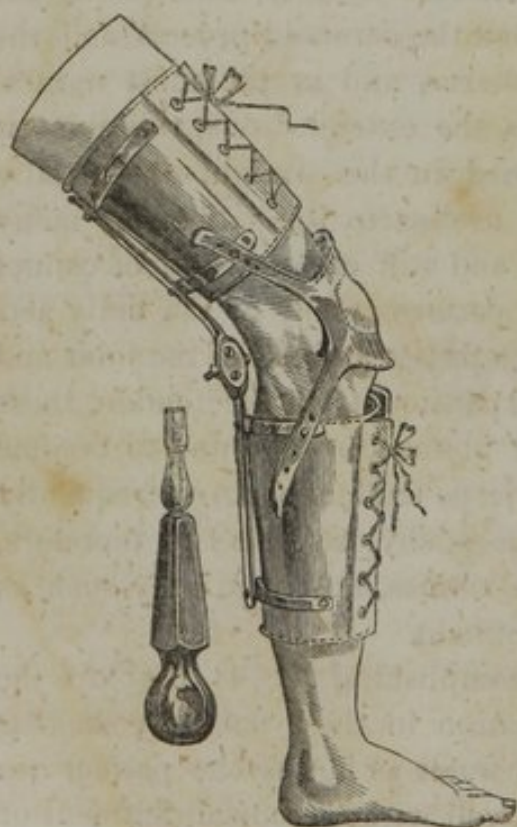


A VIEW OF KOLBE'S MODIFICATION OF STROMEIER'S SPLINT, AS APPLIED FOR THE RELIEF OF FALSE ANCHYLOSIS OF THE ELBOW.—This apparatus, as made by Kolbè, of Philadelphia, consists of two light pieces of wood, which are strapped around the arm and forearm, the joint being made to move by means of the screw seen on the front. Prior to its application the arm should be bandaged, especially if much force is to be used. (After Nature.)

§ 2.—ANCHYLOSIS OF THE KNEE-JOINT.

When *false anchylosis affects the knee-joint*, the natural position

Fig. 205.



A SIDE VIEW OF KOLBE'S MODIFICATION OF STROMEIER'S SPLINT FOR THE TREATMENT OF ANCHYLOSIS OF THE KNEE.—By means of an ingenious joint in the bend of the knee, which is acted on by the key seen in the figure, Mr. Kolbè has succeeded in obtaining great power, and yet very accurately regulating its application. (After Nature.)

of the limb being that of flexion, the articulation is most frequently stiffened in the flexed condition, the ham-string tendons, to wit, the biceps, semimembranosus and semitendinosus, being permanently contracted, and rendered prominent behind the knee. There is also usually more or less thickening of the fascia in the popliteal space, with or without a certain amount of mobility in the patella.

Treatment.—After employing on this articulation the same general means as were stated in connection with the preliminary treatment of false anchylosis of the elbow-joint, mechanical extension of the leg may be gradually accomplished by the means suggested by Stromeier, or some of the modifications of his apparatus, such as that shown in Fig. 205.¹

¹ These instruments can be obtained of Kolbè, surgeon's instrument maker, No. 45 South Eighth St. below Chestnut, Philadelphia.

SECTION IV.

MORBUS COXARIUS.

Hip-joint disease, morbus coxarius, and coxalgia, are terms applied to a condition of the hip-joint, which is sooner or later combined with ulceration, caries, or some other disease of the bones forming the articulation, and resulting in a more or less complete destruction of the functions of the joint.

The term *coxalgia* should, however, be restricted to a form of disease which is purely nervous or hysterical in its character, and which, although simulating somewhat in symptoms the true morbus coxarius, is accompanied by no organic changes. Such a condition is sometimes found in children, in connection with dentition; in young females, previous to menstruation; in hysterical women, and in hysterical men, for there is a class of men, delicate, sickly, and nervous, who are as truly hysterical as females; men or boys of weak and broken-down constitutions, and who very frequently are masturbators. These patients will sometimes complain of pains about the hip-joint, which, though simulating hip disease, are purely neuralgic in their character.

By the term *Morbus Coxarius* is designated a disease which results in more or less destruction of the head of the femur, of the cavity of the acetabulum, and sometimes of the adjacent parts of the ilium. It generally destroys the usefulness of the joint, and if it does not terminate in hectic fever and death from exhaustion, results at best in ankylosis of the articulation, and in a greater or less deformity with loss of power in the joint.

Etiology.—The causes of the complaint may be described as constitutional and local.

The most common constitutional cause is the tuberculous diathesis, in consequence of which tuberculous matter is deposited in the head and neck of the femur, or in the acetabulum, though the last is very rare. When tubercles form in the head and neck of the femur they act as a foreign body and excite inflammation, precisely as when deposited in the lungs, the bodies of the vertebræ, or elsewhere. The other causes of this complaint are, exposure to cold or dampness, or anything likely to produce congestion or inflammation of an unhealthy character in the articulations.

Among the local causes may be enumerated blows, falls, sprains, over-exertion of any kind, or any cause likely to produce synovitis in this joint. A very common cause among boys is some injury received while playing foot-ball or shindy. With regard to the influence of age, the complaint is certainly more common in the young than in those over twenty-one years of age, and the most usual period of its development may be fixed at from four to eighteen years.

Symptoms.—In the acute form of the complaint the symptoms are as follows: After a fall, a blow, or an excess of exercise, the patient is conscious of a dull pain in the hip, of which he complains, or if a child not yet intelligent enough to give an account of its sufferings, gives evidence of the presence of pain by indisposition to exertion, and by cries whenever motion of the joint is necessarily made, especially when the limb is flexed or abducted. If, however, the child is old enough to describe its symptoms, the pain will be alluded to as being seated in the hip, or as extending down the limb from the hip, or as being at the inside of the knee. So frequent and prominent is the latter symptom that parents are often misled by it, and suppose the knee-joint to be the seat of the disease when it is really situated in the hip. An explanation of this fact is to be found in the supposition that the inflammation of the joint has involved branches of the anterior crural and obturator nerves, and that the pain thus produced is referred to their extremities, instead of the true locality of the irritation.

In this stage, the patient generally complains of stiffness in the articulation, and exhibits great unwillingness to move the limb; but as he exercises it during the course of the day this stiffness wears off, and the joint becomes more flexible. After this state of things has continued for some little time, the pain increases and tumefaction of the joint takes place; the part becoming full and tense, whilst more or less fever is developed. This stage of the disease is more readily recognized, but is not so often seen as that which is more chronic. Most frequently the affection passes without treatment through this its first stage, or is tampered with by domestic remedies, and is first presented to the surgeon only after its full development, or in the second stage, when a marked disposition to flex the limb will be noticed, as well as a disposition to carry it across its fellow. As the progress of the disorder has now attacked the muscles around the joint, it will be noticed that when the

patient stands, he is generally inclined to stand with the limb flexed and carried in towards the opposite leg (Fig. 207), because the inflammation within the articulation has extended from it to surrounding parts, involving the rectus, the psoas magnus, and iliacus internus muscles, the latter of which, passing over the front of the articulation, are inserted into the trochanter minor, and, becoming inflamed, are less painful when they are relaxed by flexion of the limb. Atrophy of all the muscles around the joint is a condition also often observed in connection with the progress of the disease in the articulation. Thus, there may be wasting of the glutei muscles, the buttock becoming thin and flabby (Fig. 206), while from the diseased condition of the head of the femur the foot inclines inwards or outwards, as the case may be. The eversion or inversion of the foot becomes a matter of some importance, because it points out the condition of the articulation. If the foot inclines inwards, as is most frequently the case, it is generally due to such a destruction of the acetabulum as permits a luxation of the femur to occur upwards and backwards upon the dorsum ilii (Fig. 207), but when the foot inclines outward, it will be due to such a diseased condition of the head and neck of the bone as permits the action of the rotatory muscles to draw the trochanter outwards, though the head of the bone may still retain its normal position.

At this period, more or less decided shortening begins to be noticed (Fig. 206); though this shortening is sometimes due to the flexed condition of the limb or to inclination of the pelvis, rather than to a luxation of the femur on the pelvis. Sometimes, instead of shortening, there is apparent lengthening of the limb, this, however, being generally due to an inclination of the pelvis.

If firm pressure is now made upon the trochanter major the patient will complain of pain, because the head of the bone is thus driven more or less into the acetabulum, and therefore produces pressure upon the diseased surfaces. In the same manner a blow upon the sole of the foot will be productive of pain in these patients, and for the same reason—a fact which would at once distinguish the case from one of *rheumatism*; while in *synovitis* the amount of fluid effused into the joint would so far diminish the succussion as to interfere materially with the creation of pain by such a concussion. There is also very often a fulness over the front of the joint below the groin, and tenderness upon pressure in that spot, as well as an increase of pain at this point, when the

thigh is abducted. The buttock also becomes flattened, and a marked change may be noticed in the line of its fold, which is no

Fig. 206.



Fig. 207.



Fig. 206.—A FULL VIEW OF THE BACK AND BUTTOCK IN HIP DISEASE OF THE LEFT SIDE, showing the wasting of the glutei muscles, and the change in the line of the fold of the nates. (After Liston.)

Fig. 207.—A FRONT VIEW OF HIP DISEASE OF THE RIGHT SIDE, showing the shortening, inclination of the pelvis, and flexing of the limb. (After Liston.)

longer a transverse line, but forms an angle sometimes of 45 degrees with the spine. (Fig. 206.)

In the third stage, the peculiar symptoms of the disease are most apparent. The limb becomes very much shortened, inflammation is developed in the soft parts and skin covering the articulation, ulceration is established, pus escapes, and a probe carefully introduced along the sinuses which form, touches upon a bare surface of bone. Through these orifices small portions of bone are often thrown off. The portions of the body subjected to pressure as the patient lies in bed, as the point of the trochanter of the sound side, and the prominent points of bone along the back, now, by their pressure

upon the soft parts over them in the exhausted state of the system, also give rise to those ulcerations and sloughs known as bed-sores.

It does not follow, however, that this stage of the disease will invariably terminate in death, as sometimes the strength of the patient is sufficient to enable him to sustain the drain of the suppuration and the exhaustion of hectic irritation, and he will finally get well by ankylosis.

Diagnosis.—With regard to the diagnosis of morbus coxarius in its first stage, care should be taken not to confound it with rheumatism or a neuralgic condition of the joint; though the history of the complaint, and the general train of accompanying symptoms will generally suffice to effect this diagnosis. When the acute form of the disease is at its height it might possibly be confounded with Psoas abscess, as in this complaint, as well as in morbus coxarius, there is more or less irritation shown in the muscles of the back, more or less fulness in the groin, and the patient is inclined to flex the limb and turn the toes in. But if the buttock of a patient laboring under psoas abscess be examined, it will be found that the line of the cheek of the buttock is normal and not sloping, as in hip disease; while, if pressure is made upon the sole of the foot or upon the trochanter, the patient will not complain of pain.

In the latter stages of the disease, if the history of the case were not known, it might possibly be confounded with those spontaneous luxations of the femur which have been already alluded to.

Prognosis.—The prognosis in hip disease is always unfavorable, both on account of the great length of time necessary to accomplish a cure, and also from the character of the cure being always uncertain. The time required to accomplish this cure, even in favorable cases, is always considerable; and the patient and his friends should be informed of it; being told, in every instance, that it is hardly probable that the case will terminate in less than eighteen months, and that, though some do occasionally recover without deformity, and preserve the usefulness of the joint, yet such cases are *very rare*; while the number which terminate fatally is perhaps as great as those which recover with ankylosis.

Pathology.—The evils resulting from morbus coxarius are so great that the true pathology of the complaint has long been regarded as a question of marked interest to the surgeon. As, however, few patients die with this affection, except after the disease

has existed some time, the changes noted have been rather such as were due to the last than to the first stage, and indicated rather the result than the progress of the disorder. Although the evidences of diseased action found after death have been varied, there is no reason to doubt that the starting-point is inflammatory action, though the causes which excited it have differed. As the result of the modification created by inflammation in the part first involved, we find synovitis, softening and disintegration of the articular cartilages, with their removal, and the destruction of the substance of the bone, this destruction most frequently affecting the head of the femur, though the acetabulum often participates in it to a varied extent. Sometimes the destruction of the bone is noticed as more decided in the neck of the femur than elsewhere, the head tending then to repose against the base of the neck, so that the trochanter major approaches close to the pelvis.

Sometimes after great destruction of the cartilages the head of the bone and the acetabulum are found covered more or less perfectly with a porcelaneous deposit, new bony matter having been formed, compact, smooth, and hard, so as to facilitate the motion of the joint. The ligamentum teres is usually destroyed in bad cases, the capsular ligament softened, or much thickened, and the whole appearance of the parts greatly altered.

Frequently the disease progresses to such a point that the alteration in shape of the acetabulum and head of the bone permits a luxation of the femur upwards and backwards upon the dorsum ilii, where it either forms for itself a new articulating cavity, or may become ankylosed to the side of the ilium in an unnatural position.

The question of the frequency of this luxation of the head of the femur as a consequence of hip-joint disease has recently attracted much attention among surgeons, in consequence of the paper published by Dr. March, of Albany, in the *Transactions of the American Medical Association*, vol. vi. p. 479, 1853.

This distinguished surgeon, after taking considerable trouble in investigating the subject, and even visiting Europe, arrived at a conclusion which is directly opposed to the views of most surgeons, and the correctness of which can, it is thought, be best disproved by an examination of the specimens, from some of which the accompanying cuts are taken. (Figs. 208, 209, 210, and 211.)

In this paper, Dr. March advanced¹ the opinion that "spontaneous dislocation of the hip (as purely the result of morbid action unaided by superadded violence) seldom or never takes place," an opinion which, *if established*, would certainly influence very materially the treatment of this disorder, as well as expose surgeons every day to the complaints of patients at the lameness and deformity which they so constantly suffer from in this complaint even under the most careful treatment.

Various preparations, exhibiting the frequency of this luxation of the femur as a result of hip disease, are in my cabinet as well as elsewhere, and show that there are many facts to militate against

Fig. 208.



Fig. 209.



Fig. 208.—A FRONT VIEW OF THE CHANGES IN THE ARTICULATION AS MADE BY HIP DISEASE.—The head of the femur in this specimen is luxated just above the superior and posterior edge of the acetabulum, whilst the old acetabulum is partially filled up, elongated, and forms the inferior edge of the new acetabulum, bone having been deposited on its margin. The head of the femur is flattened, its neck is shortened, and the compact layer of the head extends over the neck. Both the head and the new acetabulum are also eburnated at the points of chief contact. 1. Head of the luxated femur in its new acetabulum. 2. The old acetabulum, partially filled up, and changed in its shape. This drawing is taken from a preparation of the right ilium, which has been macerated and dried, and is No. 40 B of my cabinet. (After Nature.)

Fig. 209.—THE LEFT INNOMINATE AFTER MACERATION AND DRYING, SHOWING THE CHANGES CONSEQUENT ON HIP DISEASE.—The old acetabulum is elongated and partially filled up, the head of the femur being entirely removed, and nothing of it left but a stump of the neck of the bone. This, by constant pressure on the middle of the dorsum of the ilium, has hollowed out a deep and large cup, which is convex on the venter of the ilium. 1. Remains of the neck of the femur as luxated. 2. The large new acetabulum made by the femur. This drawing is taken from a preparation of the left ilium, and is marked in my cabinet as No. 42 B. (After Nature.)

Dr. March's opinion. From four of these, selected as evidence of the presence of luxation, but not as exhibiting the most marked destruction of the joint, the Figs. 208, 209, 210, and 211 have been made.

Treatment.—In considering the proper mode of treatment for this

¹ Transact. Amer. Med. Assoc., vol. vi. p. 479, 1853.

tedious disorder, it must be borne in mind that in its first stage, owing to certain causes, there is an inflammation created in the arti-

Fig. 210.



Fig. 211.



Fig. 210.—A THREE-QUARTER VIEW OF THE PELVIS OF A FEMALE WHO HAS HAD HIP DISEASE ON THE LEFT SIDE, showing a luxation of the head of the femur upwards, and the formation of a new acetabulum on the edge of the dorsum ilii between the anterior-superior and the anterior-inferior spinous processes. The old acetabulum is partially filled up, the new one as well as the head of the bone exhibiting evidences of caries. The vertebral column is also curved towards the left side, and all the bones are quite thin. This drawing is taken from a preparation marked No. 45 B of my cabinet. (After Nature.)

Fig. 211.—A FRONT VIEW OF THE CHANGES CAUSED BY HIP DISEASE, the head of the bone being much flattened and partially luxated backwards, whilst the old acetabulum is so filled by new bony deposit as to change its appearance, and render the hip shorter and more prominent. This drawing is from a preparation marked No. 47 B of my cabinet. (After Nature.)

culation, this inflammation being present whether the disorder is due to constitutional taint resulting in the production of tubercles in the femur, or to a limited irritation, which creating originally a mere synovitis, subsequently ends in caries. In either case, it must be admitted that an inflammation is created, which has a tendency to produce changes in the articulating surface of the joint, to develop abscesses, to destroy the ligaments, and produce such alterations in the articulation as will allow the contraction of the muscles to draw the head of the femur out of the acetabulum. As this very brief review of the symptoms of the disease as given above, shows a variation of condition, so must the treatment, in order to be successful, be adapted to the stage of the disorder in which the patient is presented to the surgeon.

Thus, if the disease is seen in its first stage with the symptoms of acute inflammation of the joint, the treatment should be strictly

antiphlogistic in its character, leeches being applied around the articulation, not over the trochanter, where they are at some distance from the joint, but below the line of the groin, where they come closely upon it. At the same time it is necessary to keep the parts at perfect rest, which can only be done in a manner adapted to the exigency of the case by means of a splint, this being equally necessary in all stages of the complaint. But in the early period of the disease there is no such disposition to flex the limb as is afterwards observed, and any straight splint will, therefore, fulfil the purposes required; Liston's splint, as before described in connection with fracture of the thigh, answering very well. An objection to it, on the part of some surgeons, is the pressure which it causes upon the acetabulum by bearing on the trochanter, but this is by no means proved to be its action; whilst the facility with which it may be obtained in the earlier stages of the complaint, is a recommendation to its use. Subsequently, however, in the second and third stage, where the tendency to flex the limb is marked, it will be necessary to employ a splint of a different character, and the best is that originally suggested by Dr. Physick, about the year 1812. This is made of wood carved to fit the angle of the limb, and extends from the waist to the ankle, being covered on the outside with sheepskin, and lined with flannel or lint. This splint may be made by any good mechanic by laying a piece of poplar of sufficient thickness against the side of the body and limb whilst the patient is in bed, and marking the outline of the limb with pencil upon the wood; after which, with a gouge hollow out the splint until it is deep enough to receive one-half the circumference of the limb, and then shave it down on the outside with a spokeshave to prevent it from being unreasonably heavy. After this it may be coated with glue, sheepskin being applied externally, and lint or flannel placed internally. (Fig. 213.) If there is any difficulty in procuring this splint—which can be neatly carved in most of our great cities—a very good substitute for it can be made of gutta-percha, cut to correspond with the general outline of the limb, soaked in warm water, and moulded upon the limb so as to fit it accurately.

Or the same thing may be done, and a very good splint obtained by taking ordinary binders' board, soaking it in warm water, and moulding it to the part.

By such means as these, rest may be insured, the splint, well padded with cotton, being secured to the limb and body by the ordinary

Fig. 212.

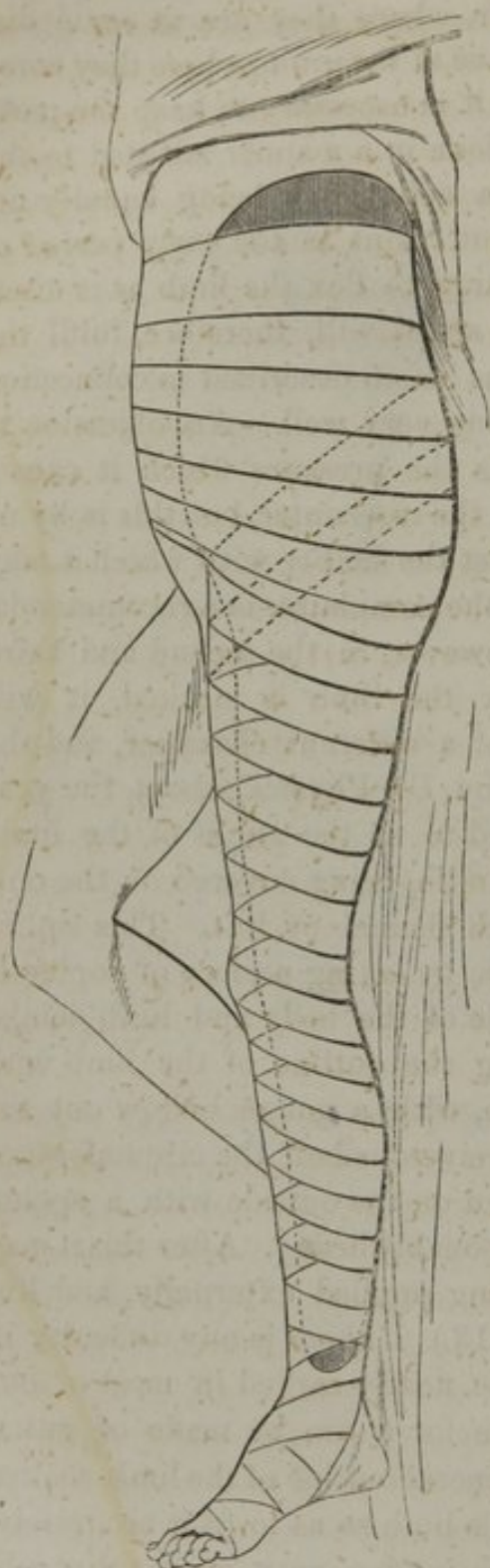


Fig. 213.



Fig. 212.—A side view of the Splint applied to the patient, as employed in the treatment of Hip Disease, showing the turns of the bandage which bind it to the limb, and especially the figure of 8 turns around the groin, those over the hip being shown by dotted lines. (After Nature.)

Fig. 213.—A side view of Physick's Carved Splint. (After Nature.)

turns of a roller, making figure of 8 turns around the groin, so as to secure this part particularly, and thus prevent the flexion of the thigh. (Fig. 212.) When it is first applied the patient often becomes restless, and if a child, is apt to cry, so that the splint will hardly be borne more than half an hour the first day. The next day, however, it will perhaps be borne for an hour, and in the course of a few days perhaps for twenty-four hours; indeed, such comfort is given that in the case of children, the child will often be quiet only when the splint is in place, and will cry incessantly when it is removed.

It has been urged as an objection to this splint that it makes pressure against the trochanter, and some even of its advocates have recommended, in consideration of this idea, that an orifice should be cut in it at a point corresponding with the position of the joint, with the view of preventing this pressure. But no such change is necessary, the shape of the splint, and the manner in which it is continued on the side of the chest, preventing any such force from being unduly exercised against the articulation.

The parts being thus kept at rest, much benefit will be derived from the use of *purgatives* twice or three times a week. A drachm of the compound powder of jalap may be given to an adult, and a proportionate dose to a child every Monday, Wednesday, and Friday night. This purging acts not only on the principle of revulsion, but also by relieving the congestion of the portal circle. The function of nutrition is, therefore, more actively carried on, and instead of being exhausted by frequent purgation, the patient sometimes actually grows fat under the treatment. The dose of the cathartic employed, whatever it may be, should not be sufficient to purge violently, but merely enough to give two or three soft evacuations. After the employment of these means, and by the local antiphlogistics above alluded to, the inflammation will often be so far diminished that the patient will suffer comparatively little pain. Occasionally, however, this becomes unusually severe, being neuralgic, or due to irritation of the nerves from the extension of the inflammatory action, and then some anodyne will be required, the Dover's powder presenting about the best that can be resorted to.

In the second stage, besides the above measures, counter-irritants, as blisters, &c., will often be found useful; but local bloodletting

will not now be well borne, nor will it afford such relief as it did in the acute stage.

In the third stage, when suppuration has come on and a discharge of pus begins to take place through ulcerated orifices near the trochanter, and in the groin, it may become necessary to cut a hole in the splint over the joint, in order to permit the escape of pus, and the application of poultices; but it is very seldom useful to expedite the escape of the pus by puncturing the integuments. Treatment will also be required to support the patient under the exhaustion of the suppuration. A full diet, as nutritious as can be borne without producing fever, should, therefore, be directed, while quinine and iron, and other tonics, may prove serviceable, especially if hectic fever supervenes. A very important part of the treatment in this stage is to give the patient fresh air, to do which he should be placed in a little wagon and thus drawn about. By these means the tendency towards luxation of the head of the femur will in many instances be prevented, and a cure accomplished with a more or less ankylosed limb; but this ankylosed limb will yet serve as a support for the body, and the patient, although lame, will be enabled to walk with a certain degree of facility.

Should the disease terminate in recovery after luxation of the head of the femur has occurred, and should the limb become ankylosed in its false position, it will sometimes be found advantageous, should the health of the patient justify it, to resort to Dr. Barton's operation,¹ and make a resection near the hip-joint, so as to establish a false joint, and thus allow the patient to recover with a limb at least somewhat more serviceable than it would otherwise have been.

¹ See Operative Surg., vol. ii. p 392, 2d ed.

PART VII.

AFFECTIONS OF THE EYEBALL AND ITS APPENDAGES.

ON account of the delicacy and importance of the eye to the usefulness and comfort of the human race, its disorders have always been carefully studied, and their treatment made to a considerable extent the duty of a special class of practitioners. Excellent treatises, creating volumes of considerable size, have, therefore, been devoted to their consideration. It is of course impossible, in a general work like the present, to do more than give a brief outline of this extended class of disorders; and what is now offered is presented in order to meet the wants of those students who may not be desirous of taking up, during their pupilage, the examination of this subject in all its details.

The disorders of the eye may be divided into two general classes: 1st, those which affect its appendages; and 2d, those attacking the ball itself. By the diseases of the appendages of the eye surgeons understand all such as affect portions exterior to its globe, as the lids, lachrymal gland, ducts, sac, muscles, &c.; whilst the affections of the ball embrace those which involve its different coats or humors, as the conjunctiva, or the lens, &c.

CHAPTER I.

AFFECTIONS OF THE APPENDAGES OF THE EYE.

SECTION I.

BLOWS UPON THE EYE.

BLOWS upon the region of the orbit of the eye produce generally more or less ecchymosis and discoloration all round it; this being

due to the rupture of small vessels beneath the skin; the violence of the blow being pretty well indicated by the extent of the discoloration.

Treatment.—These cases are to be treated: 1. By such means as are calculated to check the effusion of blood into the subcutaneous cellular tissue; and 2. By such as will lead to the absorption of that already effused. In order to attain the first object, nothing is better than cold and pressure, articles of a stimulating character being resorted to after a few days, in order to promote the absorption, such as the tincture of arnica, or any other stimulating tincture, spirits of hartshorne, &c. The practice of painting the injured part flesh color, under these circumstances, which is sometimes resorted to, retards absorption; and, while it improves the appearance of the patient for a time, postpones the period of his cure.

SECTION II.

FOREIGN BODIES IN THE EYE.

Foreign bodies may lodge between the lids and the ball, or be driven into the eye itself, and in either case should be removed as soon as possible, in order to keep down inflammatory action.

Treatment.—The treatment depends upon the character of the foreign body, and the position which it has assumed. Thus, if caustic substances, such as lime, have been introduced between the eyeball and the lids, bland injections should be immediately employed to counteract their corrosive effect, as those of olive oil, mucilage, &c.

When the foreign body has passed back into the folds of the conjunctiva, and cannot be readily seen by opening the lids, it may be found by everting them, as may be readily accomplished by pressing a probe or the end of a pencil upon the lid, while, with the other hand, traction is made upon the tarsal cartilage. The eversion being accomplished, the eye can be fully examined for the foreign body, the latter being generally readily discoverable, when it may be wiped out with the end of a handkerchief or with a camel's hair pencil. It sometimes happens, however, that, owing to the force of its propulsion, the foreign body is driven into the structure of the eye, as into the conjunctiva, or through the conjunctiva into the

sclerotic coat; or it may be imbedded in the structure of the cornea itself. Turners who work in metals are exceedingly liable to these accidents, small pieces of steel or other metal being thrown off by the revolutions of the lathe, and, striking upon the eye, penetrating it more or less deeply. In such a case, if the fragment has been driven quite through the coats into the ball of the eye, it is generally useless to attempt to remove it, as an abscess will form, and it will be thrown off when that opens—a process which involves the destruction of the eye and the consequent loss of sight.

If the fragment, however, is simply imbedded in the sclerotic coat, or in the laminae of the cornea, it may generally be removed by being raised up with the point of a curved cataract needle. Any little particle which is not removed in this manner being thrown off by the ordinary processes of suppuration and ulceration.

If the foreign body is driven into the substance of the cornea, the same plan is to be carried out, but greater care will be requisite in effecting the removal, particular attention being also paid to the treatment of the consequent ulcer, lest it result in the production of corneal opacity. The inflammation arising from these injuries should be combated on general principles.

SECTION III.

WOUNDS OF THE EYELIDS.

Injuries of various kinds, as well as surgical operations, sometimes lead to the production of wounds of the eyelids; the treatment of which requires the use of sutures and the observance of the general principles described in connection with wounds. The sutures in these wounds should, however, be removed in from twenty-four to thirty-six hours after their introduction. On account of the loose nature of the cellular tissue of the part, these wounds are liable to cause ecchymosis from the infiltration of the blood beneath the skin—a result which should be explained to the patient at the commencement of the treatment.

SECTION IV.

HORDEOLUM.

Hordeolum, or *stye*, is a little inflammatory swelling, which is often quite painful, and generally due to inflammation either in the cellular tissue of the lids, or in one or more of the Meibomian glands, the inflammation causing the obstruction of the duct and an accumulation of its secretion, from the distension of which an abscess follows; or there may be simply the creation of a phlegmon of the lid, as seen elsewhere. By the patient this affection is frequently confounded with a condition which is, in fact, a true abscess, and the result of inflammation of the cellular tissue between the fibres of the orbicularis palpebrarum and the skin. This more simple affection runs the course of abscess elsewhere, and is far from being as painful as the true *Hordeolum*.

Treatment.—In either case the treatment is precisely that which is adapted to any ordinary abscess, warmth and moisture being applied either by means of poultices, or the warm-water dressing, or something more stimulating, as the alum curd. As soon as the formation of pus is observed, it should be evacuated by means of a cataract-needle, or some similar instrument.

The popular plan of treating styas, by extracting one or two of the cilia, is only successful when the bulbs of these hairs are so situated that their withdrawal ruptures the abscess and evacuates its contents. Other popular remedies are still practised and believed in by the vulgar, as rubbing the stye with a wedding-ring moistened with saliva, or having it touched by the tongue of one's lady love, either of which are said to be exceedingly efficacious, though, if useful, can only be so through the stimulus of the saliva.

The chronic induration and thickening of the edges of the lids which are left after a stye or after a succession of styas, are to be treated by means calculated to produce absorption of the effused lymph to which the induration is due; such means are to be found in frictions with mild mercurial ointment, or with red precipitate, or iodine ointment, &c.

SECTION V.

OPHTHALMIA TARSI.

Ophthalmia Tarsi, or *Psorophthalmia*, is a complaint of an inflammatory character also, involving the Meibomian glands, the secretions of which are in consequence disordered, so that the eyelids are glued together during sleep. This affection is common among the strumous children of asylums and hospitals, with whom it assumes a chronic character, and is exceedingly obstinate, resulting in destruction of the bulbs of the eyelashes, loss of the cilia, and a thickening of the conjunctiva of the lid, the latter being often more or less everted, so as to present the peculiar raw appearance of the edges of the lid which has been denominated "blear eye."

Treatment.—In its acute form this affection is to be treated by the antiphlogistic measures adapted to inflammation elsewhere; but when it becomes chronic, more advantage will be obtained from improving the patient's general health by the use of tonics, chalybeates, &c., as well as by stimulating local applications, rather than from depletory measures. In the case of scrofulous children much benefit will also be derived from the continued administration of cod-liver oil, and from such general means as are adapted to the treatment of the tuberculous cachexia.

The local treatment is to be conducted upon those general principles which regulate the treatment of ulceration elsewhere, with the exception that, in this case, ointments are preferable to washes. The use of astringent ointments will often prove highly advantageous, such as that of the precipitated carbonate of zinc, which may be smeared upon the edges of the lids. Ointments of an alterative character, calculated to act upon the diseased Meibomian glands, are also exceedingly useful, and of these the best is probably the citrine ointment (*Unguentum Hydrargyri Nitratis* of the *Pharmacopœia*), which may be applied to the edges of the lids either pure, or diluted with varied proportions of simple cerate, according to the acuteness of the disorder. It should be applied by means of a camel's-hair pencil the last thing before retiring at night; the patient immediately closing his eyes and not opening them again, if possible, till he falls asleep. Upon rising in the morning, the eyes

should be washed in warm water, not in cold, as the latter, by the reaction which follows its use, gives rise to increased vascular action.

Sometimes this disease results in the production of such changes of structure as require local applications to modify more completely the action of the part, lest destruction of the mucous membrane, eversion of the lid and other unpleasant consequences result: in this case, nothing better can be recommended than light cauterization of the edges of the lids with the nitrate of silver.

SECTION VI.

TRICHIASIS.

Trichiasis (τριχος, a hair) is the name given to a complaint which consists in the in-growing of the eyelashes. As normally placed, the eyelashes of the upper lid are convex downward, and those of the lower lid convex upward, so that when they meet, dust is effectually excluded from the eyes, and yet there is no danger of the hairs coming in contact with the delicate conjunctival surface. Sometimes, however, as a result of disease, whether such as elongates the lid, or only affects the bulbs of the ciliæ, the eyelashes are brought against the ball, producing much irritation, and resulting, finally, if unrelieved, in inflammation of a troublesome character.

Treatment.—The treatment may be palliative or radical. The palliative treatment consists in the extraction of the cilia by means of fine forceps, and, if the extraction is performed carefully, the relief will be complete for the time. Generally, however, a new growth of ciliæ reproduces the disease, and it may then become necessary to resort to some radical mode of cure. If the disease is produced by inversion of the lids or entropion, it will be relieved by the operation appropriate to that condition, but if due to a disorder of the bulbs of the ciliæ, the only method upon which the slightest reliance can be placed, is cauterization of a sufficiently active character to destroy their bulbs completely.

SECTION VII.

DISTICHIASIS.

Distichiasis (δῖς, double, and στίχος, a row) is a modification of the above complaint, in which there are two rows of eyelashes, the inner one of which turns in so as to irritate the ball.

Treatment.—The treatment recommended in trichiasis is equally applicable in distichiasis.

SECTION VIII.

ENTROPION.

Entropion (εν, in; and τρεπω, I turn) is a complaint in which the eyelids are inverted, the edges of the lids and the eyelashes being turned in upon the ball. (Fig. 214.) The causes are various. Any irritation producing contraction of the mucous membrane lining the lid may result in this deformity. It may, moreover, be produced by diseases of the tarsal cartilage and various other causes, the evils of this complaint being chiefly those of the trichiasis which results from it.

Treatment.—The treatment may be divided into two varieties, the palliative and the radical. The palliative consists in applying strips of adhesive plaster to the lids in such a manner as to keep their edges off from the ball, a plan which may be aided by extracting the ciliæ; but the relief obtained from this treatment is merely temporary, and, in the great majority of cases, an operation for the radical cure will have to be attempted.¹

Fig. 214.



A VIEW OF ENTROPION AS AFFECTING BOTH EYELIDS, showing how the eyelashes are applied against the ball of the eye. (After Miller.)

¹ See Operative Surgery, vol. i. p. 276, 2d edit.

SECTION IX.

ECTROPION.

Ectropion (*εκτρεπω*, I turn off), or eversion of the eyelids, is a condition precisely opposite to that which has just been described, and gives rise to various inconveniences which are chiefly due to the exposure of the lid as well as the ball, and the deformity which this creates. It may be caused by chronic thickening of the conjunctiva, as the result of inflammation, or by the cicatrix of burns, &c., and may be met with either in the upper or lower lids, the latter causing marked deformity (Figs. 215 and 216).

Fig. 215.



Fig. 216.



Fig. 215.—ECTROPION OF THE UPPER EYELID, showing the deformity which it creates, and the amount of the conjunctiva thus exposed to the dust of the atmosphere. (After Miller.)

Fig. 216.—ECTROPION OF THE LOWER LID, the result of a cicatrix on the cheek. (After Miller.)

Treatment.—The treatment must consist in the removal of the cause; thus, if the ectropion be due to chronic conjunctivitis or chronic psorophthalmia, these complaints should be treated, and their cure will generally produce a removal of the complaint; but should these measures fail, an operation may be resorted to.¹

SECTION X.

LAGOPHTHALMUS.

Lagophthalmus (*λαγος*, a hare; and *οφθαλμος*, an eye), or hare-eye, is the name given to a complaint due to a loss of power in the orbi-

¹ See Operative Surgery, vol. i. p. 272, 2d ed.

cularis palpebralis muscle which results in an inability to close the eye, of so marked a character that the ball remains uncovered during sleep, it being said that the hare never closes her eyes in sleep. It may ensue upon various causes, as exposure to cold, or any cause capable of producing local paralysis.

Treatment.—When dependent upon such causes it is to be treated as a local paralysis would be elsewhere, a small blister being put upon the temple or over the eyebrow, the raw surface thus created being afterwards dressed with strychnine ointment until slight twitchings of the muscles are perceived.

SECTION XI.

PTOSIS.

Ptoſis (πτωσις, a falling), or falling of the eyelid, is the opposite condition of the lid, in consequence of which it droops so as to cover the eye partially and interfere with distinctness of vision. It may be produced by any cause that results in palsy of the third pair of nerves. Relaxation of the levator palpebræ being thus caused, the contractions of the orbicularis palpebrarum muscle draws down the lid.

Treatment.—The treatment must be conducted upon the same general principles as are applicable to lagophthalmus.

SECTION XII.

ANCHYLOBLEPHARON.

Anchyloblepharon (αγκυβλη, contraction; and βλεφαρον, the eyelid) signifies union of the edges of the lids to each other, and may result from various causes, as burns, cicatrizing ulcers, psorophthalmia of a chronic character, &c.

Treatment.—The adhesions may be divided; but if extensive, the complaint will return in spite of every effort, and reproduce the deformity.

SECTION XIII.

SYMBLEPHARON.

Symblepharon (συν, with; and βλεφαρον, the eyelid) signifies the adhesion of the conjunctiva lining the lid to that covering the eyeball. It may be produced by chronic conjunctivitis, by burns, by the cicatrices of wounds, and by ulcers, &c. &c.

Treatment.—The adhesions, if very slender and thread-like, may be divided and the ulcer that will be left, healed, by gently cauterizing it with the nitrate of silver; but if the adhesions are extensive, it is useless to subject the patient to the pain of an operation, as the deformity will generally be reproduced.

SECTION XIV.

ENCYSTED TUMORS.

Encysted Tumors of the lids are to be treated on the same principles as those seen elsewhere, the most judicious plan being to excise them.¹

SECTION XV.

AFFECTIONS OF THE LACHRYMAL APPARATUS.

The lachrymal apparatus consists of the lachrymal gland by which the tears are secreted and conveyed over the conjunctival surface of the eyeball, and of the various structures forming the puncta lachrymalia, the canaliculi lachrymalis, and the lachrymal sac by which the tears are conducted through the ductus ad nasum into the nostril.

§ 1.—ENCANTHUS.

Encanthus (εν, in; and γωνος, angle of the eye) is a disease caused

¹ See Operative Surgery, vol. i. p. 266, 2d ed.

Fig. 217.



A front view of an Encanthus of some size. (After Miller.)

by an enlargement of the lachrymal caruncle. (Fig. 217.) When it creates marked deformity, a portion of it may be excised.

§ 2.—XEROPHTHALMIA.

The lachrymal gland is liable to be attacked by various diseases, any of which may result, under certain conditions, in a diminution of the secretion of the tears, producing what has been described as *xerophthalmia* (ξηρος, dry), or dryness of the eyes, a condition which may be created by a diminution of the mucous secretion of the ocular conjunctiva.

Treatment.—This condition is to be treated upon the general principles which apply to the treatment of diminished secretion elsewhere. During the treatment much comfort will be derived from the occasional introduction of mucilaginous washes into the eye, to supply temporarily the lost secretion.

§ 3.—EPIPHORA.

As a result of inflammation or other causes, a condition precisely the reverse is sometimes observed; the patient having an increased secretion of tears which overflow the lid and run down upon the face. To this condition the name of *Epiphora* has been given. It is to be treated by the use of astringents and by dilatation of the puncta.

§ 4.—DACRYOCYSTITIS.

Dacryocystitis (δακρυον, a tear; and κυστις, a bladder), or inflammation of the lachrymal sac, is a complaint which, proceeding from

various causes, runs the course of inflammation elsewhere, and often results in suppuration and abscess of the sac. When it goes on to this extent, the ordinary symptoms of abscess are presented, as redness, pain, and swelling of the skin over the sac at the inner canthus of the eye, with the evidences of the formation of pus, the abscess bursting near the inner angle of the eye, and producing the condition which is generally described as fistula lachrymalis.

§ 5.—FISTULA LACHRYMALIS.

When this condition has been created by the causes above described, means must be taken to restore the obstructed duct to its patulous condition, and this is best effected by means of a style which is to be introduced into the duct.¹

SECTION XVI.

STRABISMUS.

Strabismus (στραβος, twisted), or squinting, is a want of parallelism in the axis of the two eyes, which is kept up by the defective action of the muscles of the ball. The muscles involved are most frequently the recti, although the oblique muscles are also at times affected. The squint generally depends upon excessive contraction of *one* of the muscles, and this is most frequently accompanied by preternatural relaxation of its antagonistic muscle.

Varieties.—If the contraction affects the internal rectus, the complaint is called a *converging squint* (strabismus convergens); the affected eye being turned inward toward the inner canthus. The opposite condition is called a *divergent squint* (strabismus divergens), in which the internal rectus is relaxed, and the external preternaturally contracted, causing the ball of the eye to roll towards the external canthus.

If the oblique muscles are affected, the eye may be rolled inwards and upwards, or outwards and downwards; but these varieties are more rare.

¹ See Op. Surg., vol. i. p. 282, 2d edit.

Etiology.—The causes which create the disorder are various. Thus, it may arise from congenital weakness of sight; from congenital malformation; from imitating others who squint; by looking too steadily and too frequently at small objects; by irritation of the stomach and bowels; by worms, &c.

Treatment.—The treatment of strabismus is both constitutional and local, and on account of the neglect of the constitutional treatment, many local remedies—as operations for its relief—have failed, which would otherwise have been perfectly successful; the general treatment should, therefore, precede any operation. If the cause is found to be irritation of the stomach and bowels, this condition must be attended to; if it is found in worms, they should be removed by means of anthelmintics; and if the patient is debilitated and anemic, the use of chalybeates and tonics is indicated. By thus improving the patient's general health, we may anticipate an improvement in the condition of that muscle of the ball upon which the complaint depends, particularly when the excess of action on one side is the result of paralysis of the opposite muscle.

Advantage will also be derived from exercising the motions of the eye, as the muscles of the eyeball may be strengthened and improved by judicious exercise, precisely as those of other parts of the body. The patient should, therefore, stand before a mirror, and, covering the sound eye with his hand, endeavor to look straight at it, as he can readily do. Or, in children, the same result may be obtained by placing two gilt balls—fastened behind the head upon a semi-circular wire—near the external canthus of the eyes, and inducing the little patient to look at them. When it is evident that the strabismus is produced by paralysis of one of the muscles of the eye, such means must be employed as are likely to correct this condition; thus, a blister of small size may be put upon the temples, and the raw surface dressed with a cerate consisting of a quarter of a grain of strychnia to an ounce of simple cerate.

Electricity has also been said to prove serviceable, particularly that form of electro-magnetism which is produced by the revolution of coils of wire before the ends of a horseshoe magnet. Such a current may be passed daily through the temples; but it is necessary to use it with caution, particularly in the case of children, where the fright produced by the incautious application of it, by creating violent struggles, screaming, &c., might result in an afflux of blood

to the part, the pernicious influence of which would more than counterbalance any good that would follow the application.

But when the careful employment of these means has failed, and the surgeon is satisfied that the squint is caused by a direct and continuous contraction of one of the muscles, he may derive benefit from an operation.¹

CHAPTER II.

DISEASES OF THE EYEBALL.

Anatomical Relations.—The eyeball consists of various coats, which contain the humors of the eye. Of these coats the most external is the mucous coat, which is designated as the *conjunctiva*. This covers the front of the ball, and being reflected over it on to the lids, lines their internal surface. It is a delicate mucous membrane, which is exceedingly liable to take on inflammation, and is continuous through the puncta, lachrymal sac and nasal ducts, with the mucous membrane of the nose. Immediately within the *conjunctiva* is to be found the *sclerotic coat*, a dense fibrous structure into which the tendons of the muscles of the eye are inserted, and which may perhaps be regarded as formed by their expansion. This structure is liable to the ordinary affections of the fibrous tissues, just as the diseases of the *conjunctiva* present symptoms similar to those of mucous membranes elsewhere.

In the front of the eye there is a circular opening in the *sclerotic coat*, having a bevelled edge which receives the *cornea*, a transparent structure consisting of various laminae, and serving to transmit the rays of light to the inner portions of the eye. Within the *sclerotic* are several other coats, the *choroid*, &c. &c., which are of no importance in a surgical point of view; whilst the most internal coat is the *retina*, upon which the image of an object is finally thrown, there producing the impression which is perceived by the brain. A short distance behind the *cornea* is the membrane known as the *iris*, a circular curtain attached around its circumference to the ciliary bodies, and perforated in the centre by a round opening,

¹ See Operative Surgery, vol. i. p. 288, 2d edit.

which is designated as the *pupil*. In the structure of the iris there is a certain amount of muscular fibre, and these muscular fibres are of two classes, the one circular, producing by their contraction a diminution of the size of the pupil, the other longitudinal and radiating, which dilate it by their contraction. The space between the iris and the cornea is designated as the *anterior chamber*; the space between the iris and the front of the lens, which is of smaller size, being known as the *posterior chamber*. These two chambers are filled with a fluid, which is called the *aqueous humor*. At a short distance behind the iris is *the lens*, surrounded by its proper capsule, between which and the lens itself is a small amount of fluid known as Morgagni's liquid. Behind the lens is the *vitreous humor*, which constitutes the greatest part of the bulk of the eye.

In addition to this rapid description of the structure of the eye, it may be stated for the information of the young student that the names of the inflammations of these coats are formed simply by adding *itis* to the name of the coat; thus, inflammation of the conjunctiva is designated as conjunctivitis; of the cornea, as corneitis; of the sclerotica, as scleritis; of the iris, iritis, &c.

SECTION I.

CONJUNCTIVITIS.

Conjunctivitis, or inflammation of the conjunctiva, resembles the inflammations of other mucous membranes generally.

Etiology.—It may arise from various causes, as simple exposure to cold, resulting in catarrh; from the presence of foreign bodies between the lid and the ball; from wounds—in fact, from any cause likely to result in the production of inflammation elsewhere.

Symptoms.—The symptoms are as follows: The patient experiences pain in the eyes of a sharp pricking character, the sensation being similar to that experienced from the presence of a foreign body in the eye, and due simply to engorgement and consequent enlargement of the superficial vessels of the conjunctiva. There is also a sense of heat and stiffness, and some intolerance of light, the lids being kept partially closed. The irritation extending to the lachrymal gland, the action of that organ becomes excessive, and there is consequently increased lachrymation, the tears over-

flowing and running down upon the face, whilst, as the secretions become changed by the inflammatory action, the tears mixed with the vitiated secretion of the conjunctiva often become acrid and irritating. The eye is red and bloodshot, and the character of this vascularity should be noticed particularly, on account of its value as a diagnostic mark, as it serves to distinguish between conjunctivitis and sclerotitis; the enlarged vessels in conjunctivitis being tortuous, reticulated in their character, and giving the appearance of a network, while in sclerotitis they are quite straight, and radiate from the cornea towards the circumference of the eye. (Fig. 218.)

Fig. 218.

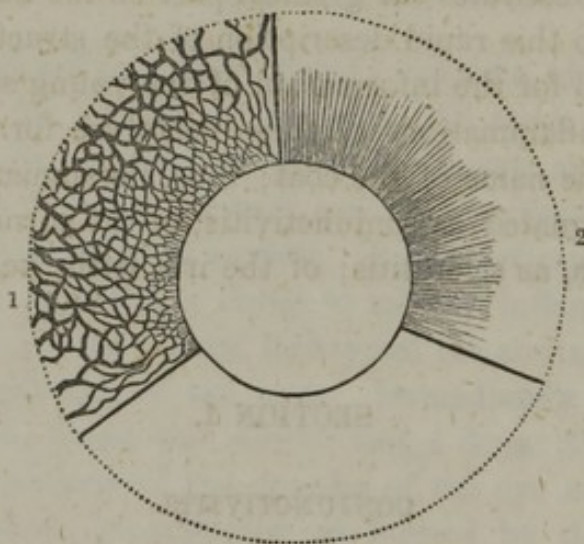


DIAGRAM TO SHOW THE CHARACTERISTIC VASCULARITY OF CONJUNCTIVITIS AND SCLEROTITIS.—1. Tortuous vascularity of conjunctivitis. 2. Straight vessels of sclerotitis. (After Wharton Jones.)

If the disease is violent, it also develops a certain amount of constitutional disturbance, this consisting in febrile reaction, with digestive and circulatory derangements. Occasionally, instead of the simple affection just described, more marked symptoms occur, and the condition is presented which is designated as *purulent conjunctivitis*. In this case an increase of the secretion of the part is first noticed; then there is a tendency in this secretion to become white, thick, and opaque at first, afterwards yellow and purulent, and finally thin, acrid, and irritating; greenish in color, and presenting characters of ichor; or it may resemble sanies, the color being produced by the rupture of some of the superficial vessels, and the escape of the more or less altered coloring matter of the blood. This thin, acrid,

irritating pus running down over the face, also produces more or less excoriation or eczema of the cheek. In a short time a fulness and swelling of the lid are noticed, which increase frequently to such an extent as to result in closure of the eye, in addition to which there may even be a protrusion of folds of the mucous membrane; or this protrusion may take place before the swelling of the lids has gone on to such an extent as to close the eye, thus producing a true ectropion. The disease continuing, the inflammation may be extended from the conjunctiva to the submucous cellular tissue, which is to be found between that membrane and the sclerotic coat; and the effusions of serum or of lymph thence resulting may elevate the conjunctiva to such an extent that the cornea appears deeply sunken in the eye, thus producing the condition designated as *chemosis*. If this condition continues, the cornea itself is apt to become involved, and the disease be complicated with the symptoms of corneitis, which may even go to such an extent as to result in sloughing of the cornea.

Etiology.—The causes are various, as exposure to a bright light for a great length of time; derangements in the constitution of the patient, and certain conditions of the atmosphere which are not understood. When produced, conjunctivitis is not unfrequently capable of being propagated by contagion, and will consequently often sweep through the entire wards of a hospital.

Treatment.—The treatment of simple acute conjunctivitis is based upon general principles. Antiphlogistics are imperatively demanded if the patient has a good constitution, and if he is plethoric they may be carried with advantage to a marked extent. Where the attack is violent under these circumstances the treatment must also be prompt, the patient being stood up and bled until he becomes faint. Afterwards local bleeding by means of leeches and purgatives should be resorted to, especially the saline purgatives.

Much advantage will also be derived, after the first few days, from the use of astringent collyria, these being very much the same as the astringent injections adapted to the urethra in gonorrhœa, except that the collyria must be weaker. As a general rule, a solution of any of the astringent salts, such as sulphate of zinc, acetate of lead, &c., of the strength of half a grain to the ounce of distilled water, will make a collyrium suitable to begin with; but the acetate of lead must not be used in cases which are complicated with ulceration of the cornea, as there will result from its use a white deposit of carbon-

ate of lead in the ulcer, which may lead to the production of a corneal speck. Much comfort will be derived at first from mucilaginous washes, as the mucilage of the pith of sassafras, &c. When the disease becomes chronic, more stimulating applications are demanded, and the nitrate of silver now comes into play, it being applied of the strength of one-quarter or one-half grain to the ounce of distilled water.

Purulent Ophthalmia will require a more active treatment, and here advantage will be found from using, from the first, a stronger solution of nitrate of silver—say a grain or a grain and a half to the ounce—with the view of modifying the action of the diseased mucous membrane. Advantage will also be frequently derived from painting the inner surface of the lids with a pencil dipped in a still stronger solution of the nitrate of silver, say twenty grains to the ounce. When there is marked *chemosis*, the patient will often be benefited by making punctures in the conjunctiva with a view of allowing the effused serum to escape, or by applying a few leeches directly to the conjunctiva.

§ 1.—GONORRHOËAL OPHTHALMIA.

Gonorrhœal Ophthalmia, a very high grade of purulent conjunctivitis, is produced by the contact of gonorrhœal matter with this coat of the eye. That such a disease may be produced in this manner should always be borne in mind by the surgeon, when treating gonorrhœa, the patient being warned of the possibility of the fact, that so formidable a disease may thus be prevented. Gonorrhœal ophthalmia is very violent in its grade, running its course and resulting in total destruction of the eye, if not promptly met, in from twenty-four to forty-eight hours; but, except in its degree and cause, it is very similar to ordinary purulent ophthalmia.

Gonorrhœal Ophthalmia, being a peculiarly violent grade of conjunctivitis, requires to be treated very promptly, in such a manner that the specific inflammatory action shall be changed and another substituted. The lids, therefore, should be thoroughly everted, and their inner surface having been well cleaned, they should be painted with the solid stick of nitrate of silver, so as to form a delicate white film over their surfaces—then water should be squeezed on them from a sponge, so as to wash off any of the free caustic, after which

the lids may be allowed to come in contact with the eyeball. This application, instead of adding to the pain, often gives prompt relief with an amelioration of the symptoms, and may be followed next day by a strong collyria of thirty grains of the nitrate to the ounce of water, a portion of which may be dropped into the eye, or the lids painted with it by means of a camel's hair pencil. By these means there is some hope of arresting the progress of the complaint, which otherwise, in a few hours, would result in sloughing of the cornea and destruction of the eye, as has been shown in many melancholy instances.

§ 2.—SCROFULOUS CONJUNCTIVITIS.

This modification of conjunctivitis, which is met with in children of the tuberculous diathesis, among the poor and inmates of asylums and hospitals, is much the same in its symptoms as the ordinary inflammation of the conjunctiva, above described; but there is more intolerance of light, and a greater disposition to febrile reaction; the intolerance of light being sometimes such that the patient, particularly if a child, turns upon his belly and buries his face in the pillow, or covers it with his hands, to exclude, if possible, the faintest rays from entering. The muscles of the face, and particularly the orbicularis palpebrarum, are also violently contracted, so as to cover the ball. The pus secreted by the conjunctiva, when the inflammation is of a high grade, is generally very irritating, and, running over the face, produces eczema and excoriation. The corneal conjunctiva is also apt to be involved in this form of conjunctivitis, in consequence of which ulceration of the cornea frequently supervenes; the cicatrix left by the ulcer, should it heal, being slightly depressed, and presenting more or less opacity of the cornea, thus creating what the vulgar call a "feather on the sight."

Scrofulous Ophthalmia is to be treated by means of those constitutional measures appropriate in ordinary cases of the tuberculous diathesis, tonics, stimulants, and chalybeates being resorted to instead of antiphlogistics, whilst the local treatment is to be carried out upon the same principles as the other forms of conjunctivitis, being proportioned in activity to the grade of the complaint.

§ 3.—PTERYGIUM.

The *Pterygium* (πτερυξ, a wing) is a varicose excrescence, or enlargement of the vessels of a portion of the conjunctiva accompanied with thickening of the membrane itself, which is generally triangular in shape, and found in the inner corner of the ball, as well as occasionally on its outer margin, or sometimes in both points (Fig. 219), the apex of the triangle in either case presenting towards the cornea. This condition may result from any of the chronic forms of conjunctivitis, and may be removed by extirpation, with a pair of curved scissors, or by cutting it across transversely, and thoroughly cauterizing the wound with the solid stick of

Fig. 219.



A front view of a Double Pterygium. (After Miller.)

the nitrate of silver, so as to close the vessels and cause the portion of the pterygium, which is on the cornea and impairs the sight, to disappear by atrophy.

SECTION II.

SCLEROTITIS.

Sclerotitis, or inflammation of the sclerotic coat of the eyeball, is sometimes called rheumatism of the eye, or rheumatic ophthalmia. It is found following upon changes in the condition of the atmosphere, and is sometimes due to extension of inflammation from some neighboring tissue, as from the iris or the conjunctiva. It may be produced by wounds, or by any of the ordinary causes which lead to the development of inflammation.

Symptoms.—The symptoms of sclerotitis are as follows: There is a dull heavy pain in the ball, which is severe and pulsatile in its character. There is pain in the temple, and tenderness of the ball upon pressure, the pain being more severe at night, and the cornea becoming hazy. There is, however, little or no increased lachrymation, unless the disease is combined with conjunctivitis, whilst the pupil remains unchanged, unless it is complicated with iritis.

Diagnosis.—Sclerotitis may be readily diagnosed from conjunctivitis by the character of the vascularity, as was pointed out under the head of conjunctivitis. If the two diseases exist at the same time, the two varieties of vascularity will be present simultaneously and readily recognized.

Treatment.—The treatment is similar to that of rheumatism, free purgatives being administered, and combined with the use of antimonials or of Dover's powder. Wine of colchicum seeds, in the dose of ten to twenty drops three times a day, will also prove of service, though sometimes this will require to be given in large doses, say a teaspoonful three times a day, when it will be useful not only as a purge but as a sedative. The local applications should all be warm, and may consist in the warm water dressing, applied according to the exigencies of the case. Counter-irritants are often serviceable, such as the application of small blisters to the temples or behind the ears; and advantage will frequently be derived from rubbing upon the lids the extract of belladonna, rendered thin with water, or aconitia, in the proportion of a grain to the drachm of lard. These anodynes prove of service, both by allaying the pain and diminishing the flow of blood to the part; or a plaster of opium may be applied to the temple, and worn for several days.

SECTION III.

CORNEITIS.

Symptoms.—The symptoms of *Corneitis* are haziness of the cornea, a disposition to increased lachrymation, from its connection with the conjunctiva, which is spread as a thin layer over its front lamina, and intolerance of light, whilst it is not unfrequently complicated with conjunctivitis and sclerotitis, all their symptoms being also present. If the disease progresses to any extent, it may result in a true ulcer of the cornea, or there may be effusions of lymph into the structure of the cornea itself, producing opacities which have been designated by various appellations, according to their degree. When very slight, the opacity is designated as a *nebula*, this being a mere cloudiness or circumscribed haziness in the vision of the affected eye, and often requiring some care on the part of the surgeon to perceive it. A thick opaque spot in the cornea, such

as results from the healing of a corneal ulcer, is designated as *leucoma*; and when there are vessels running over the surface of the cornea, to communicate with a spot of opacity somewhere on the cornea itself, the condition is designated as *pannus*.

An amount of lymph greater than that in a leucoma, and which produces a distinct white spot, is designated as *albugo*.

These effusions of lymph into the substance of the cornea are very difficult to relieve, though much may be done in the way of prevention by care in the treatment of the early stages of the corneitis and by cauterizing, with the nitrate of silver, any ulcers that may form upon the cornea.

Treatment.—Corneitis, being accompanied most frequently with conjunctivitis, requires very much the same treatment as was directed for simple inflammation of the conjunctiva, great attention being given to the formation of the little blisters or abscesses which form beneath the conjunctiva covering the cornea, and are the commencement of the corneal ulcers. As soon as an abrasion of the corneal conjunctiva is seen, or an ulcer which is only superficial shows itself, it should be *lightly* cauterized, in order that it may heal under the eschar or film thus created, which thus protects the surface from the irritation of the tears. When thus promptly met, an ulcer of the cornea will often heal without creating opacity. Should, however, an opacity unfortunately form, it is to be treated by such applications as will stimulate the vessels of the part, and favor the absorption of the lymph that creates the whiteness of the spot. The popular remedy of dropping sugar-house molasses into the eye is not a bad one. Benefit has also been derived from blowing calomel and finely-powdered white sugar into the eye; as well as from the application to the spot of red precipitate ointment, applied by means of a camel's hair pencil; from the use of a collyrium consisting of a half grain of corrosive sublimate dissolved in an ounce of water; and from the application of nitrate of silver, either in strong solution or in the solid stick. Fumigations with the vapor of hydrocyanic acid by means of a glass bottle with a neck so shaped as to fit the eye has also been recommended, and may prove useful as a stimulant. At one time the sulphate of cadmium was supposed to possess peculiar efficacy in removing opacities of the cornea, but personal experience has not shown that it has any more power than the sulphate of zinc.

The cure of *albugo* and of *leucoma* has been attempted by

excising the outer layer of the cornea in order to allow the applications to be brought directly in contact with the effused lymph, the spot being afterwards cauterized with the nitrate of silver; but this treatment has been very generally unsuccessful.

SECTION IV.

STAPHYLOMA.

As a consequence of various affections of the cornea and of the interior of the eyeball, the former becomes prominent, projects beyond the lids and creates an unsightly deformity, besides giving rise to considerable irritation from the fact that it collects on its surface the little particles of dust which are constantly floating in the atmosphere. This condition is designated as staphyloma (*σταφυλή*, a grape), from its conical or globular form (Fig. 220).

Fig. 220.



A side view of Staphyloma.
(After Miller.)

Etiology.—The causes are various. It may be a consequence of inflammatory action in the globe resulting in effusion, or in softening of the vitreous humor; or it may ensue on dropsy of the aqueous humor, the pressure of which causes the cornea to protrude; but most frequently this condition is the result of the morbid alterations in the cornea already stated. It is generally accompanied with opacities of the cornea more or less dense, and the patient suffers from loss of sight as well as from the irritation consequent upon the complaint.

Treatment.—The treatment in such a case is simple; nothing curative can be effected, but much relief may be obtained from evacuating the humors of the eye, as the patient loses nothing by the operation, his sight being already destroyed; whilst he gets rid of the deformity, and of the suffering entailed by the constant irritation of the eyeball from the foreign matter which adheres to its prominent surface.

The operation may be effected by slicing off the more prominent parts of the staphyloma, and allowing the humors to be thus gradually evacuated; or the same end may be attained by a simple puncture with a lancet.

SECTION V.

IRITIS.

Inflammation of the iris, according to the law of nomenclature above alluded to, is termed *Iritis*.

Etiology.—The causes are numerous, and are to be found in some peculiar condition connected with secondary syphilis, which is perhaps the most frequent cause of the complaint; or it may be created by exposure to cold; by blows; by wounds made during operations upon the eye, as in the operation for cataract; or it may result from a simple extension of an inflammation set up in some other coat, and thus be a consequence of conjunctivitis, of corneitis, sclerotitis, or choroiditis.

Symptoms.—When iritis is developed by any of these causes the symptoms are as follows: There is violent pain in the eye, this pain being deeply seated, and referred to the course of the optic nerve

or to its origin in the brain, in addition to which, changes in the color of the iris become apparent, the tint becoming darker than is natural, owing to the afflux of blood to the tissue. There is also often a change in the shape of the pupil, in consequence of the irregular contraction of its muscular fibres, and there is usually noticeable a zonular redness around the cornea, this zonular redness being of that variety of vascularity which is characteristic of sclerotitis. (Fig. 221.)



Iritis, showing the characteristic Vascularity, the Lymph on the Iris, and the contracted irregular Pupil. (After Miller.)

The effects of the inflammation may also show themselves in a way that produces serious consequences; thus the iris may become adherent at its pupil

by the organization of the effused lymph, either posteriorly to the capsule of the lens, producing a condition which is described as *synechia posterior*, or it may adhere anteriorly to the cornea, and produce the condition designated as *synechia anterior*.

Inflammation of the iris may run on to such a grade as will result in suppuration, the effused pus escaping into the anterior chamber, and producing various degrees of yellowness in the color of the aqueous humor, to which the name of *Hypopion* has been given. If the effusion of pus is very free, it may produce a bulging of the cornea forward, and result in the establishment of staphyloma.

Diagnosis.—The diagnosis of iritis is generally easy, the change of color being the most marked symptom. It therefore becomes important to bear in mind the fact that there may be peculiarities in the color of perfectly healthy eyes which, to a certain extent, would simulate the disease. Thus, an individual may naturally have one eye gray and one slightly greenish; and, under these circumstances, the surgeon would sometimes fall into error if he depended for his diagnosis upon the color of the iris alone. Still, as a general rule, where there is a difference between the color of the two irides, particularly if the pupil is irregularly contracted, and the other local and constitutional symptoms of the disease are present, the case may be safely set down under the head of iritis.

Prognosis.—The prognosis of iritis depends very much upon the period at which it comes under the surgeon's observation. If lymph has been effused, if the pupil is irregularly contracted, and particularly if the condition of things is such as to lead the surgeon to suspect either synechia anterior or synechia posterior, the prognosis will be unfavorable. If the case is seen at an earlier stage, and before there is reason to suspect the effusion of lymph, the prognosis will be much more favorable.

Treatment.—The treatment of iritis is precisely that which would be proper in the treatment of inflammations of any other highly vascular and important structure, as it must be of the most active antiphlogistic character. The inflammatory process here, as elsewhere, always presents an increased vascularity, which, if left unchecked in the iris, will result in an effusion of lymph—the dangers of which have been pointed out—if it does not result in an effusion of pus. To diminish this increased vascularity, and thus prevent evil consequences, there is no better remedy than general blood-letting; which, to be truly efficacious, should be prompt and carried to a considerable extent. The medicinal treatment should then be commenced by the administration of a brisk purge; and this, to be serviceable, should contain a mercurial. Mercurials in small doses frequently repeated, and carried to such an extent as to im-

pair the condition of the blood, break down the plasticity of the lymph, and thus diminish or remove the evils consequent upon adhesions of the iris, are also often highly useful; but, in order that their effects may be fully produced, the mercurial should be carried to such an extent as to induce salivation.

To alleviate the pain from which the patient suffers, opium may be resorted to, this being also indicated on account of the sedative, and consequently antiphlogistic properties of the drug.

Another important measure is the local use of belladonna or of atropia, which, while it serves to relieve the pain, also acts by directly diminishing the inflammatory action, and this because it diminishes the pain upon the old principle, "Ubi irritatio ibi affluxus est." Belladonna, moreover, answers another important point, as, by relaxing the circular fibres of the iris, it allows the radiating fibres to contract, and thus producing dilatation of the pupil, removes in a great measure the risks of the adhesion of its edges.

The extract of belladonna should be applied by rubbing it, when softened with a little water, around the eye, and, as it becomes dry and hard, sponging it off and applying more. Or it may be combined with lard and made into the form of an ointment or a cerate; but, as the pores of the skin become clogged with the grease, the absorption is not so rapid when it is thus employed. The best and most prompt method of producing a permanent dilatation of the pupil, however, is to drop into the eye a solution of atropia, made by dissolving from one-quarter to one-half a grain in two or three drachms of water, to which half a drop of acetic acid is added. This application may be repeated once in two days, provided it does not prove so irritating as to cause the patient to complain when it is first applied.

Should it happen, either from neglect or unskilful treatment, or notwithstanding good treatment, that the effusion of lymph takes place in such a manner as to lead to the obliteration of the pupil by the adhesion of its edges, and the patient is thus left perfectly blind, an operation will become necessary in order that by the formation of an artificial pupil the rays of light may be transmitted to the retina. In selecting the portion of the iris in which the artificial pupil is to be made, care should be taken to choose that which is directly posterior to some portion of the cornea that is clear, if any opacities exist. (See *Operative Surgery*, vol. i. p. 312, 2d edit.)

SECTION VI.

CATARACT.

Cataract is that diminution or total loss of vision which is the result of certain changes produced by disease upon the lens, or on its capsule, or on both. The function of the lens being to aid vision by concentrating and modifying the rays of light in such a manner that the reflected image of external objects may be fairly thrown upon the retina, it is placed immediately behind the pupil, close to the iris, and directly in the axis of vision, being surrounded by its own proper capsule, between which and itself there is said to exist a small quantity of fluid, described by anatomists as the Morgagnian fluid.

From these facts it will be perceived, that should the lens and its capsule, or either of them, become opaque, and the rays of light pass imperfectly through them, or not pass at all, no impression, or a very imperfect one, will be made upon the retina. When such a condition occurs, it is easy to understand, that if we could get rid entirely of the opaque lens and its capsule, and correct the imperfections of vision which its removal produces by wearing spectacles of a similar convexity to that of the lens, sight would be restored, and this is what is actually done in the different operations for cataract.

Etiology.—The causes of cataract are various; sometimes it is the result of inflammatory action, either commencing primitively in the lens, or communicated to it from the other structures of the eye. The excessive stimulus of exposure to a glaring light by stimulating the nerves of the eye, and producing inflammatory action, often induces the complaint; hence cataract is common among glassblowers and the operatives in iron-foundries. Late hours employed in looking at minute objects by a dim or a glaring light have also an effect in the production of the disease; and it is sometimes found, therefore, in professional men and students, in sempstresses, in embroiderers, and the whole class of persons similarly occupied. Cataract is also not unfrequently the result of wounds, or of old age, whilst it is also sometimes congenital; it is also found in the eyes of other animals as well as of man, being said to be not unfrequent in the eye of the calf.

Varieties.—Cataract may be of various kinds, and it is hence divided into several varieties; this division being made according to its consistency, thus creating the so-called *hard* and *soft cataracts* according as the diseased lens is harder or softer than the normal one. It is also divided according to its completeness, into *mature* and *immature*, whilst other varieties are made according to the seat of the disorder, as *lenticular*, *capsular*, or *capsulo-lenticular*. A variety also exists in which the part particularly affected is the liquor Morgagni, which becomes thick and opaque, and is hence sometimes designated as *Morgagnian cataract*.

There are also varieties which are dependent on color, the diseased lens appearing, when examined, to be *white*, *gray*, *amber-colored*, *brown*, *radiated*, &c., whilst other varieties are named according to the contents of the capsule; if these are thin, watery, and whitish, it is called a *milky cataract*; if thicker, and jelly-like, *gelatinous*; whilst, if hard or like bone in its consistence, it is called *osseous*. Now, it is a matter of some importance to be able to diagnose between these various kinds of cataract, as the operation which would exactly suit one variety would be useless and unjustifiable in another. It will therefore be useful to detail some of the symptoms by means of which these varieties can be distinguished.

Symptoms.—As a general remark it may be stated, that most of the varieties of cataract may be detected by simple inspection, as some of them are not only readily recognized in the color and transparency of the lens, but also by its position and size.

1. *Soft cataract* creates in the lens a prominence which does not naturally belong to it, in consequence of which it projects through the pupil, a condition which can be readily observed by looking at the eye sideways. The lens is here larger than natural, while in hard cataract its size is diminished, or is of the natural bulk. Soft cataracts can also be distinguished by their color, which is of a grayish hue, light, almost white, or of a slightly bluish tint, resembling the color of skimmed milk, there being in this color little or no admixture of yellow. The opacity also is not uniform, but resembles rather a cloud, being darker in some parts than in others. The soft cataract should not be confounded with the *fluid* cataract, which is much more watery in its consistence, there being in the latter a breaking down of everything like solidity in the structure of the lens. In color this variety is a dull gray, presenting an appearance which has been compared to thick oatmeal gruel, or to

good thick rich cream, and in this gray there is generally more or less yellowness of color.

2. *Hard cataract* is, on the contrary, often positively yellow, or gray and yellow combined, in various proportions so as to present the various shades of brown; or it is amber-colored, or resembles wax slightly softened by heat.

By these and similar characteristics a diagnosis of the consistence of the cataract will generally be made with considerable accuracy. As a general rule, the appearances presented by the cataract will be sufficient to inform the surgeon whether the lens or its capsule is involved in the disease, the capsular cataract being much whiter around its circumference than at any other part, and presenting, generally, opaque striæ, by which it may readily be recognized. Even when the capsule alone is involved and the lens is sound, it is possible for the experienced ophthalmist to detect it, the opacity not having the same density as is seen when the latter is also involved.

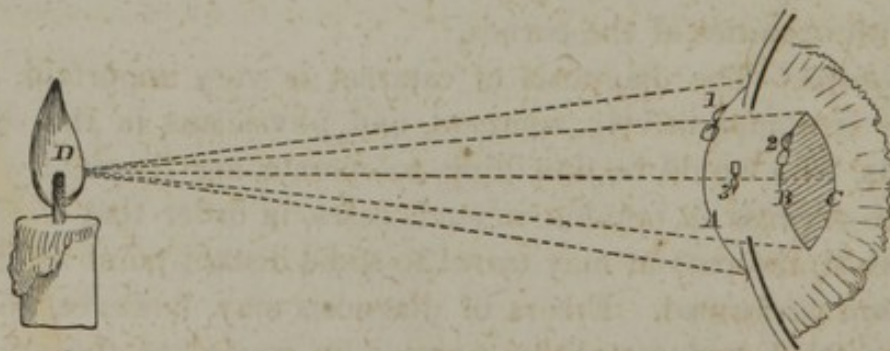
Complications.—The complications of cataract consist chiefly in the opacity of the lens being combined with some affection of the iris, as adhesion; or with some loss of power in the nervous portions of the eye. Thus the same individual may have both cataract and amaurosis, or dimness or loss of sight from an impaired condition in the retina or of the optic nerve; whilst the iris may be adherent to the capsule of the lens, &c. In the first of these cases it would be useless to operate, for when the obstruction was removed, and the rays of light were allowed to pass freely through and impinge upon the retina, they would find that structure totally unconscious of the impression; or, if adhesions existed between the lens and the iris, the removal of the cataract would probably induce iritis. Cataract may also be complicated with obliteration of the pupil, and with opacities of the cornea.

Diagnosis.—The diagnosis of cataract is very important, as the disease is comparatively common, and physicians in the country districts, who would be unwilling to operate, are frequently called upon to express an opinion in such cases, in order that if the eye requires it, the patient may travel to some distant point to have an operation performed. Errors of diagnosis may, however, be generally avoided, and a positive opinion in regard to the existence of cataract accurately formed by means of *Sanson's* catoptric test, which depends upon the fact that if in a darkened room a small candle flame is held before the healthy eye, three images or reflections of it will be seen in the eye, one being formed on the

surface of the cornea which is large and upright; one faint and inverted farther in, and a third upright, clearer, more distinct, and deeper in the eyeball than the inverted, but not so distinct as the first erect image. In cataract one or more of these images is always wanting, for reasons that will be presently shown.

Catoptric Test.—The formation of these three images in the healthy eye will be readily understood by a brief reference to the character of the surfaces which reflect them; thus the cornea presents a convex surface which not only transmits light, but like all transparent bodies reflects more or less of it, in consequence of which it acts precisely like a convex mirror; this, as is well known, giving upon its surface an erect image smaller than the object itself, and of a size diminishing as the convexity of the lens increases. When, then, a candle is held before the healthy eye, the reflection from the cornea causes the formation of a distinct image which is erect, and corresponds in its movements with the movements of the candle, thus forming the first of the three images of the catoptric test. The anterior surface of the lens forms also a convex mirror, but it is a mirror much smaller and more convex than that formed by the anterior surface of the cornea. This image, therefore, is erect, and distinct, though not so distinct as the anterior image nor so large; and, like that, it follows the motions of the candle, and is the third or deepest image of the catoptric test. (Fig. 222.) The posterior surface, or, more correctly, the anterior face of the posterior surface of the lens, presents however a concave surface, performing the part and obeying the laws of a concave mirror, which, as is well known, forms a small inverted image, that is generally seen

Fig. 222.



A DIAGRAM OF THE CATOPTRIC TEST OF THE STATE OF THE LENS.—A. The cornea. B. The front of the lens. C. The anterior surface of the posterior side of the lens. D. The candle.—1. The anterior erect image formed on the cornea. 2. The deep-seated erect image formed on the front of the lens. 3. The middle and inverted image formed by the posterior face of the lens. (Original.)

in the focus of the mirror or at some distance anterior to its surface. This inverted image is therefore noticed between the two upright images just described; it is fainter than either of them, moves down whenever the candle is moved up, and up whenever the latter is moved down, its motions being precisely the reverse of the motions made by the candle.

In order to derive full advantage from the application of this test, the pupil should be dilated by placing around the eye some of the extract of belladonna, or by dropping into it the solution of atropia. The room should also be darkened, whilst the operator, seating himself upon a chair rather higher than that upon which the patient is placed, holds a bright candle before the eye; and looks first for the most anterior image, which is invariably to be seen if the cornea is clear. That found, he should proceed—disregarding the first image entirely—to look for the second, or the small inverted image, which will be present in the healthy eye, but not in one where there is cataract, the opacity of the lens preventing the rays of light from falling upon the concave mirror, where this inverted image is formed. In the same manner, if the capsule of the lens is affected so that the anterior surface of the lens loses its mirror-like qualities, the deep upright as well as the inverted image will have disappeared.

The diagnosis of cataract, therefore, is *positive*, although of course the catoptric test will not enable the surgeon to decide whether or not the complaint is complicated with glaucoma, with amaurosis, or any other disorder, either of which would render the performance of the operation useless.

Treatment.—The treatment of cataract being purely operative, its details will be found in the volume on *Operative Surgery*.¹

The after-treatment is the same as that of other operations on delicate tissues.

§ 1.—DISPLACEMENT OF THE LENS.

It sometimes happens, as a result of blows or other violence, that the lens is displaced, either backward into the vitreous humor, or forwards into the anterior chamber, though most frequently forwards. If it is thrown backward into the vitreous humor, nothing

¹ See *Operative Surgery*, vol. i. p. 303, 2d edit.

can be done but to treat any inflammation that may arise upon general principles, and when the patient has recovered completely, supply him with a cataract glass. But if the lens is dislocated forwards into the anterior chamber, it sometimes acts as a foreign body, and creates such an amount of irritation and inflammation as justifies the surgeon in making a section of the cornea and removing it, as in the ordinary operation for the extraction of cataract.

SECTION VII.

AMAUROSIS.

Amaurosis, which is often confounded with cataract by the inexperienced, is a condition in which the sight is impaired or lost, owing to changes in the vitreous humor, the retina, optic nerve, or the cerebral centres which preside over vision. It is sometimes also due to choroiditis. It has various synonymes, different terms being applied to special forms, which are after all only varieties of amaurosis as above defined; thus, some writers draw a distinction between glaucoma and amaurosis, describing as glaucoma that peculiar variety of amaurosis which is due to choroiditis or retinitis, and which results in a peculiar green appearance of the pupil, and limiting the term amaurosis to a diminution of the sight, or blindness resulting from derangement of the optic nerve, or of the cerebral centres connected with vision, as the *thalami nervorum opticorum*.

Among the various terms applied to the complaint, are *gutta serena*; *black cataract*, or *suffusio niger*, on account of its color; and *green cataract* when the color of the pupil justifies such an appellation.

Symptoms.—The symptoms are as follows: There is a gradual loss of vision, accompanied or preceded by symptoms of cerebral disturbance. Sometimes it happens that, while the patient sees well during the day, he cannot see at all when the stimulus of light is diminished, as during the night; this is what is called *nyctalopia*, or night-blindness. Or, the reverse condition may occur, the patient seeing best during the night. The patient is sometimes near, and sometimes far-sighted (*myopia* and *presbyopia*). Generally, there is cloudiness of sight, a condition designated as *visus nebulosus*. Or the patient may see objects in a different position, or of a differ-

ent shape from reality, or the objects may appear lengthened, the flame of a candle appearing three or four feet long; this condition being designated as *visus defiguratus*, a condition which, according to Beer, always indicates serious disease of the brain. Sometimes the patient sees only one-half of an object (*hemiopia*), or he sees motes and other indistinct forms floating before the eye (*muscæ volitantes*). Sometimes he sees fiery spots in every direction, or objects appear to be flame-colored—a condition which is generally accompanied by *tinnitus aurium*, and other symptoms indicating congestion of the brain.

The catoptric test in amaurosis will show the three images perfect, and it can thus be, with readiness, diagnosed from cataract.

Etiology.—The causes of amaurosis may be either local or general. The local causes are changes in the structure of the optic nerve, or the vitreous humors, or the retina, or choroiditis, etc. Excessive use of the organ will also sometimes produce this complaint, and hence it is often found in opticians and microscopists—a class of men in whom, when true amaurosis is not developed, certain changes of the power and even shape of the eye sometimes occur which are quite as peculiar as the appearances of the eyes of those who are near-sighted.

Amaurosis may also follow an injury of the supra-orbital nerve. Among the general causes may be mentioned fever, mental anxiety, &c.

Varieties.—There are several varieties of the complaint; thus it has been divided into *incipient* and *developed*, *partial* and *complete*, *functional* and *organic*, *idiopathic*, *sympathetic* and *symptomatic*, terms which explain themselves.

Prognosis.—The prognosis depends upon the causes and upon the condition of the patient. Generally speaking, it is favorable if the disease is due to congestion of the organ, and unfavorable if created by a change of structure.

Treatment.—The treatment of this complaint, as of many other diseases of the eye, is both constitutional and local, the constitutional treatment being the most important. If the affection is due to local or general plethora, or to congestion of the vessels of the part, active antiphlogistic measures must be resorted to. If it can be traced to a checked discharge, such a condition, for example, as at times follows the operation for hemorrhoids, the indication is clear, depletion must be resorted to, and this in the case just alluded

to, is best effected by leeches applied around the anus. Leeches in this location indeed are singularly applicable to the congested condition just described, and in France are frequently made use of no matter what the cause may be by which the congestive amaurosis has been produced. Various other modes of treatment have resulted successfully in cases proceeding from certain causes. Thus, mercury given so as to induce gentle ptyalism, has proved successful in cases ensuing on effusions of lymph, and saline purges have proved efficacious in cases due to a congested condition of the vessels. Where the disease depends upon paralysis of the optic nerve, the same treatment should be adopted as is applicable in local paralysis elsewhere—blisters dressed with strychnia ointment, counter-irritants, &c., being resorted to; and it is in these cases that benefit has been derived from passing a current of electricity through the temples. Fumigations with the vapor of hydrocyanic acid have also been much lauded, and may be applied by means of a glass cup, with a neck so shaped as to apply itself to the ball; but this has often failed to produce the benefit that was at one time expected from it.

PART VIII.

DISEASES OF THE EAR.

THE diseases of the ear, like those of the eye, are so numerous and involve an organ the anatomical study of which is so often neglected by the student, that their treatment has generally been declined by the mass of the profession, and become the business of a special class of surgeons. Still there are certain general principles which may be readily carried out by every practitioner, and it seems, therefore, desirable to express some general views of these diseases in this place, if only to induce the student to notice the simplicity of the pathology of these affections, as well as the fact that they are often due to inflammatory action, and amenable to the general laws of inflammation, so that hereafter they may use their influence to take this class of patients out of the hands of the quacks, to whom they so often abandon themselves.

Anatomical Relations.—The external ear is composed of the cartilages covered by the skin, the latter being liable to simple or erysipelatous inflammation, like the skin of other parts of the body. This skin is reflected from the ear into the meatus externus, and its cuticle is continuous with the membrane lining that passage, in which are the ceruminous glands. At the bottom of the meatus externus is the *membrane of the tympanum* or drum of the ear, which forms a septum across the meatus, and is covered externally by the cuticle, or by the lining of the meatus, whilst internally its covering is continuous with the lining membrane of the internal ear. The proper membrane of the tympanum is of a clear pink color when healthy. On its inner side is the *tympanum*, or the cavity which contains the four small bones of the ear, and within or beyond these we have the *cochlea* and *semicircular canals*, concerning which, all that need be said in this place, is that they are

lined by a membrane which sufficiently corresponds with the mucous membranes elsewhere, to be named a mucous membrane, and which is liable to the same inflammations and diseases as mucous membranes generally. The tympanum is connected with the mouth by a passage designated as the *Eustachian tube*, which opens into the throat about two lines below the floor of the nostril, and just behind the posterior half arch of the palate. A probe bent to a $\frac{1}{8}$ th of a circle, and passed into the nostril till it reaches the soft palate—as may be known by the effort of the patient to swallow—and then made to rotate a quarter of a circle, will readily enter this orifice.

The Eustachian tube is lined with a mucous membrane which is continuous with the mucous membrane of the pharynx and œsophagus, and of that of the internal ear. Inflammation of the mucous membrane of the throat may, therefore, travel along through the Eustachian tube and involve the ear, thus presenting all the symptoms, and being followed by very much the same results as inflammation of the urethra or ductus ad nasum.

CHAPTER I.

AFFECTIONS OF THE EXTERNAL EAR.

SECTION I.

OTITIS.

By the general term *otitis* is designated an inflammation of the ear; one of the specific forms of which is designated as *external otitis*, and is an inflammation in the meatus externus that results in abscess, this abscess involving either the skin or the mucous membrane of the meatus, whilst the other is known as *internal otitis*, and involves the structure of the tympanum.

§ 1.—OF EXTERNAL OTITIS.

Symptoms.—The symptoms of external otitis are those of abscess elsewhere; thus, there is violent pain in the part, which is described

by the patient as that of earache, and which is due to the effusions causing swelling in a dense unyielding structure. This pain may be told from simple neuralgia of the ear by seizing the external ear with the thumb and finger and drawing it gently upwards, as in external otitis, the pain will be augmented by the stretching of the external meatus, whilst in the pain from internal otitis or from neuralgia, this motion will not affect it. Sometimes, after pus is formed, it tends downward and escapes through the fissure at the bottom of the meatus, so that the abscess will point below the ear, whilst sometimes it points behind, or in the meatus itself.

Treatment.—The treatment of external otitis should be conducted upon the general principles of abscesses; warm moist applications, antiphlogistics, injections of warm water into the ear, leeches behind or below the ear being resorted to. When pus has evidently formed beneath the cartilaginous tube, it should be evacuated as soon as possible. The laudanum and oil so recklessly dropped into the ear under these circumstances by the old women and quacks does positive harm when the otitis is superficial, because of the stimulating quality of the laudanum, as the lining membrane of the external meatus is very delicate, and that part covering the membrane of the tympanum quite as delicate as the ocular conjunctiva.

Great comfort will, in some cases, be derived from the use of a hop-poultice, which presents heat and moisture conjoined with anodyne effects. This poultice should be made of hops mixed with flour, and moistened with hot vinegar or water, the introduction of the flour being for the purpose of obviating the disagreeable rustling and crackling under the ear which would result from the use of the hops alone, even when moistened. Anything which presents heat and moisture to the parts is always of service, and this is the true solution of the success of the popular remedy of the roasted onion, from which benefit is sometimes obtained. Frictions of aconitia, rubbed up with lard in the proportion of 1 gr. to the drachm, or the tincture of aconite combined with soap liniment, &c., are exceedingly useful in allaying pain, but they are rather more serviceable in otalgia than in otitis, as will be hereafter shown.

§ 2.—INTERNAL OTITIS.

Sometimes inflammation attacks the more internal structures of the ear, and there may be *internal otitis*, or inflammation of the tympanum proper, which, by inducing a suppuration within the cavity of the tympanum, will involve the bones of the ear or the Eustachian tube.

Symptoms.—The symptoms of *internal otitis* are similar to those of the external form, but more marked; the pain being deeper-seated, and more pulsatile, whilst there is also more heat, pain in the head, and fever.

Diagnosis.—The diagnosis of internal from the external form of otitis is readily made, because in the internal variety there is not the same sensibility when the ear is drawn upwards, as in the external, except when the two forms of the disease are combined. There will also be a greater degree of constitutional disturbance, as indicated by fever, &c. Like the external variety, internal otitis may terminate in an effusion of pus, which, being prevented from escaping into the external meatus by the membrane of the tympanum, may distend it until it bursts, when the bones of the ear may be rendered carious and be thrown off by the external meatus, or the pus may escape by the Eustachian tube into the throat.

Prognosis.—The *prognosis* is favorable, except when it is due to the effects of scarlet fever. It is, however, under all circumstances, less favorable than in external otitis.

Treatment.—As the inflammation is deep seated, and involves delicate and most important parts, the treatment should be active; thus, it may be necessary to bleed as freely as the patient will bear, or to leech around the ear, and employ all such antiphlogistic measures as are applicable to inflammations of a similar grade elsewhere, the use of antimonials being advisable, whilst calomel, particularly when combined with Dover's powder, in order that it may excite the secretory action of the skin, is especially serviceable.

The moment of the formation of pus behind the membrana tympani is generally marked by a chill; and after this the examination of the ear by means of a speculum will often show the presence of pus if the accumulation has taken place to such an extent as to

involve the membrana tympani, the latter being then prominent externally instead of depressed.

Treatment.—The indications for the treatment of internal otitis are the same as are presented in any other abscess; thus the pus must be evacuated, and there should be no hesitation in puncturing the membrana tympani in order to accomplish this, the dangers from the accumulation of pus in the internal ear, and the production of caries or necrosis of the small bones, with the distension and disorganization of the tympanum, being much greater than those arising from simple puncture of the drum of the ear. The puncture may be made by a needle, a short straight pointed bistoury, or still better by means of Deleau's instrument, prepared especially for the purpose, taking good care, however, whatever be the instrument employed, to avoid striking the handle of the malleus.¹ Having thus got rid of the pus, warm water should be injected into the meatus with the view of thoroughly washing it out, when the symptoms will generally be much alleviated. The after-treatment is the same as that of any other abscess, the little wound in the tympanum healing rapidly like any other incised wound, and with the greater rapidity because the previously distended membrane having now collapsed, the edges of the punctured wound are brought into accurate juxtaposition. Indeed, so readily is union effected in perforation of the membrane of the tympanum, that in those cases where it is desirable from any cause to keep a wound in it open, a free crucial incision or the use of caustic is necessary to obtain that result.

Should the fears or ignorance of the patient lead to a neglect of these measures and the pus be not evacuated, the membrane will not be saved, as its distension by the pus will terminate in ulceration, the ulcer that is left being difficult to heal and often destroying the whole membrane, whilst the luxuriant granulations from its edges will give rise to a fungus that will fill the meatus. Or if ulceration does not take place, or if the membrane of the tympanum does not rupture, still the violent irritation will impair its usefulness by leading to a deposit of lymph, the membrane becoming so thickened that it will cease to vibrate. If pus collects and the membrane is ruptured, the little bones of the tympanum may also be loosened from

¹ For an account of this operation, with drawings of the instruments, &c., see *Operative Surgery*, vol. i. p. 413, and Plate XXVIII., 2d edit.

their connections and be discharged with the pus that escapes, the patient being thus rendered permanently deaf, a condition which is not unfrequently seen in children as one of the sequelæ of scarlet fever. The inflammation of the pharynx which is so characteristic of this fever, also often extends itself along the Eustachian tube to the internal ear, where it develops inflammation, and sometimes notwithstanding the best treatment, but more frequently on account of bad treatment, or for want of any treatment, rapidly destroys the small bones of the ear by ulceration and caries. When the membrana tympani is ruptured, a patient can generally be made to show it by directing him to close his nose and mouth and expel the air from his lungs, when, if the Eustachian tube is still patulous and the membrane is perforated, the air will escape from the external ear. Absence or perforation of the membrane from any cause will also account for the power sometimes observed in certain individuals of expelling tobacco smoke from their ears; a most dangerous practice, as the irritation of the smoke is liable to lead to inflammation of the internal ear, and thus result in permanent disorganization of the organ.

The treatment of the cases of inflammation of the internal ear which arise during scarlatina, or as a sequel to it, is plain. As the irritation and inflammation started originally in the pharynx, the first remedies should be addressed to the throat, and indeed careful treatment of the pharyngitis during this fever will often prevent the condition of the ear under consideration. But should inflammation occur notwithstanding these precautions, it is to be treated upon the same general principles which have been laid down for the treatment of acute internal otitis arising from any other source.

§ 3.—CHRONIC OTITIS.

Chronic otitis is, as its name imports, merely a chronic condition of the affection just described. It is precisely similar to chronic inflammations in other mucous membranes, such as chronic conjunctivitis, chronic gleet, &c., and is to be treated on the same principles, the greatest service being obtained from counter-irritants, in the use of which the patient must steadily persevere for months in order to obtain benefit.

Cases of chronic deafness, in which the patient hears imperfectly

under ordinary circumstances, though he can hear distinctly the ticking of a watch when placed between his teeth or against his mastoid cells, so as to receive the reverberation of sound that passes through the bones of the cranium to the ear, are usually cases of chronic otitis. They are by far the most frequent forms of deafness, and are sometimes spoken of as cases of nervous deafness and pronounced incurable, though really due to chronic inflammation and thickening of the mucous membrane of the internal ear, and often amenable to a treatment based on the principles which would be appropriate to any chronic inflammation elsewhere.

Treatment.—The treatment of chronic otitis should consist in the use of the warm foot-bath every other night, this being advantageously combined with counter-irritants, the employment of which should be kept up from nine to eighteen months; such as tartar emetic ointment, croton oil, or small blisters constantly kept behind the ear. As to the popular employment of Scarpa's oil, British oil, Acoustic oil, or the thousand and one nostrums generally dropped into the ear, it is only necessary to say that usually they are positively injurious, or if beneficial are so chiefly by their stimulating properties.

SECTION II.

OTALGIA, OR EARACHE.

Otalgia is the name applied to neuralgic pain in the ear; which in children and others may be produced by sudden exposure to cold, by sitting in a draught, by getting the feet damp, &c.; or it may be due to carious teeth, like the usual forms of facial neuralgia.

Diagnosis.—Otalgia may be diagnosed from otitis—except when the two are combined—by the fact that the most careful examination by means of a speculum discovers little or no appearance of inflammation in the ear.

Treatment.—The treatment will be that of neuralgia generally. Thus an ointment of aconitia, gr. i to ʒij of lard, applied around the ear will often produce prompt relief, and the otalgia of children will frequently be promptly relieved by painting the ear and immediately around it with the tincture of aconite. The affection

is much more common in children than in adults, and in them seems often to be due to dentition and indigestion, which when present should receive attention.

SECTION III.

OTORRHŒA.

Otorrhœa is the name applied to any irritation which results in a puriform discharge from the external ear. It is often one of the sequelæ of otitis, and is most frequently seen in children. If there is caries or necrosis of the small bones of the ear, or of the mastoid cells, this discharge will be exceedingly offensive, presenting the ordinary characteristics of discharges from dead or diseased bones, the sulphuretted hydrogen contained in the discharge under these circumstances not unfrequently blackening the parts around the ear, and producing appearances which are quite characteristic, especially when lead-water has been used as a wash. *Otorrhœa* is also frequently a result of scarlet or of other fevers. The discharge, however, is often referable to a much simpler source, and may be due to an inflammation in the external mucous membrane covering the tympanum, or to the lining of the external meatus which has resulted in the secretion and discharge of pus.

Treatment.—Whether this or the former and more serious condition exists can generally be told by washing out the ear, and examining the canal by means of a speculum. The washing out of the ear should be practised by means of a syringe, which should be of sufficient size, say large enough to hold four fluid-ounces of liquid. Having filled this with tepid water or tepid soap and water, draw the patient's ear upward and forward with one hand, and grasping the syringe with the thumb and middle finger, slip the forefinger through the ring in the piston, introduce the nozzle into the external meatus and inject the fluid simply by bringing the forefinger towards the thumb and middle finger. Before, however, this is done, the patient should be directed to hold a cup close beneath the ear for the purpose of receiving the fluid as it escapes from the ear. Neglect of this simple precaution will lead to the soiling of the patient's clothes with the fluid used, which should be carefully avoided, especially where it is necessary

to repeat the operation a number of times, as it is desirable not to disgust a patient with the operation in the beginning. After thus thoroughly washing out the meatus, the membrane of the tympanum should be examined by means of the speculum auris, an instrument the use of which, it should be fully understood, is merely to dilate the external orifice of the meatus, and to reflect the light into the bottom of the canal. This examination will at once show whether the tympanic membrane is thickened or diseased, and whether it has been destroyed by ulceration, or is distended by pus. But care must be taken by the young practitioner not to mistake the natural appearance of the part for the evidences of disease. This caution is by no means a groundless one, as the depression and opacity caused in the normal membrane by its attachments to the handle of the malleus have been mistaken by beginners for ulceration.

The alterative local treatment of otorrhœa should be conducted upon general principles, whether the disease involves merely the external meatus or the whole internal structure of the ear. When otorrhœa has existed for a length of time, there is the same indication for the application of astringent and alterative salts that exists for their employment in chronic inflammations of mucous membranes elsewhere. Injections, therefore, may be thrown into the ear, consisting of solutions of any of these astringents, as sulphate of zinc or nitrate of silver, of the strength of one grain to the ounce of water, or the liq. plumb. subacetat. may be advantageously substituted in the proportion of gtt. vj to two or three ounces of water, being augmented in accordance with the chronic character of the discharge.

The constitutional treatment is also important, as the disease is very common, perhaps most common among tuberculous children. Here, of course, the constitutional treatment of the tuberculous diathesis must also be adopted, as the use of the iodide of potassium, cod-liver oil, tonics, &c.

The inflammation of the mucous membrane, which produces the otorrhœa, sometimes also results in ulceration of the membrane of the tympanum, in consequence of which fungous granulations sprout from the ulcerated surface, so that upon looking into the ear, these fungous granulations can be readily seen, their appearance being such that they might be mistaken for polypus of the ear. The former, however, possess a mulberry-like surface, which

is quite characteristic, while polypus presents a fleshy tumor, with a surface that is generally smooth and even.

In the adult, otorrhoea is sometimes caused by the presence of foreign bodies in the meatus, and not unfrequently from accumulations of the secretion of the ceruminous glands, mingled with dirt, dust, epithelial scales, and other matters. Many individuals, who are very cleanly in other respects, are not unfrequently careless in regard to the condition of the external ear, never washing it out, and merely removing the wax from time to time with a tooth-pick. When a person of such habits goes on a journey, the dust and cinders of the road collect in the ears, and becoming adherent to the wax, the patient soon finds himself quite deaf, a condition which he generally ascribes to the effect of the noise of the cars instead of its true cause. This accumulation of dirt and wax in the external ear, if allowed to remain, will soon act as an irritant, precisely as any other foreign body would, and nine cases out of ten of otorrhoea, in healthy adults who have not suffered previously from an attack of otitis, will be correctly attributable to this cause, and relieved by simple syringing the meatus, with the subsequent use of mild astringents.

SECTION IV.

FOREIGN BODIES IN THE EAR.

The mention of the accumulation of wax, or a foreign body, in the meatus, leads naturally to the consideration of the fact that foreign bodies may get into the ear. These may consist of bits of cotton, used for stopping the ear, or of the hair which grows within the orifice, both becoming agglutinated with the ear wax. In the case of children, small foreign bodies, such as beads, beans, grains of coffee, bits of ribbon, peas, cherry-stones, &c. &c., are often mischievously thrust into the external meatus, and require to be removed. In these cases, the attempt to remove them with the probe or forceps should not be made, because it is most frequently unsuccessful, and only exaggerates the irritation already created. A much safer, less painful, and more certain method, is that recommended by Dr. Marion Sims, formerly of Alabama, now of New York, and consists in washing them out by means of a syringe with a small

nozzle. The syringe used for this purpose should be of good size, and from twelve to twenty syringes full, if necessary, be thrown in, before the attempt is given up, the meatus being rendered as straight as possible, by drawing the ear upwards and backwards.

If insects get into the ear, they may be removed by pouring in a little oil of almonds or olive oil, which, checking the respiration of the insect, compels it to come to the surface, when it may readily be removed.

SECTION V.

POLYPUS OF THE EAR.

Like other mucous membranes, that lining the external meatus, and covering the membrana tympani, may be the seat of those various morbid growths which pass under the common name of polypi, and which may here be produced under the same conditions and in the same manner as polypus elsewhere, whether in the nostril, in the uterus, rectum, or urethra. Polypus of the ear generally arises from the walls of the meatus, or from the external surface of the tympanic membrane, though it may spring from its internal surface, where by filling the tympanum, it causes the membrane to ulcerate, and then forces its way through, so as to appear in the external meatus, where it sometimes attains such size as to extrude at the external orifice.

Symptoms.—When a polypus forms in the ear and attains some size, the patient begins to complain of frequent earache, for which he is unable to assign any cause, not being subject to neuralgia, and not having been exposed to cold, &c. Soon after this a running from the ear of a sero-purulent character will be noticed, this discharge being the same as that which accompanies polypi, wherever situated. Next, he may suffer more or less from deafness, because the growth from the polypus obstructing the passage, and the altered character of the membrane itself, interfere with the transmission of sonorous undulations; or, if the polypus has arisen from the side of the meatus, it may act as a foreign body, and plug up the canal.

The slightest ocular examination of the meatus will at once reveal the true character of the disease, as in looking into it a fleshy-looking, smooth tumor can be seen, varying from the size

of a pea to that of a tumor, which fills the whole meatus, and protrudes beyond the external orifice.

Treatment.—The treatment, as already stated, is that of polypus elsewhere. The indications are evidently to produce the removal of the tumor itself, and to cause such a change in the surface from which it has grown, as will prevent its reproduction. Both these indications may be accomplished in various ways. The removal of the tumor, for example, may be effected by means of the polypus forceps, with which it can be twisted off if great care is taken. But to this method there are serious objections. Thus, if the polypus grows from the membrane of the tympanum, the mucous membrane covering that structure, or the whole structure itself may be torn away, and the little bones of the ear be displaced, so as to create serious injury to the hearing of the patient.

Instead of the forceps, the removal of a polypus of the ear may be accomplished by means of the ligature, which is much the best method; or it may be effected, in many instances, by the constant and patient application of the nitrate of silver, after each application of which, the surgeon should be careful to put a little oil into the ear, to prevent the excess of caustic from inflaming the adjacent structures.

The application of the ligature may be very readily accomplished by forming a loop with an ordinary silk ligature, and, having passed it over the polypus, carry it down as far as possible by means of a probe, as directed in the *Operative Surgery*.¹ After this operation, but more particularly after removing the tumor by means of the polypus forceps, there will be more or less hemorrhage; but this can generally be checked by means of the ordinary styptics.

SECTION VI.

DEAFNESS.

Deafness is a complaint from the treatment of which many members of the profession often shrink, thus leaving it in the hands of quacks, who deceive the patient with false promises, and not only rob him of money, but also do him irreparable injury. Much of

¹ See vol. i. p. 417, 2d edit.

the unwillingness shown in regard to the treatment of deafness, has doubtless, been due to the tedious, and often unsatisfactory character of the treatment, as well as the apparent necessity for a peculiar apparatus for its treatment. Though this may be true in some cases, there are yet many in which every practitioner of medicine can furnish relief, or at least gain such a knowledge of the patient's condition as would justify him either in advising a consultation, or in urging upon the patient the advantages of doing nothing.

§ 1.—DEAFNESS FROM EXCESS OF WAX.

Deafness may be produced by several conditions of the ear: the most common, and the first to which attention should be given, is the accumulation of the secretion of the ceruminous glands, which, when allowed to remain as already mentioned, becomes mingled with particles of dust and dirt and other foreign matter, and not only produces at times the otorrhœa already referred to, but also creates more or less deafness. Besides this there may be a true increase of activity in the ceruminous glands, leading to a considerable augmentation in the quantity of wax produced. When from either of these causes the wax accumulates in the meatus, blocks it up, and becomes hard and inspissated, it acts like a foreign body and produces very marked symptoms, of which the imperfect hearing is usually that which most attracts the patient's attention.

Symptoms.—In the deafness from this cause the patient complains not only of loss of hearing, but of roaring and ringing in the ears. When the meatus is examined with a speculum under these circumstances, it will generally be found to be diminished in depth, and to have at its bottom a dark brown or blackish body which blocks up the passage completely. If this wax has become very dry from time, or any other cause, it will be movable, and will sometimes rattle in the ear; but if it is yet soft and adheres to the sides of the meatus, it will often be found adhering firmly to the mucous membrane of the canal, and sometimes to the external covering of the membrane of the tympanum. In the attempts of nature to get rid of this mass, inflammation is not unfrequently developed, and pus secreted, as already shown in connection with otorrhœa.

Treatment.—As this wax is in fact a foreign body, and as such re-

quires removal by such means as will at once free the passage and thus enable sound to reach the membrane of the tympanum, the prognosis of the complaint is very favorable, and the plan of treatment a simple one. This is as follows: Drop into the ear at bedtime some glycerine or warm oil of sweet almonds, for the purpose of softening the wax as much as possible, and then next morning wash out the passage with plenty of warm water and a syringe, throwing in about twenty syringes full, as advised in the removal of foreign bodies. It is a good plan, however, not to wash the ear too much at the first time, but to desist when some impression appears to have been made upon the hardened wax, and to resume the washing next day, repeating the operation as often as necessary until the whole is removed. After the wax has been completely gotten rid of, the condition of the meatus should be examined, and if it is found to be red and inflamed near the bottom, as it will often be, owing to the removal of the cuticle, or epithelium, it should be treated as ordinary inflammation elsewhere. Sometimes the condition of the passage is such as to require the use of a weak solution of sulphate of zinc, of acetate of lead, or the nitrate of silver, the surgeon being careful to coat the external ear and side of the neck with sweet oil before throwing in the last injection, in order to prevent the ugly black stains which will otherwise be made by the solution wherever it comes in contact with the skin, as this both disfigures and annoys the patient. Having once removed the wax, the ears should be kept scrupulously clean, or if the condition appears to depend upon increased activity of the ceruminous follicles, some mild astringent wash may be dropped into the ear each night and morning for a week or ten days.

§ 2.—DEAFNESS FROM DRYNESS OF THE EAR.

Sometimes deafness, instead of proceeding from the accumulated secretion, or increased activity on the part of the ceruminous glands, is the result of excessive dryness of the external meatus and of the membrane of the tympanum, caused by a diminution of the secretion. The general symptoms of this condition are in many respects similar to the symptoms produced by an accumulation of wax in the ear; thus there is the same dulness of hearing, and the same sensation of ringing and roaring in the ear. But a

diagnosis may be made by means of a very simple test. In most instances of deafness from dryness of the tympanum, the patient hears better when there is a good deal of noise. Thus a conversation which, under ordinary circumstances, would not be heard, he will often hear quite distinctly, as, when riding in an omnibus, the noise of which would perhaps make the voice quite inaudible to a person with a perfectly healthy ear. This same peculiarity, it may be here mentioned, is also found in what is called nervous deafness, a disease which the best authorities believe to be much rarer than is generally supposed by the majority of the profession. A diagnosis from nervous deafness may be very readily made, from the fact that in deafness from dryness of the tympanum, the patient can often hear the ticking of a watch perfectly well if it is placed in his mouth, or against his mastoid cells; while in deafness from disease of the nerve this will not be the case. Dryness of the tympanum can also be recognized by means of the speculum, the membrane of the tympanum, which, in health, is pink and translucent, being then observed to be whitish, opaque, and presenting more or less the appearance of damp parchment, although not quite so thick.

Treatment.—The treatment of this form of deafness, is that of chronic deficiency of secretion elsewhere, the mucous surface being stimulated into activity by means of various irritants. During the interim the natural moisture of the parts may, however, be temporarily restored by means of glycerine dropped into the ear, this being the best substance known for preserving moisture on a dry surface, but if glycerine be not at hand, melted chicken-fat may be substituted. With a view of stimulating the part to an increased secretion, the nitrate of silver may be very properly employed, the solution being dropped or injected into the ear; or, still better, applied with a camel's-hair pencil, the external ear being first oiled as before directed. It may be used in the proportion of from one to four grains to the ounce of water. External irritants may also be applied in the neighborhood of the ear, and they are very useful, when applied either directly in front of the meatus, or still better behind it, and over the mastoid cells, as by blisters, or by means of adhesive plaster mixed with tartar emetic, or by tartar emetic ointment, or croton oil, or collodion containing cantharidin, &c.

The popular plan of treatment, by warming salt upon a shovel

and rubbing it while warm behind the ear, is not a bad one, as the hot salt acts like any other stimulant, and some patients find the sensations produced by it extremely agreeable. Or the external membrane of the tympanum may be painted with citrine ointment applied with a camel's-hair pencil, pure, if the patient can bear it, or diluted with lard. At the same time, the general health should be attended to, the patient taking a foot-bath every two or three nights as a revulsive. When the membrane of the tympanum is thickened, as well as dried, it may be recognized by the fact that when the patient closes his mouth and nose and expels the air from his lungs, the usual sensations produced by the impression of the air driven through the Eustachian tube against the inner side of the membrane is not produced. The treatment in these cases is precisely that which has been stated under the head of simple dryness, except that the stimulating washes which are introduced into the ear may here be made a little stronger. But when the membrane of the tympanum has been thickened in this manner for a considerable length of time, when it resists treatment, and we are satisfied that the obstruction of this dried and thickened membrane is the true cause of the patient's deafness, a very simple operation may be attempted, which can do no harm, if properly performed, and that is, the puncture of the membrane. For this purpose, various instruments have been contrived, and perhaps the best is that of Deleau, as shown in the *Operative Surgery*.¹

If no benefit is derived from this operation, the wound may then be allowed to heal, which it generally does very readily; but if the hearing is improved, a free crucial incision should be made, and the wound kept open by the occasional application of the nitrate of silver, until a permanent opening is thus established, which will permit the waves of sound to act directly on the internal ear.

§ 3.—CATARRHAL DEAFNESS.

Deafness may also be due to a *catarrhal inflammation* of the mucous membrane lining the internal ear; this having arisen either in the ear itself, or had its origin in the throat and been transmitted to the ear through the Eustachian tube.

¹ See vol. i. p. 418, 2d edit.

Symptoms.—The symptoms, as might be expected from the nature of the complaint, are those simply of chronic otitis, as already described, the disease being liable to result in internal abscess and destruction of the small bones of the ear. As the inflammation of the mucous lining of the Eustachian tube produces a thickening which diminishes its calibre, or causes such a secretion as partially obstructs it, it will generally be found at a very early period, that though the patient is unable to blow air through this tube into the ear, yet a watch, introduced into the mouth, will be heard with perfect distinctness, owing to its contact with the cranium.

Treatment.—The treatment of this form of deafness is that of catarrhal inflammation, as already described. If the inflammation has originated in the pharynx, and that structure is yet in a state of inflammation, the remedies should be addressed to the throat, by swabbing it out with a probang, or sponge wet with a strong solution of the nitrate of silver or some similar substance. After which, the disease of the ear may be treated as was directed under the head of chronic otitis.

Obstruction of the Eustachian tube as a cause of deafness is, however, much less frequent than was formerly supposed, the Eustachian tube being by no means so small or so easily obstructed as was at one time thought, whilst the angle at which it is placed, as well as the size of its orifice, favors the escape into the throat of any secretions that may accumulate within it. It is, however, sometimes closed by a thickened condition of its lining membrane as the result of chronic inflammation, though this is by no means common. Such an obstruction, when it occurs, is generally the result of a chronic inflammation of its lining membrane, and commences primarily in the pharynx, though it may exist either in the course of the tube, or at its orifice, in the pharynx, in which location it is generally the result of the adhesions produced by such deposits of lymph as result from syphilis or scarlet fever. Obstructions in the Eustachian tube may be tested by the introduction of an ear catheter or bougie, as well as by closing the nose and mouth and making a full expiration, as already mentioned.¹

¹ For the operation of catheterism of this tube, as well as the after-treatment, see Operative Surgery, vol. i. p. 420, 2d edit.

SECTION VII.

NERVOUS DEAFNESS.

Nervous deafness, or that due to a paralysis of the auditory nerve, which is a disorder often alluded to, is really a rare affection. It, however, sometimes occurs, and may arise from organic changes in the portio mollis, from tumors pressing upon the nerve, and from organic changes in the cerebral centres which may or may not result in paralysis. But it should be remembered that it is very seldom seen, and when it does exist, is generally coexistent with some other disease in the ear. When these diseases exist, they should be treated as directed elsewhere. When, however, true nervous deafness exists, very little can be done for the patient. Cases which appear to be due to mere paralysis of the portio mollis, in which there is no pain in the head, no cerebral disturbance in which the existing condition appears to be a mere loss of power, may sometimes be benefited by transmitting a current of electricity through the ear, applying one pole behind the ear, and the other in front, or to the mouth and throat.

Counter-irritants behind the ear or to the nucha, may also be employed, and will sometimes prove useful, whilst blisters dressed with strychnine have been of service. But before a case is pronounced to be one of nervous deafness, and before such measures as those suggested are adopted, a most careful examination should be made of both the external and the internal ear, to ascertain whether disease exists in them. If the patient can hear a watch tick when placed against his head, it may be safely asserted that some power yet exists in the nerves of the organ of hearing.

PART IX.

AFFECTIONS OF THE NOSE AND ITS CAVITIES.

CHAPTER I.

AFFECTIONS OF THE NOSE.

Anatomical Relations.—The external nose is covered with skin, which is maintained in shape by means of the ossa nasi and the nasal cartilages, and abounds in follicles; whilst it is lined throughout with a mucous membrane called the Schneiderian or nasal mucous membrane. The nasal passages communicate with the pharynx by means of an opening on each side, which is designated as the *posterior nares*; with the eye by means of a bony tube lined by mucous membrane, and known as the *ductus ad nasum*; with the antrum Highmorianum, which is situated in the superior maxillary bone, by a lateral orifice through which the mucous membrane of the nose is reflected and lines the antrum.

SECTION I.

LIPOMA.

When the external sebaceous follicles of the nose become obstructed and hypertrophied, they become the seat of a genuine fatty degeneration, which sometimes attains considerable size, and is designated as *Lipoma*, though this term is also applied to any fatty tumor no matter where it is located. When connected with the nose, the lipomatous tumor attains various sizes, those which are small and most frequently seen being oftener met with in the case

of drunkards. Usually, this lipoma is about the size of a pea or a bullet; but it may attain much greater size, and has been seen, though rarely, of the size of the fist or even larger. The only treatment applicable to them is *excision*.

SECTION II.

LUPUS.

Lupus is a disease of the skin which frequently attacks the alæ of the nose, and is characterized by a rapidly spreading ulcer.

Symptoms.—It commences as a small, smooth, and shining tubercle, a little larger than a pea, the skin of which, becoming distended, cracks, and rapidly develops ulceration. The ulcer thus formed is very much disposed to assume the phagedenic character, and that not only in its extent but also in its depth, the varieties of the disorder being named according to the rapidity with which it spreads; thus, when it extends itself notwithstanding all efforts to check it, and speedily invades and destroys the surrounding tissues, it is called *lupus exedens*, or the *noli-me-tangere* of the old writers, a term which was applied to the complaint because all remedies seemed only to aggravate it and increase its disposition to spread. Another form of the disease, which is milder, and without so marked a disposition to ulcerate and travel, is generally found in scrofulous persons, and is known as *lupus non exedens*.

Etiology.—Lupus may be caused by various circumstances. Sometimes it is hereditary, and takes on all the characters of malignant disease, being only distinguishable from cancer by the mode of its origin, lupus beginning in a tubercle, while cancer, particularly epithelial cancer, begins as an epithelial ulceration or fissure. Frequently, lupus is associated with the syphilitic taint, and, under these circumstances, while the progress of the lupus carries away the soft parts of the nose, the syphilitic disease produces caries of the bones, thus producing horrible deformity. Lupus itself, uncombined with syphilis, seldom involves the bones of the face.

Prognosis.—The disease is exceedingly intractable.

Treatment.—To consider the treatment of lupus in full would lead us deeply into the pathology and treatment of the tubercular

class of skin diseases, and it must, therefore, at present suffice to state, that the general principles required in the treatment of unhealthy inflammation will generally suffice for its relief, whilst the loss of substance caused by the ulcer can sometimes be relieved by one of the rhinoplastic operations described in the volumes on Operative Surgery,¹ though, as the disorder is very apt to return, but little permanent benefit is derived from any operation.

SECTION III.

OZÆNA.

Ozæna (οἶσω, I smell of something) may be defined as an unhealthy inflammation of the Schneiderian mucous membrane which is generally connected with disease of the periosteum, or with caries or necrosis of the bones of the nose, and is very frequently a result of syphilis.

Symptoms.—The symptoms of ozæna are, first, those of coryza; but the discharge presently becomes profuse, then muco-purulent, and then rapidly assumes the peculiar stinking odor which is characteristic of the disease, and from which it is named. Sometimes the ulceration of the mucous membrane is deep, and involves the bones, spreading rapidly and casting off scales of bone, when, if the disease is syphilitic in its character, the nasal bones fall in and produce all those deformities which will be alluded to in connection with secondary syphilis.

Diagnosis.—The diagnosis of ozæna may be made by noticing that it is characterized by a fetid discharge from the nostril, though such a discharge will also sometimes take place in children, particularly those who are scrofulous, but in whom it is unaccompanied by any disease of the bone, a point which renders the diagnosis comparatively easy.

Prognosis.—The prognosis of ozæna will depend very much upon the causes and the complications of the complaint; if due to syphilis, of course the prognosis will be unfavorable, and, in all cases, should be guarded, lest the caries of the bones create the entire destruction of such as are involved.

¹ See Operative Surgery, vol. i. p. 325, 2d edit.

Treatment.—The treatment of ozaena should be both constitutional and local. If the disease arises from a tuberculous taint, or is due to syphilis, the constitutional treatment adapted to these conditions will, of course, be necessary; whilst, if the patient is weak and exhausted, tonics and chalybeates will be imperatively demanded. The local treatment should be conducted upon general principles; thus, as there is ulceration of a mucous membrane, which is more or less connected with disease of the bones, alterative and astringent washes may be expected to prove serviceable, especially the solutions of lead, which, being thrown into the nostril, diminish the fetor by combining with any free sulphuretted hydrogen which may be present. The strength of a solution of acetate of lead for this purpose should be from five to ten grains to the ounce of water. The mild chlorides are also serviceable in the same manner, such as the chloride of soda in the form of Labarraque's solution. The late Dr. Horner, of Philadelphia, obtained much benefit in several cases from the use of chloride of lime in the proportion of two drachms to the ounce of water. Advantage will also be found from the alterative effects of solutions of nitrate of silver. But when the caries, or necrosis of the turbinated and other bones has gone on to any extent, the disease will often prove exceedingly intractable.

SECTION IV.

RHINOLITHES.

Rhinolithes is the name given to nasal calculi, or little concretions, which consist generally of inspissated mucus and some of the phosphates. They may be of various sizes, from that of a pea to that of a bullet, or a little larger, and should be removed from the nose in the same manner as any other foreign bodies; they are, however, very rarely met with.

SECTION V.

FOREIGN BODIES IN THE NOSTRIL.

Foreign Bodies in the nostril may be of various sorts and sizes, as beads, pieces of ribbon, peas, grains of coffee, or any other articles likely to be thrust up the nostril by mischievous children. Grains of coffee, which are sometimes introduced, are particularly troublesome, because, imbibing moisture from the part, they swell and may thus not only become firmly imbedded, but also produce displacement or fracture of the turbinated bones, or even fracture of the vomer.

Treatment.—To get rid of these foreign bodies, a pair of forceps may be used if properly curved to suit the nostril, the instrument being introduced into it close to the septum in order to avoid the turbinated bone, when a little manipulation will enable the surgeon to seize the foreign body and withdraw it. Foreign bodies may also sometimes be extracted by means of a probe bent into the shape of a hook; or their removal may frequently be accomplished by the use of the syringe, which is a better plan.

SECTION VI.

ABSCESS OF THE SEPTUM NARIUM.

The presence of foreign bodies and other causes, most of which are not understood, sometimes produces abscesses in the septum narium, the seat of which is in the cellular substance found between the two layers of cartilage by which the septum is formed. The result of such an abscess is, of course, a separation of the two layers of cartilage, in consequence of which the patient soon notices such a bulging of the septum towards one or the other nostril as creates a deformity.

Treatment.—The treatment is simple; the abscess being punctured and treated as abscesses elsewhere, the chief danger being from the continued distension of the cartilages creating a condition of the septum narium which will induce permanent deformity. The ulcer left after the evacuation of the abscess should be treated by nitrate of silver and other alterative applications, and when, as a conse-

quence of the complaint, dryness of the nostril occurs, glycerine may be used as in the case of dryness of the tympanum, or if this be not at hand, a substitute may be found in melted chicken-fat.

SECTION VII.

POLYPI NARIUM.

Polypi of the nostril, like polypi elsewhere, may be the result of several different conditions of the nasal mucous membrane.

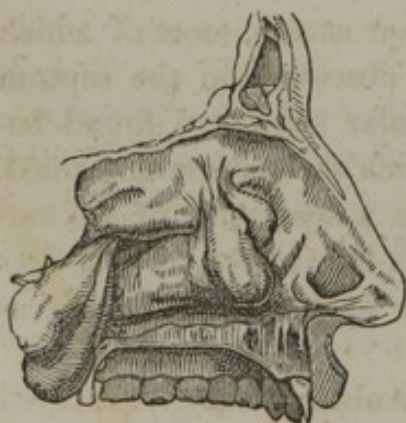
Varieties.—In consequence of this diversity of origin, there is some variety in the polypi themselves, and they have hence been variously classified. The simplest division is, however, that which arranges them according to their density, dividing them into soft and hard; a division which sufficiently corresponds with the division into simple and fibrous, or into benignant and malignant; although the correspondence is not scrupulously exact.

§ 1.—SOFT POLYPI.

The characters of the soft polypi are as follows: They present, when cut into, an apparently homogeneous soft tissue, which contains one or more cells, and are filled with the mucous fluid of the

part; this fluid escaping when the sac containing it is punctured or lacerated. Polypoid tumors of this character are generally due to some obstruction in the muciparous follicles, the secretion of which distends and elongates them beneath the mucous membrane until a tumor is formed which presents the characters just described. This tumor is generally covered by the distended mucous membrane which, owing to its tenacity, readily permits endosmose and exosmose to go on; the secretion escaping from within through the covering, and moisture being absorbed in the same manner from without; a fact which ac-

Fig. 223.



A vertical section of the Nasal Cavity, showing the appearance and position of the soft mucous polypi. One is seen hanging into the anterior, and another projecting from the posterior nares.

(After John Bell.)

counts for several of the symptoms of soft polypi, as their giving rise to muco-purulent discharges, and being larger in damp than in dry weather. In color, this polypus is pinkish, and has in it very few vessels, these being chiefly seen on the mucous membrane covering its external surface. In shape the soft polypus is usually pedunculated, as shown in Fig. 223.

Symptoms.—The symptoms of polypus in the nose are well marked. The patient complains of feeling something in his nostril, and has, therefore, a constant desire to blow his nose, from which he finds a thin mucous discharge. He also notices that he breathes through the nostril more freely in dry weather than in moist. As the polypus grows, the symptoms become more marked, its bulk encroaching upon surrounding parts, until it may at last block up the entire nostril and so press on the orifice of the ductus ad nasum as to prevent the passage of the tears into the nose. In consequence of this the tears will often overflow the eye, and, the patient being ignorant of the true cause, refers all his symptoms to a troublesome coryza, which he is not able to get rid of. As the tumor grows still larger, it will protrude from the nostril anteriorly, and show itself externally, or it may project backwards through the posterior nares into the top of the pharynx (Fig. 223); or it may work its way, if its growth still continues, through fissures in the bones of the face, and appear in parts apparently wholly unconnected with the nostril; thus tumors have been produced in the temple as a result of an excessive growth of one of these polypi in the nose. This encroachment on the face is, however, much more common with the fibrous than with the soft polypi. Another symptom which, so soon as the polypi have attained any size, develops itself in a very marked manner, is an alteration in the voice, which assumes a peculiar nasal twang on account of the obstruction of the nostrils, interrupting the reverberation of sound, the patient speaking as he would do if he held his nostrils between his thumb and finger.

Upon looking into the nose this polypus can generally be seen as a smooth, pinkish swelling, owing to its being covered by the Schneiderian membrane; but caution must be used lest the anterior extremity of the inferior turbinated bone be mistaken for the polypus, when it projects towards the anterior nares.

Prognosis.—The prognosis of soft polypi in the nostril is favorable, as the tumors can generally be removed, and although they will

frequently return, yet they can be removed again and again, until the tendency to their reproduction is finally overcome, unless they be malignant or have induced serious organic changes in the adjacent parts.

Treatment.—The treatment of polypi may be either palliative or radical; the palliative consisting in puncturing the tumor with a sharp-pointed bistoury, evacuating its contents, and allowing it to collapse. Although this treatment is in the majority of cases only palliative, yet it is not unfrequently followed by destruction of the sac and a disappearance of the disease. Should, however, this not happen, as is more frequently the case, the sac will begin shortly to refill, and resort must be had to the operation of extirpation as a means of effecting the radical cure.¹

Sometimes a polypus can be removed simply by causing the patient to sneeze violently, when, in the efforts consequent upon this action, the tumor will be expelled by being torn off from its base by the air as it is forcibly driven through the nostril.

To produce this effect, ordinary snuff may be employed, or one of a more stimulating character, as powdered sanguinaria, cloves, rhubarb, or powdered sage, though any active sternutatory will answer the purpose. Having by any of these means gotten rid of the tumor, any wash which is astringent and alterative in its character may be used as an injection into the nostril, with a view of preventing the reproduction of the complaint—the best of these being the nitrate of silver. When the latter salt is used, the precaution should be taken of anointing the upper lip and the orifice of the nostril with sweet oil, in order to prevent the wash from discoloring the skin.

§ 2.—OF FIBROUS OR HARD POLYPI.

The *fleshy, fibrous, or hard polypi*, present characters which, in many respects, correspond with the variety that has just been described; thus, they have a tendency to grow rapidly, and invade the surrounding parts, producing by their pressure caries and necrosis of the bones with which they come in contact. Those of the bones thin enough—as the walls of the antrum under certain con-

¹ For these operations see the Operative Surgery, vol. i. p. 343, 2d edit.

ditions—are also apt to become distended, and the patient is horribly deformed, creating a distortion of the features which has been designated as “frog-face.” (Fig. 224.)

Fig. 224.



Frog-face, or the deformity caused by Polypi of the Nose encroaching on the bones of the face. (After Liston.)

Prognosis.—These polypi, when once formed, are very apt to become the seat of some of the malignant deposits already described, and, under these circumstances, it is generally useless to attempt anything like thorough extirpation, as the tumors will be rapidly reproduced, and, perhaps, the best advice that can be given is to let them alone, for the more they are irritated the more rapidly will they run their course and end in the destruction of the patient by encroaching upon the brain, or adjacent parts of the throat, &c.

Seat.—The seat of polypi of this class is generally the back part of the nostril, where they distend the posterior nares, and sometimes project into the mouth.

Treatment.—The treatment of the fibrous polypus, when not believed to be malignant, is very similar to that of the soft variety; but the prognosis of the removal of this class of polypi is less favorable than that just described, whilst in the malignant variety it is decidedly unfavorable.

SECTION VIII.

ULCERATION OF THE POSTERIOR NARES.

Another disease affecting the nostril is an *ulcer* which is sometimes found upon the *nasal surface* of the *soft palate*, or on the sides of the posterior nares, and is produced by various causes, but especially by the irritation created by excessive smoking, the passage of more or less of the smoke over the nostril creating an irritation which results in inflammation and the production of a superficial ulcer, which is shortly covered by a small dry scab.

Symptoms.—At certain times, particularly when the patient first rises in the morning, he experiences considerable irritation in the part, which he refers to the back of the mouth, and, after violent efforts at hawking, expels the little scab which has just been alluded to, as well as a certain amount of thick tenacious mucus or pus.

Treatment.—In the treatment of this condition, it will often be sufficient simply to direct the patient to rinse out his nostril every morning by snuffing up into it a little cold water, but if this is not sufficient, he may mix with the water which he employs for this purpose, a little soap, and, if that fails, resort to injections of sulphate of zinc, of nitrate of silver or similar articles, which will generally effect a cure. Sometimes cauterization of the pharynx with a small curved probang will prove exceedingly efficacious, though it is not possible to reach the seat of this ulcer by an instrument passed up behind the soft palate, from the throat.

CHAPTER II.

AFFECTIONS OF THE ANTRUM HIGHMORIANUM.

Anatomical Relations.—The Antrum Highmorianum is a large cavity situated in the superior maxillary bone, which communicates with the nostril, and is lined with a mucous membrane that is a continuation of the mucous membrane of the nose. This lining membrane is, of course, subject to the same diseases as those which attack the nasal mucous membrane; thus, it may be the seat of inflammation, of polypi, &c.

It is also important to recollect, that the superior dental branch of the fifth pair of nerves passes along the inferior wall of the antrum on its way to the teeth, being there simply covered by the lining membrane of the antrum.

SECTION I.

EFFUSIONS INTO THE ANTRUM.

Etiology.—Effusions into the cavity of the antrum may be the result of a simple increase in the mucous secretion of the part, or they may ensue on a serous discharge from the lining membrane, such as sometimes takes place from the Schneiderian mucous membrane as the result of catarrh. These accumulations, owing to their being circumscribed, will often give rise to very distressing symptoms, one of the most painful of which is the neuralgic pain created by the pressure of the effused fluid upon the dental nerve, of which mention has just been made. Sometimes this fluid will continue to accumulate until, rising to the level of the orifice, it is evacuated through the nostril, and relief is obtained.

Treatment.—The treatment consists in the employment of such means as are applicable to irritated conditions of the mucous membranes generally—as warm applications—but if the accumulation

of the fluid obstinately remains, it may be gotten rid of by puncturing the antrum, precisely as one would get rid of the pus in an abscess.

SECTION II.

ABSCESS OF THE ANTRUM.

Etiology.—Abscess of the antrum is a complaint connected with inflammation of the lining membrane, and due to the same causes as would produce inflammation in the nose. Any irritation of the antrum, such as that created by exposure to cold; or the extraction of teeth under certain circumstances, as where the violence done at the moment of extraction produces fracture of the alveolar process; or where the prongs of the tooth, being unusually long, encroach upon the cavity of the antrum, may also develop an abscess of this cavity.

Symptoms.—From these circumstances, and from many other unexplained causes, inflammation of the lining membrane of the antrum is developed, from which an accumulation of pus results, which having no exit, gradually increases in quantity and creates an abscess, thus producing severe suffering, until it has sufficiently filled the antrum, and begins to escape into the nostril, when prompt relief follows as in the evacuation of abscesses elsewhere. These symptoms will also be frequently aggravated by the violent neuralgia which is produced, as in the serous effusions into the antrum by pressure upon the dental nerve, as it passes along the inferior wall of the antrum.

Treatment.—The treatment is first to evacuate the pus as soon as possible; but, as it is here necessary to act upon a bony structure, peculiar means become necessary in order to accomplish this. If the abscess has been caused by the extraction of a tooth, the pus may perhaps be evacuated by puncturing the floor of the antrum through the cavity in the alveolar process, by some suitable instrument, such as a small trocar and canula, the trocar being withdrawn whilst the canula is left to keep the orifice in the mucous membrane open and permit the escape of the pus through it. After the entire evacuation of the matter, it will often be useful to inject the cavity of the antrum through the canula with tepid water, in order to

wash it out thoroughly, as may be readily done by fitting the beak of a syringe to the mouth of the canula.

But sometimes an abscess of the antrum occurs which is not a result of the extraction of teeth, and, under these circumstances, it becomes necessary to make an opening through the sides or walls of the antrum, as may generally be done by turning the lip forcibly upward, and puncturing the anterior and external walls of the superior maxillary bone by means of a strong trocar and canula, or by a sharp bistoury; this being a very simple operation, as the bones of the part are naturally thin, and, under the circumstances described, are not unfrequently rendered yet thinner by disease.

SECTION III.

POLYPUS OF THE ANTRUM.

Polypus of the antrum may at times occur, though it is comparatively a rare disorder, unless found in connection with polypi of the nostril.

Treatment.—If the polypus is benignant, the treatment is to remove, by ligature or otherwise, the polypi in the nostril if there be any, and to do likewise with so much of the polypus of the antrum as protrudes into the nostril, or can be reached from it; after which it will be necessary to act upon the diseased mass remaining in the antrum by means of astringent and alterative injections, which are to be thrown into the nostril. But most generally polypi of the antrum are either primitively malignant in their character, or become the seat of malignant deposits, and then create a tumor of the antrum, which has a disposition to invade surrounding parts, the neighboring bones being encroached upon until they become diseased, and a peculiar condition results which requires extirpation of the superior maxillary bone entire.¹

¹ See Operative Surgery, vol. i. p. 379, 2d edit.

SECTION IV.

AFFECTIONS OF THE CHEEK.

Under this head may be placed the various tumors of the cheek, which are, most generally, small encysted tumors, sebaceous tumors, &c., and the treatment of which is removal by excision. Under the same head would also be placed *Salivary Fistula*, or the fistulous ulcer, resulting from wounds of the duct of Steno, as is fully described in the *Operative Surgery*.¹

SECTION V.

AFFECTIONS OF THE LIPS.

Affections of the lips consist in cancer and harelip, the first having been already alluded to under the head of Cancer, and the cure of the latter by operation being described in the volumes on *Operative Surgery*.²

¹ See *Operative Surgery*, vol. i. p. 363, 2d edit.

² See vol. i. p. 349, 2d edit.

PART X.

AFFECTIONS OF THE THROAT AND NECK.

CHAPTER I.

AFFECTIONS OF THE THROAT.

SECTION I.

FOREIGN BODIES IN THE PHARYNX.

Anatomical Relations.—The term Pharynx is applied to all the upper portion of the œsophagus, or the orifice of the throat, and is formed by a series of muscles which are designated as the superior, middle, and inferior constrictors; the object of these being to seize upon the bolus of food, and, by their successive contraction, carry it down into the œsophagus, the muscular coat of which, by like contractions, carries it down into the stomach. The pharynx is attached posteriorly to the bodies of the vertebræ by a certain amount of loose cellular substance, which, like all cellular substance, may become the seat of inflammation and abscess. The entrance from the mouth into the pharynx is guarded on each side by the two half arches of the soft palate which have between them the tonsil gland. Just below this point, and anterior to the pharynx, or at the root of the tongue, is the epiglottis cartilage, which closes the orifice through which the air passes into the larynx and trachea when the patient swallows. As the thyroid cartilages, which compose the upper part of the larynx, are open posteriorly or rather united only by muscular tissue, they do not afford that protection to the surface of the larynx which is next to the pharynx

that they do on its front, whilst the rings of the trachea being also imperfect on the posterior side, any force that distends the pharynx and œsophagus acts with great readiness upon the air-passages, so as to produce compression and all the consequent symptoms of difficulty of respiration, and strangulation. It should also be noticed that the situation of the great vessels of the neck with regard to the œsophagus and pharynx is such, that any forcible distension of the œsophagus or pharynx is liable to interfere with the freedom of the circulation by inducing spasm of the muscles of the neck, and thus compressing the veins which bring the blood from the brain.

Etiology.—The foreign bodies which are most likely to get into the pharynx are such as are ordinarily taken into the mouth for the purposes of nutrition, although bodies of various characters may, through a variety of accidents, obtain the same position. Of these foreign bodies, the most common are such as fish-bones, especially the smaller bones of such varieties as the herring or shad, the smallness of which causes them to pass unnoticed to the fauces, when, getting transversely, their length is sufficiently great to cause them to lodge across the pharynx; or, the offending substance may be a piece of tough meat or gristle taken into the mouth during a meal. In the same manner, foreign bodies taken into the mouth for any purpose may accidentally be swallowed, such as pins, which are often held in the mouth by housemaids and others, bits of glass, beads, coins, &c.

Seat.—When any of these substances are swallowed, the first place at which their progress is likely to be arrested, is at the half arches, where the body, if sharp, such as a pin, needle, or fish-bone, will often be found sticking directly into the structure of the tonsil, the imbedding being sometimes effected by means of the spasmodic contractions of the isthmus of the fauces, the muscular contractions of which have sometimes such power, that cases are on record in which pins and similar pointed articles have been driven completely through the fauces, so as to wound the great vessels of the neck.

Diagnosis.—In these cases, the surgeon will generally be able to recognize the foreign body by the sight, simply by directing the patient to open his mouth widely; but if from the minuteness of the body, or its position, he fails to do so, and the symptoms clearly indicate its presence, he should have no hesitation in introducing

his finger into the throat, by means of which the substance, if present, can always be recognized.

Very frequently, however, it passes the isthmus of the fauces, and becomes fast in the pharynx, where it may generally be looked for about the bottom of the middle constrictor muscle, though sometimes it is held in the embrace of the superior constrictor. Here, also, its presence can be recognized by means of the finger, which, under these circumstances, should be passed down a little below the orifice of the larynx.

Symptoms.—When a foreign body is thus arrested in the pharynx, it is very apt to produce such pressure upon the larynx or trachea, as will be followed by violent spasm in the muscles of respiration, with evidences of strangulation. As a general rule, foreign bodies which pass fairly into the pharynx, yet are of such a size or shape as prevents their passage into the stomach, hitch upon a point that corresponds with the posterior face of the larynx, and by irritating the thyroid muscles induce spasms which are very violent in their character, owing to the irritation of the nerves of respiration. The patient therefore soon gasps and struggles for breath; whilst, by the contraction of the respiratory muscles thus thrown into a state of spasm, the larynx is pressed forcibly back upon the foreign body, and the danger is increased.

Treatment.—The treatment in these cases must always be prompt, particularly if the foreign body is large, as the spasm will soon result in closure of the glottis, when the patient will be suffocated in a few minutes.

A person when seen making these violent spasmodic efforts, under circumstances which would lead to the suspicion of a foreign body being the cause, should therefore at once be compelled to lean forward and drop his head upon the chest in such a manner as to relax the muscles of his throat, and thus prevent as much as possible the occurrence of contraction in such muscles as will, by forcing the larynx against the pharynx only increase the evil. Then, having fastened the jaws apart by means of a fork handle or a cork, thrust a finger into the throat and hook out the foreign body, if possible, when the relief will be prompt.

If, however, this manipulation should fail, the patient's head should be retained by assistants in the same position while the surgeon resorts to more efficient means. Thus, if the foreign body is a piece of tough meat, or any similar substance which will not

be injurious if swallowed, all that is required in the way of instruments will be simply the probang of the shops or a flexible stick, the extremity of which is guarded by several folds of muslin firmly tied on. By means of either of these instruments, the foreign body may then be pushed down into the stomach, which will of course be followed by complete relief of the difficulties due to the irritation of the laryngeal muscles.

If, however, the body is of such a nature that it would be manifestly improper to carry it down into the stomach, it may be removed by forceps adapted to this purpose,¹ the best of which is that contrived by Dr. Henry Bond, of Philadelphia, and an account of which, in connection with an excellent paper on foreign bodies in the pharynx, was published in the *North American Medical and Surgical Journal*, vol. vi. p. 322, in 1826.

SECTION II.

AFFECTIONS OF THE MUSCLES OF THE NECK.

Torticollis, or *wryneck*, is an affection connected with the muscular structure of the neck, which is generally due to a spasmodic contraction, often a permanent one, of the sterno-cleido-mastoid muscles.

Treatment.—In its milder form this disorder is only a rheumatic affection of the muscle, and may be readily relieved by means of warm stimulating frictions, a very good article for the purpose being found in the *tinctura saponis camphorata*, combined with a due proportion of the tincture of the root of aconite, or it may be necessary to abstract blood by cups. The popular plan of covering the neck with a damp cloth, and ironing it with a warm flat-iron so long as the patient can bear it, is also not a bad plan of treatment.

A more permanent contraction of the muscle requires, however, a more decided course of action; and it should be borne in mind that here, as in *strabismus*, while there is a preternatural contraction of the muscles of one side, there is a preternatural relaxation in its antagonistic muscle, so that if the condition has existed for some weeks or months, and promises to remain permanent, it will be necessary to resort to an operation, this being conducted upon

¹ See *Operative Surgery*, vol. i. p. 479, 2d edit.

precisely similar principles to that alluded to in connection with strabismus;¹ but here the operation must be followed by the proper application of mechanical means to overcome the contraction. The operation of *myotomy*, as generally practised for the relief of these deformities, is a very simple one, and only dangerous in the hands of a surgeon grossly ignorant of the anatomy of the part. In its performance, it should ever be borne in mind that the muscle, in which the section is generally made, is placed just above the carotid artery and the great veins of the neck.²

The new tissue formed by the organization of the lymph which is thrown out between the edges of the divided muscle, being very extensible, should subsequently be brought to such a length as will insure a removal of the deformity by means of various mechanical contrivances, such as are to be found either in the handkerchief of Mayor, specially designed for this purpose, or in an instrument which regulates the position of the head by means of a pad and screw, or in a sort of helmet, with shoulder-bands so contrived as to hold the head in the proper position. (Fig. 225.)

Bronchocele, or Goitre, with other tumors of the neck, will be found described in detail in the *Operative Surgery*, vol i. p. 506, 2d edit.

Fig. 225.



HELMET, &c., FOR THE TREATMENT OF TORTICOLLIS AFTER THE OPERATION OF MYOTOMY.—1, 2. Straps to pass under the chin and around the head. 3. A movable rod to adjust the helmet to necks of different lengths. 4, 4. Straps to surround the shoulders. 5, 5. Straps to fasten the shoulder-brace around the chest, and thus furnish a point of support for the apparatus. (After Nature.)

SECTION III.

HYDROCELE OF THE NECK.

Hydrocele of the neck is the name given to a disease which consists essentially in the accumulation of fluid in the proper structure

¹ For the details of myotomy, see *Operative Surgery*, vol. i. p. 503, 2d edit.

² See *Operative Surgery*, vol. i. p. 501, 2d edit.

or in the capsule of the thyroid gland. This fluid is generally serous in its character, the conditions favoring its development, and the pathological changes which are its proximate cause, being very imperfectly understood. Its treatment is that of hydrocele of the tunica vaginalis testis. Thus, its contents should be evacuated by means of a trocar and canula, and the tendency to its reproduction overcome by means of injections of some stimulating substance, that most frequently used being solutions of the tincture of iodine in water, gradually increased in strength until sufficient adhesive inflammation is established to obliterate the cavity of the sac.

SECTION IV.

POISONS IN THE STOMACH.

As the stomach is chiefly to be entered by the surgeon through the neck, we may now study the effects of poisons found in this viscus, whether introduced accidentally or with murderous or suicidal design.

Varieties.—These poisons may be divided into three great classes: 1, those from the mineral; 2, those from the vegetable; and 3, those derived from the animal kingdoms.

1. The mineral poisons most frequently taken are arsenic, corrosive sublimate, salts of copper and lead, and the mineral acids, such as the sulphuric, nitric or muriatic acids, and the like.

2. The vegetable poisons are generally narcotic articles, such as opium, cicuta, stramonium, belladonna, laurel, &c., as well as mushrooms, truffles, and other similar articles of diet in particular constitutions and under certain circumstances; there are also some vegetable poisons which cannot correctly be called narcotics, such as strychnia.

3. The poisons derived from the animal kingdom are very various, those perfectly innoxious in some seasons being sometimes poisonous under diverse conditions; thus fresh pork, so generally used as an article of diet, will act upon certain constitutions, in hot weather, as a positive poison; and this, perhaps, not merely from its nature, but also from the manner in which it is often eaten, being bolted in masses that are unmasticated. In some cases of poisoning thus induced, a brisk emetic has occasionally brought

away large lumps of undigested pork several days after they were swallowed, the debility, delirium and cutaneous eruption disappearing soon after the pork was vomited. Poisoning from this cause has been sometimes noticed among the laboring classes in the summer season. So also certain shell-fish, though often used as articles of diet, will occasionally produce in some individuals symptoms of poisoning, one being well known to me, upon whom stewed oysters will act as a positive poison, creating violent retching—evidences of gastritis—prostration, and a marked form of erythema nodosum.

Besides these ordinary articles there are certain animal substances which invariably act as poisons if given even in a comparatively moderate quantity: such as cantharides, &c.

Symptoms.—The symptoms produced by these different classes of poisons will vary greatly, and must be separately alluded to.

1. *Mineral Poisons.*—The symptoms produced by the ingestion of a mineral poison are usually the symptoms of violent irritation and inflammation of the mucous membrane of the alimentary canal. The tongue, therefore, presents more or less evidences of deficient secretion, and is dry, whilst the throat is sore, and the pharynx inflamed, there being at the same time all the ordinary evidences of violent gastritis. There is also vomiting with frequent and violent retching, besides which, if the inflammation of the stomach progresses, it may result in perforation and all the usual symptoms of peritonitis. As these symptoms gradually increase, cold sweats come on, and in a variable period the patient dies.

2. *Vegetable Poisons.*—The symptoms of vegetable poisoning are generally excessive narcotism, and all the symptoms of congestion of the brain, as loss of sensation, vertigo, dizziness, loss of vision and hearing, headache, snoring or stertorous respiration, loss of consciousness, coma, and all the symptoms of compression of the brain.

3. *Animal Poisons.*—The symptoms of the various animal poisons will depend very much, both in their violence and character, upon the nature of the articles taken. As a general rule, however, it may be stated that there is in these cases a disposition to vomit, accompanied by all the other symptoms of gastric and intestinal irritation or inflammation, whilst it is not unusual for these animal poisons, when not sufficiently active to destroy life, to be followed in certain constitutions by the development of skin disease, &c. &c.

Treatment of Poisons in the Stomach.—The indications for the treatment of poisons in the stomach, are, 1. To evacuate the organ; 2. Where this cannot be accomplished, or after it has been accomplished, if there is any reason to suspect that a portion of the poisonous matter has remained behind in the stomach or bowels, to employ proper antidotes; 3. To get rid of any portion which may thus have passed into the bowel, even after the administration of the antidote, by means of brisk and active purgation; 4. To combat any effects of the poison which may occur notwithstanding these measures, these effects being generally found either in inflammatory action in the mucous coat of the stomach, as in the case of the mineral and animal poisons, or in narcotism of the brain, as in the case of certain vegetable poisons.

The means to be employed in carrying out these various indications differ materially in accordance with circumstances. Thus, the simplest manner in which the first indication may be accomplished, and the contents of the stomach evacuated, is by means of emetics, and as these are sometimes demanded with great promptness, it is as well to remember those that are most likely to be found under ordinary circumstances, the simplest and most readily and speedily obtainable of which is, that of mustard, salt, and warm water, a teaspoonful of the ordinary table mustard and a tablespoonful of salt being put into a tumblerful of lukewarm water, and drank off by the patient at a draught, after which the throat may be tickled with the finger or a feather with the view of exciting more prompt emesis. This substance generally acts with great promptness and efficiency. Another article which is applicable under these circumstances, particularly in the case of mineral poisons, where it acts not only as an emetic but as an antidote, is one which is also readily obtainable, though not now found so generally in houses as formerly, namely, common lamp oil; few persons being able to drink a tumblerful of it without having prompt emesis induced, whilst if it should not vomit it will yet sheathe the coats of the stomach from the action of acrid substances. Powdered ipecacuanha, if it can be obtained, is an excellent emetic, and may be administered in the dose of a teaspoonful every ten minutes, warm drinks being freely given in the interval until the desired effect is produced. Sulphate of zinc may also be resorted to in doses of half a scruple; or tartar emetic in doses of from two to five grains; sanguinaria, or bloodroot, in doses of a scruple; or

lobelia or tobacco, though these articles should be cautiously given and carefully watched, lest the injury resulting from their depressing and prostrating effect be no less than that resulting from the poison itself. The effects of the tobacco can be obtained either by giving it internally, or simply (and this is preferable) by macerating the leaf and binding it upon the skin at the pit of the stomach.

But a more certain mode of thoroughly evacuating the stomach is by the use of the stomach-pump and œsophageal tube,¹ which should be passed into the stomach so as to pump out its contents.

Having thus gotten rid of as much of the poisonous matters as possible, the next duty of the surgeon is to resort to proper antidotes; these, of course, varying according to the nature of the poison, as each one has its appropriate and more or less efficient antidote. After thus neutralizing the effects of irritating poisons, the gastritis, &c., should be treated on general principles.

§ 1.—ANTIDOTES FOR POISONS IN THE STOMACH.

1. *Arsenic*.—The antidote for arsenic is albumen or gluten, which may be conveniently administered in the form of the white of eggs or of flour and water, or lightly calcined magnesia, which should be given very freely, the albumen forming with the arsenic a comparatively insoluble and innoxious compound which may be subsequently removed from the alimentary canal by emetics and purgation. The albumen, however—though it should always be resorted to if other means are not at hand—is not nearly so efficient an antidote for arsenic as it is for corrosive sublimate, and the surgeon should therefore, if it be in his power, resort at once, in the case of arsenic, to the hydrated sesquioxide of iron, which is usually kept by the apothecaries ready prepared, and which is the most efficient antidote for arsenic known.

2. *Corrosive Sublimate*.—The best antidote for corrosive sublimate, as already stated, is albumen, though gluten, milk, or Peruvian bark, may also be resorted to if albumen cannot be obtained. Any of these articles, to be thoroughly useful, should be given freely, and followed by the use of emetics and purgatives.

3. *Nitrate of Silver*.—For nitrate of silver the antidote is common table salt.

¹ See Operative Surgery, vol. i. p. 486, 2d edit.

4. *Salts of Lead*.—For the salts of lead the proper antidote is diluted sulphuric acid, which forms with them, by a chemical reaction, the sulphate of lead, this being an insoluble compound. If, however, the salt of lead taken is the carbonate, the sulphuric acid should be cautiously given, and some means employed to prevent distension of the stomach from the carbonic acid gas, which will be rapidly evolved.

5. *Salts of Copper*.—In cases of poisoning from the salts of copper the antidotes recommended are albumen, oil, &c.; but as the compounds thus formed are by no means perfectly insoluble, resort should afterwards be had to purgation and emetics.

Vegetable Poisons.—Among the substances derived from the vegetable kingdom, the most common source of poisoning is the narcotics. In case of suspected poisoning from any of these substances, the first thing to be done is to empty the stomach, and this will be performed most efficiently by means of the stomach-pump; but if that is not at hand, or while waiting for it, prompt emetics may be given. The stomach having thus been properly evacuated, the next indication is to purge with a view of removing any of the substance which has passed into the bowels. In order to obtain full benefit from this treatment, the purge given should be an active one, as elaterium, gamboge, large doses of calomel, or similar prompt and efficient drastic cathartics. After having removed from the stomach all of the drug that can be obtained, and whilst waiting for the operation of the purgative, the effect of any portion of it which may have previously been absorbed should be counteracted by keeping up the activity of the brain until the sedative influence of the poison shall have passed off. This object may be effected by stimulating measures of various kinds, all of which should be steadily persevered in, as it is an established fact, that if the activity of the brain can be kept up for six or eight hours, in a case of narcotic poisoning from an article like opium, the patient will generally recover. A very good mode of carrying out this indication is by stimulating the nerves of the skin, and the simplest manner in which this can be effected is by switching the patient well by stripping him and striking him round the legs with a switch. The same end may be effected by the application of cold; either by leading him up and down a cold room, or giving him every fifteen or twenty minutes a shower-bath, or throwing a bucket of cold water over him; but this treatment should be

cautiously practised, for if the cold is carried so far as to produce its sedative effects, it will only add to the power of the drug. If, however, all these means seem to fail the surgeon should not despair, as he has yet a resource which, in skilful hands, has saved life, and that is, to attempt to keep up the action of the brain by the galvanic battery, the most convenient form of which is to be found in the electro-magnetic machine, already alluded to.

Mineral Acids.—In the case of poisoning by the mineral acids, the antidote is to be found in the free use of the alkalies, avoiding, however, the carbonated alkalies on account of the distension which would result from the consequent evolution of carbonic acid gas.

In the case of oxalic acid, a vegetable acid which is sometimes a source of poisoning, the most serviceable antidote is lime, which may be obtained from a piece of chalk, or by scraping the ceiling of a room, and which forms with the oxalic acid an exceedingly insoluble compound.

In all cases of poisoning in which the substance used is acrid or corrosive in its nature, the indication to follow the use of the antidote by free mucilaginous drinks is a clear one, as they sheathe the mucous coat of the alimentary canal, and facilitate the action of the cathartic which is to be subsequently employed.

...the first of the great principles of the American Revolution, the right of the people to alter or to abolish their government, and to institute a new one, whensoever they shall judge it necessary for their safety and happiness. This principle was the foundation of the American Republic, and it was upon this principle that the American people have ever since acted. It was this principle which gave birth to the Declaration of Independence, and it was this principle which gave birth to the Constitution of the United States. It was this principle which gave birth to the Bill of Rights, and it was this principle which gave birth to the great principles of the American Republic. It was this principle which gave birth to the great principles of the American Republic, and it was this principle which gave birth to the great principles of the American Republic.

PART XI.

AFFECTIONS OF THE ABDOMEN.

CHAPTER I.

HERNIA.

HERNIA, or rupture, is the name of a disorder which consists in "a protrusion of any of the abdominal viscera covered by the peritoneum through a natural or preternatural opening in any part of the abdominal parietes." As it is a very common complaint—about one person in every eight suffering from it—and as it is one which exposes the patient to great inconvenience, and may at any moment result in his death, it is an affection to which surgeons have always paid great attention. This attention has, however, resulted in such an anxiety to describe all the parts minutely, that the vast multiplication of terms which resulted from their detailed anatomical statements has produced, as its legitimate result, a confusion of ideas. The present account will, therefore, be a comparatively brief outline, though it is hoped it will prove sufficiently explicit for all practical purposes.

Seat.—Hernia may occur in any portion of the abdominal parietes except one, and that is posteriorly in the line of the spinal column. Its most common seats are, however, at those parts of the abdominal parietes which give exit to bloodvessels, to the spermatic cord of the male, or to the round ligament of the female.

Varieties.—For the purposes of methodical study, hernia is classified, 1, according to the location at which the protrusion occurs; or 2, according to the contents of the tumor, *i. e.*, according to the character of the portions of the viscera that have protruded.

When under the first division a tumor occurs in the groin, it is therefore called an *inguinal* hernia; if its contents have passed

down into the scrotum, it is spoken of as *scrotal* hernia; if it comes down in the sheath of the femoral vessels, it is called *femoral* hernia; when found at or near the umbilicus, it is designated as *umbilical* hernia; and when it passes through the abdominal walls at any other point, it constitutes *ventral* hernia. A combination of ventral and inguinal hernia is called *ventro-inguinal*. If the hernia passes out through the ischiatic notch, it is called *ischiatic* hernia; through the thyroideal foramen, *thyroideal* hernia; through the diaphragm into the cavity of the thorax, *phrenic* hernia; while an inguinal hernia in the female, which passes down into the labium, receives the designation of *pudendal* hernia. In the older works on hernia, certain names will also be found applied to these various forms of hernia which it is perhaps as well to understand, and which are intended to point out the locality and contents of the tumor. Thus, an inguinal hernia was formerly designated as a *Bubonocoele*, or groin tumor, a very incorrect term, and one which evidently would be quite as correctly applied to a bubo as to a hernia; whilst scrotal hernia received the name of *oscheocoele*, femoral hernia was entitled *merocele*, and an umbilical hernia was called an *exomphalos*.

2. The hernial tumor, in the second place, has been variously named according to its contents; thus, if it contain intestine, it is termed *enterocoele*; if omentum, *epiplocele*, and if both, *entero-epiplocele*.

Certain terms, moreover, are applied to the varieties of hernia in accordance with the condition in which their contents are found. Thus, if they can be restored to the abdomen at pleasure, the hernia is said to be *reducible*; if this is not possible, it is said to be *irreducible*; and when, from any cause, an irreducible hernia is so constricted as to impede or prevent the passage of the feces and the circulation of the blood in the tumor, it is spoken of as *strangulated*; whilst if present at birth, it is designated as *congenital hernia*.

Hernial Sac.—As the bowels and omentum are both behind the bag of the peritoneum, they must, as they escape from the abdomen, push this membrane before them, and every hernia thus obtains a covering which is almost always present and which is designated as the *hernial sac*.

Regions of the Sac.—The portion of the sac most distant from the point through which the hernia escaped from the abdomen is designated as its *fundus*; the orifice which communicates with the abdo-

men is known as its *mouth*, and the part constricted as the *neck* of the sac.

Varieties in the Sac.—The sac, as first noticed, is a thin serous covering, formed of peritoneum, and in every way identical and continuous with the portion of this membrane yet left in the abdomen; but soon after the formation of a hernia the pressure to which it is exposed develops more or less inflammation, by which its structure is much thickened and its original appearance quite lost, becoming frequently several lines thick, whilst its transparency and vascularity are also much modified. But it sometimes happens that the distension of the sac results in a total destruction of the peritoneal covering of the hernia, and thus it happens that the contents of the tumor may be found protruded from the abdomen without a sac, though such a condition is very rare.

Etiology of Hernia.—The causes of hernia may be arranged under two separate heads: 1. Those which are *exciting*, and 2. Those which are *predisposing*. The exciting causes are such as act violently upon the abdominal parietes, such as lifting heavy weights, blowing horns, jumping, and strains of every character. It is often excited by the tight lacing of corsets; whilst crying violently sometimes causes it in children. Pregnancy in the female is a common cause; whilst falls and blows, or any similar violence, may at any time induce the complaint.

The predisposing causes are all such as result in a preternatural relaxation of the abdominal walls, or in a preternatural size of the various normal openings in the abdominal parietes for the passage of vessels. Thus, an unusually wide pelvis in the female is often a predisposing cause, because it creates a larger space beneath the crural arch, whilst the congenital deficiencies of the abdominal parietes, especially at the groin and umbilicus, greatly facilitate its production on the subsequent application of slight exciting causes.

SECTION I.

REDUCIBLE HERNIA.

Symptoms.—The *symptoms of reducible hernia* are as follows: There is a tumor in the abdominal parietes or on the thigh which is well marked while the patient is standing up, but which disappears when

he lies down, and to which coughing generally communicates a distinct impulse, as may be felt by placing the hand upon the tumor and directing the patient to cough, when the succussion will be readily noted.

The tumor caused by a hernia is also very apt to be larger after a full meal than at any other time, and the patient experiences more or less of the evils of flatulence, as *borborygmi* or grumbings and roarings in the bowels, particularly in the neighborhood of the tumor, these being excited by the difficulty experienced by the flatus in passing through the protruded portion of the intestine.

The hernial tumor generally commences above and extends downwards, and, if it attains any size, is more or less pendulous in its character; the size attained finally being in some cases truly immense, reaching almost to the knees of the patient, and seeming to contain the whole of the contents of his abdomen. If the hernia be of the scrotal variety, as it increases in size the natural rugæ of the scrotum disappear, and the skin becomes tense and shining, whilst the distension causes the penis to look like a depressed umbilicus.

Whenever, however, a hernial tumor is either large or small, it can generally be told that it contains intestine both by the effect produced by the coughing, as well as by the fact that the tumor is more elastic and more springy than when it contains only omentum; besides which, rumbling can occasionally be felt in the intestinal tumor, but not in that which is omental.

The tumor which contains only omentum is, on the contrary, more doughy and less elastic to the touch; gives less sensation upon coughing; has less tendency to tympanitis, and creates no *borborygmus*.

Occasionally, such changes take place in the sac of a hernia as prevent the protruded portion from being returned to the abdomen, and its contents are then said to be *irreducible*.

SECTION II.

IRREDUCIBLE HERNIA.

Etiology.—The exciting causes of irreducible hernia are all such as are likely to produce adhesive inflammation between the peritoneal surface of the sac and that of the intestine, this occurring most frequently at the neck or near the mouth of the sac. Irreducible her-

nia may, therefore, at any time result from blows upon the tumor of a reducible hernia; from pressure upon the neck of the sac; from improper manipulation, such as the application of a truss when the tumor is not properly reduced; from too great an amount of violence in making taxis, &c. &c. Every irreducible hernia has usually been reducible in the first instance, and those which are found irreducible are, therefore, generally of some weeks or months' standing.

Another change which takes place, commonly after a very short time, even in the reducible hernia, is the contraction of adhesions between the hernial sac and the surrounding parts, so that although the intestine can readily be passed up into the abdomen, the sac itself still remains outside. In this case, after the surgeon has reduced any intestine or omentum which the sac may contain, further manipulation can do no possible good, and may do harm by bruising the sac and exciting an inflammation in it that may create an abscess. After the hernia is reduced, however, it has been recommended, by many, to keep up a steady though moderate pressure for some time upon the neck of the sac, and it has been asserted that adhesive inflammation has thus been produced, and the opposite edges of the mouth of the sac so glued together that a hernia could no longer come down, a radical cure being thus effected; but surgeons differ in opinion in regard to the possibility of such cures being radical; my own personal observation being decidedly adverse to its practicability in the great majority of instances, except in children.

Prognosis.—Either reducible or irreducible hernia may exist for years and not destroy life, and, beyond the mere inconvenience of bulk, do not seriously trouble the patient. But so long as a hernia exists in the irreducible form, or so long as it remains reducible and not properly kept up within the cavity of the abdomen, so long is the patient exposed to strangulation and sudden death, living as if the sword of Damocles were constantly suspended over him, ready to fall without a moment's warning.

In reducible hernia, the tumors containing intestine are generally much more readily reduced than those containing omentum, for the constriction at the neck of the sac, which is always more or less present, interferes so rapidly with the circulation in the omentum, that effusions take place and it soon becomes very difficult to replace it in the abdomen.

SECTION III.

STRANGULATED HERNIA.

When an intestinal hernia is so constricted as to check the passage of food along the canal, or the circulation of the blood in the constricted intestine; or when an irreducible omental hernia has its circulation so interfered with as to set up an inflammation which, if unrelieved, will result in mortification, the patient is said to suffer from *strangulated hernia*.

Symptoms.—The symptoms of strangulated hernia are as follows: The patient first complains of pain and uneasiness in the tumor, which pain continuing, gradually extends up into the abdomen; then he is conscious of a sense of constriction and uneasiness about his umbilicus, a sensation which he speaks of as resembling a cord tied around his stomach. This is followed by symptoms of disorder of the stomach, as nausea and vomiting, the vomiting being either of bile or fecal matter, or sometimes even of blood.

After this he usually begins to show great anxiety in the expression of his face, his countenance becoming distressed and presenting a peculiarly haggard look, and there is marked constipation; such portions of feces being only passed as were in the intestines below the constricted part at the time of its strangulation, whilst subsequently he passes nothing by stool.

While these symptoms are in progress, changes may be noticed in the state of the pulse which, as might be expected, shows clearly by its irritable condition that the circulation shares in the constitutional effects of the severe local constriction of a vital tissue.

The patient, meanwhile, from excessive pain and debility falls into a profuse perspiration, and the vomiting returning, he begins to eject fecal matter, this being brought into his stomach by the reverse action of the peristaltic motion of the bowels above the seat of the constriction. As the irritation extends to the diaphragm he also suffers from hiccough, whilst gases accumulating in the intestines produce more or less tympanitis and general distension of the abdomen.

These symptoms having continued for a variable period, the patient begins to show signs of prostration; the perspiration becomes more profuse, but is cold; the pulse becomes feeble, thready, windy, or like what is termed a "soap-bubble" pulse, which the

slightest touch causes to disappear, when one of the most marked symptoms of the condition which is now coming on, shows itself in a sudden cessation of the pain in the tumor, which if pressed under the finger will crackle and give a crepitating sensation in consequence of the disengagement in the strangulated tissues of putrefactive gases. The tumor has now, moreover, ceased to exhibit the slightest tenderness on pressure, and changes its color, becoming brownish, or lead-colored, and livid. The abdominal tympanitis now rapidly becomes immense, the belly of the patient being sometimes as large as that of a pregnant woman in her ninth month. Then follow quickly the various symptoms of collapse and death; or in the smaller number of more fortunate cases the inflammation in the tumor is communicated to the skin, the latter ulcerates, the strangulated intestine sloughs—adhesive inflammation having already glued it fast to the side of the abdominal walls—and an opening or *artificial anus* is formed, through which the intestinal contents escape outwardly.

Results.—Strangulated hernia may terminate in two ways: first, and more commonly, in death; and second, in artificial anus. This latter fact should always be borne in mind in forming a prognosis, as it will not do to tell a patient laboring under strangulated hernia that if he is not operated upon he will certainly die, although this will happen to him in the great majority of cases; for it may be that his case will take the second termination, and, sparing his life, result in the formation of an artificial anus.

Diagnosis.—There are several conditions with which strangulated hernia may be confounded, and from which it is important to distinguish it. Of these, that for which it is most likely to be mistaken is *ilius* or *intussusception*, or the train of symptoms not unlike those of strangulated hernia, such as pain, constipation, stercoraceous vomiting, &c., which ensue when a portion of the intestine is invaginated within itself, so as to create a diminution of its calibre, or a continued spasm of its muscular walls, so as to obstruct the passage of the fecal matter towards the anus.

But although the general symptoms in these cases are similar to those of hernia, yet a diagnosis can often be made with facility; because in hernia a careful examination will always show a tumor, whilst even in those cases which, from the difficulty of recognizing the tumor, have been named *concealed hernia*, the tumor may be found with more or less readiness by etherizing the patient and examining him carefully, when he is fully relaxed by the influence

of the anæsthetic. The history of the case will also materially aid the diagnosis; and if the patient be old enough or intelligent enough to give one, will generally leave no doubt as to the true state of the bowels.

Pathology of Strangulated Hernia.—When, as a consequence of strangulated hernia, the patient dies, the *post-mortem* appearances are very marked, the tumor itself usually exhibiting all the symptoms of mortification of a portion of the intestine. The latter, therefore, will be observed to be of a brown or chocolate color, resembling in this respect the color already described as belonging to moist gangrene. The hernial sac also usually presents a greater or less quantity of serum, which is generally tinged of a deep chocolate color by the altered hæmatin that has been effused as the result of the congestion that follows the constriction of delicate and vascular tissues.

Prognosis.—The prognosis in strangulated hernia is always serious, and should be very guarded, death being apt to ensue if the strangulation is not relieved by an operation, whilst the operation itself is frequently unsuccessful. Still, cases occur in which, as has been already stated, the patient will survive the strangulation without an operation in consequence of the formation of an artificial anus. As regards the prognosis of the different forms of strangulated hernia, it should be remembered that small hernia are more frequently the cause of danger and death than those of greater bulk, perhaps because they are more frequently overlooked or trifled with, and also because large tumors dilate the parts to such an extent that the strangulation is not so complete, and therefore by no means so dangerous as is the case in the small protrusions. The prognosis of intestinal hernia, when strangulated, is much more dangerous than that of strangulated omentum, as might readily be imagined, because in the latter the calibre of the intestine is not involved, and the passage of the fæces not interfered with, the danger in omental cases being chiefly from the development of peritoneal inflammation. The time in which death may occur from strangulated hernia, is various; thus it may happen in twenty-four hours, though, as a general rule, it will not take place until sufficient time has elapsed to permit the patient to pass through the symptoms above detailed, whilst not unfrequently to these will be added the more tedious symptoms of general peritonitis, this being not unfrequently the cause of death. The dura-

tion of a strangulated hernia may, therefore, be stated as varying, according to circumstances, from twenty-four or forty-eight hours to eight or ten days, whilst the most frequent period may be set down as being from the fourth to the sixth day.

In reducible hernia, the prognosis is altogether favorable, because, if proper means are adopted to keep the tumor up within the abdominal cavity, there will be no danger of constriction and strangulation. In irreducible hernia, the prognosis is less favorable, because at any moment it may become strangulated, when all the symptoms detailed in connection with the latter condition may ensue.

Treatment.—The plain indication for the treatment of any variety of reducible hernia is to resort to such means as will restore the contents of the tumor to the abdominal cavity, and when there prevent them from again protruding. The manipulations by which the tumor is to be restored within the abdominal parietes, are designated as the *taxis*.

In making taxis, attention should first be paid to the position of the patient. Thus, he should recline, and be so placed as to relax such of the abdominal or femoral muscles as might constrict the tumor. If the tumor is in the groin, the patient should therefore lie with his thighs flexed upon his body, and his shoulders so raised as to relax the abdominal muscles as much as possible, and if it is a femoral hernia, the position should be the same, but the toes should also be turned sharply inwards, so as to relax the tissues about the femoral ring; but wherever the hernia is situated, the same general rule applies, to wit, to place the patient in that position which will relax as much as possible the parts concerned. Taxis is made by gently kneading the tumor alternately with the fingers of each hand, so as to press it back again into the abdomen, taking care to exercise the pressure in the line in which the hernia has descended. Having reduced the tumor, the next indication is to resort to such means as will prevent its reproduction, and these may be either palliative or radical. The palliative treatment consists in preventing the recurrence of the hernia by exercising a proper amount of pressure upon the orifice through which it has escaped; this pressure being generally produced by means of the instrument which is well known as a *Truss*. The radical cure of hernia has for its object the creating of such changes in the mouth of the hernial sac and in the ring as will close the latter, and thus permanently prevent the reproduction of the tumor.

Application of the Truss.—In taking the measure of a patient who is suffering from reducible hernia, with a view to the application of a truss, an annealed wire should be passed around his hips, just below the brim of the pelvis, so as to get his exact size and shape, if he is very thin; when in selecting the truss, the instrument-maker should allow about half an inch on each side, to compensate for the space occupied by the stuffing and covering of the instrument. If, however, the patient is fleshy, it will generally suffice simply to take his size around the hips with a string, which, with the above allowance for the stuffing of the truss, will be sufficiently accurate.

A good truss should consist of a spring of sufficient strength to resist the descent of the diaphragm; this spring having upon one end of it a pad so shaped as to exercise a direct pressure upon the orifice through which the hernia has escaped, so as to counteract the tendency of the intestine or omentum to come down again, and it is a matter of some importance that this should be accurately fitted to the part; for if the truss does not accomplish this, not only is it perfectly useless, but it may, by pressure upon the neck of the sac, when the hernia slips by the instrument out of the abdomen, create such an amount of inflammation as will cause a previously reducible hernia to become irreducible, or even strangulated. As the effect to be obtained by the application of a truss is generally understood, a great variety of instruments have been manufactured, each of which, it is usually claimed, accomplishes most accurately the end in view; besides which, many persons have the idea that the pressure upon the mouth of the sac should produce a sufficient amount of adhesive inflammation to close it, and thus prevent the re-formation of the hernia. Certain of these trusses are therefore said so to act as to create a radical cure, a point which many surgeons regard as impracticable in adults, though it sometimes occurs in the case of children.

The pad of the common old-fashioned truss, as it is now found all over the country, consists of an oval plate of sheet-iron covered with a compress of horsehair, over which buckskin is sewed. Trusses are also made with pads of wood, of glass, and of ivory; and there is even one made with a pad formed of a wire spring, like those of the seat of a chair or sofa.

This truss presents one illustration of the evils which have arisen from the application of trusses having passed into the hands of unprofessional men, this truss, as well as many others, being often

formed upon improper principles, and rather made by the dozen to expose for sale than shaped to suit the exigencies of each particular case, as a truss really ought to be.

The surgeon is, therefore, liable to have offered to him all sorts of "patent trusses," "patent self-regulating, graduated, self-fitting trusses," "patent trusses for the radical cure of hernia," &c. &c., all which should be cast aside simply from the fact of their being patented, as this usually makes them unnecessarily costly, and induces apothecaries and others to meddle in a matter which should be strictly confined to medical men who are familiar with the anatomical relations of the parts concerned. All that is required in any truss is, that it should have a simple, well-shaped, firm pad; but whether this be formed of wood, glass, or ivory, matters little provided it is smooth, and properly formed to fit the region on which it is to be applied; the soft stuffing being liable to change its form, to absorb perspiration, to become offensive, and to irritate the part, so that the patient is induced to lay the truss aside until the skin becomes less sensitive.

At one time it was supposed that young children could not bear the pressure of a truss, but they, on the contrary, bear it very well, if the strength of the spring is properly adapted to their age. The children's trusses of Messrs. Kolbè & Kumerle, for example, which are made of inflated caoutchouc, will do no injury, if properly fitted, to any child having a hernia, and as the period of childhood is that at which most benefit is to be derived from these instruments, a radical cure may be frequently accomplished at this period of life.

The treatment of irreducible hernia resolves itself into attention to the general health, and the use of such means as will prevent the tumor from attaining any greater size. An excellent plan for accomplishing this is to use a hollow pad, or a suspensory bandage, or some similar apparatus, by which the tumor can be supported, and yet not compressed. A patient laboring under an irreducible hernia should, however, always be directed to pay particular attention to the tumor, and to guard against any blows upon it, as well as to avoid pressure or any other causes which may set up inflammation, lest it become strangulated.

The treatment of strangulated hernia consists, first in a judicious employment of the taxis with a view of ascertaining whether the hernia be really irreducible, but this taxis should be used with extreme caution, particularly if the tumor has been strangulated for

some time, as by violence or even by a too tedious employment of a degree of force which if but briefly exercised would not be improper, an amount of inflammation may be set up which will render the operation of herniotomy useless, or compel the surgeon to save the life of the patient by favoring the establishment of an artificial anus, the protruded intestine being in such a condition that it would not be safe to restore it to the cavity of the abdomen. If a cautiously made taxis—say efforts continued for twenty minutes—fails to restore the intestine, it will be better to employ other means; thus a bladder filled with pounded ice may be made to touch the lowest end of the tumor so as to favor its retraction, though it should not be pressed on the protrusion or permitted to touch the neck of the sac. In consequence of the cold thus applied, the contraction of the tissues will often be such that the tumor will retract thoroughly, and the hernia be reduced without much effort at taxis. Ice, however, should never be employed for such a length of time as would endanger freezing the parts, as might happen if care is not employed. If the strangulated hernia has been reducible up to a short period before its strangulation, it may sometimes be replaced by passing a stomach tube as far as possible up the rectum, and then distending the gut by injecting large quantities of water into the bowels, this acting both by its distension and by its exciting such a peristaltic action as will perhaps end in the reduction of the tumor.

When these means fail, such measures may be resorted to as will produce complete relaxation of the tissues of the body, and thus favor the reduction of the tumor. Usually the best mode of producing this general relaxation is to put the patient into a perfect state of anæsthesia, when the hernia will often readily pass back. But if he is so situated, in the country or elsewhere, that no ether can be obtained, resort may be had to venesection, which should be carried *ad deliquium animi*, when, in the total relaxation that follows, the tumor will often be readily reduced. If the loss of blood be contra-indicated by the state of the patient's health, or by any other circumstances, an attempt may be made to obtain relaxation by the use of the warm bath, or by the administration of tartar emetic, given in sufficient doses to produce general prostration and relaxation of the muscular system.

Another mode of obtaining a very complete state of relaxation is by the use of tobacco, which it was formerly recommended to

employ in the form of infusion, a small portion of it being thrown into the rectum with a syringe. The relaxing effects of this article were thus very completely produced; but it sometimes happened that in the purgation that followed the injection was not thrown off, and as some of it thus continued to be absorbed, too much of the drug was introduced into the system, and a prostration ensued which was often serious if not fatal.

This danger may now be avoided with tolerable certainty by using the tobacco in the form of a suppository instead of employing it as an enema, the suppository being conveniently made by macerating a drachm of tobacco in an ounce of hot water until it is quite soft, and then tying it up in a piece of bobinet, when it should be put into the rectum so as to leave the string attached to it hanging out of the anus. As absorption quickly takes place, the constitutional effects of the tobacco will thus be induced, and when the depression has been carried to a sufficient extent, the suppository may be withdrawn simply by exercising traction on the string.

If the efforts at taxis thus made do not succeed, then there will be a necessity for resorting to an operation for the purpose of relieving the constricted bowel and preventing mortification; this operation being a serious one, as the patient always incurs more or less danger, though it is one which is successful in very many instances if resorted to early, whilst it is not near so dangerous as the taxis, when rudely or improperly practised. In resorting to the operation of herniotomy, it is important to its success that the taxis previously made should have been of the gentlest kind, so as to diminish as much as possible the dangers of bruising and inflaming the intestine, and that it should be early resorted to, in order that there may be as little time for the strangulated portion to become inflamed and mortified as possible. So frequently has this been noted, that Dessault, in the Hôtel Dieu of Paris, would not permit the young residents of his hospital to touch a case of strangulated hernia until he saw it himself, and then if the hernia was not reducible on the gentlest taxis, he proceeded at once to the operation. Statistics clearly show that by such a course fewer lives are lost than when more violent efforts at taxis are made before resorting to the operation. A similar result coincided with the experience of the late Dr. Parrish, of Philadelphia,

few surgeons having had more extensive opportunities than himself of testing the value of any opinion respecting the treatment of hernia.

It may therefore be laid down as a general rule, that if, under gentle but well-directed taxis, a strangulated hernia cannot be reduced in a reasonable length of time—say an hour—it is best to proceed at once to an operation.¹ The general preparation for the operation is very simple: thus the bowels should be emptied as far as possible by means of an injection, and the bladder voided, especially if the hernia is at the lower portion of the abdomen. Then the parts adjacent to that through which it is intended to make the incision (Figs. 226, 228), should be shaved of their hair, in order to obtain a clean surface for the subsequent application of the adhesive strips. Proper assistants should also be selected, and their duties assigned to each, the instruments being laid on a table, or tray, in some convenient place, so that they may be within the surgeon's reach.

After the operation has been performed, the after-treatment should consist in closing the wound so that the upper part of it

Fig. 226.



A view of the Tumor, showing the Line of the Incision through the Skin as shaved and prepared for the operation. (After Ferguson.)

may unite by the first intention; but a mesh of lint should be introduced into the lower portion of the skin to keep it open and favor the escape of any pus which may form in the deeper tissues. After twelve, eighteen, or twenty-four hours, a *gentle* laxative

¹ For Herniotomy, Taxis, &c., see Operative Surgery, vol. ii. p. 126, 2d edit.

should also be administered, so as to get rid of any fecal matter which may have been left in the upper portion of the intestine, above the seat of strangulation; the patient being kept at perfect

Fig. 227.



A view of the Position of the Patient, Shape and Position of the Tumor, as well as the Line of the Incision in Femoral Hernia. (After Ferguson.)

rest until the wound has healed, any extra inflammation which may arise during the process of healing being actively combated on general principles.

When strangulated inguinal hernia is operated on in a case which is congenital, a much larger space will be found around the testicle in the scrotum (Fig. 228); or it may be that the original pouch of peritoneum protruded by the testicle in its descent has remained unclosed on the cord; consequently the hernia and the testicle will be found near to each other in the scrotum.

As the greater portion of the subject of hernia involves a minute examination of the regional anatomy of the part through which it passes out of the abdomen, and as its treatment is almost entirely mechanical or operative, the reader is referred to the *Operative Surgery*, vol. ii. p. 86, 2d edition, for the other details of this subject, as well as for the creation and treatment of artificial anus, all of which is amply illustrated in the plates of the same work.

Fig. 228.



A diagram illustrative of the State of the Parts in the Scrotum in a case of Congenital Scrotal Hernia. (After Liston.)

PART XII.

DISEASES OF THE GENITAL ORGANS.

CHAPTER I.

SYPHILIS.

Syphilis, or the *Venereal Disease*, is the name ordinarily given to a disorder which commences in the organs of generation after an impure connection, and results in the production of certain changes which lead to the inoculation or poisoning of the blood. The origin of the term is unknown, though it has been variously ascribed; thus it has been said by some to be derivable from the Greek word *σὺς*, a hog; and by others from *σιπαλός*, shameful, dirty.

The general term Venereal Disease includes under it two distinct forms; in the one, the mucous membranes of the genito-urinary apparatus are involved and give rise to an increased discharge from these passages mingled with pus, and accompanied with the ordinary symptoms and results of inflammation in mucous tissues elsewhere, which is known as *Gonorrhœa*; whilst in the other is noted a morbid inflammatory action that leads to suppuration and ulceration in some part of the organs, and which is strictly designated as *Syphilis*. To the ulceration, which is the starting-point of the infection of the system in this latter disorder, the name of *Chancre* is applied; the transmission of the morbid matter from this chancre through the lymphatics of the part into the general circulation, giving rise subsequently to various constitutional symptoms which are noted in affections of the skin, mucous membranes, bones, &c.

Origin of Syphilis.—The origin of the venereal disease was certainly impure sexual intercourse, and the period of the world's history at which it first appeared, having been long and freely

discussed by surgical writers, is worthy of a brief reference, especially as it will show to the young American student that neither the discovery of America by Columbus in 1492, nor the siege of Naples by Charles the Eighth of France in 1498, could have originated this disorder. That the disease brought back by the followers of Columbus from the West Indies was without doubt that which still occurs there and is known as the Yaws or Framboesia, is a point now regarded by many as settled, whilst it is more than probable that the soldiers of Charles the Eighth only contracted, as the result of the unbounded license and disorderly life of the camp, an exaggerated form of a disease which previously existed. That the venereal disease undoubtedly followed close upon the licentious habits of men at an early period of the history of our race is also believed by many to be proved by some of the allusions to the habits of the Israelites as made in Leviticus, where the rules of cleanliness are laid down and distinctions drawn between gonorrhœa and other results of the sins of the flesh.

As violations of natural laws are always followed by disease, it is not improbable that this complaint was first originated by vicious intercourse between man and beast, to which allusion is also made by Moses, or arose from the frequent intercourse of one man with several women, which, with filthy habits and a warm climate, would doubtless prove sufficient for the creation of this disorder.

But without discussing the signification assigned by able commentators to the expressions of the laws of the ancient Jews, there is yet evidence of the existence of syphilis in England and elsewhere, long before 1492, Hippocrates 460 B. C., and Celsus, who was the contemporary of Horace, Virgil, and Ovid, describing the disease and giving many details of treatment which are noted as existing even at the present day.

In the *Acta Sanctorum*, as quoted by Sir A. Cooper in his *Lectures*, by Lee, vol. iii. p. 19, it is stated that two cases were published in Great Britain in the year 1010.

The disease is also, he says, mentioned by Bernard Gordon, Professor of Medicine at the University of Montpellier, in a work *De Passionibus Virgæ*, published in 1305.

In 1320, Dr. Gaddesden, of Oxford, published a work which he entitled *Rosa Anglica*, in which ulcers on the penis arising from sexual intercourse, are described.

In 1347, brothels were established in Avignon, under Queen

Jane, and certain laws or regulations laid down for their management. Among these will be found certain regulations which are still extant in Paris, though in a modified form.

Some of these rules were very singular, and may be here repeated, as giving an idea of the sentiments upon this subject in those old times, rude and barbarous as they were.

Thus the wenches were restricted in their walks, and were to wear upon their shoulder a red knot, by means of which they could readily be known.

The third rule is so singular that it may be given more in full: "Our good Queen Jane doth further order that a brothel shall be located near the convent of the Augustine friars, and that no youth be admitted therein without permission first obtained from the abbess, or governess, who is to keep the keys, and counsel and advise them not to make a noise, or to frighten the wenches, which, if they disobey, they shall be laid under confinement by the beadles."

The fourth rule clearly shows the existence of disease in those times, as it orders that once a week the wenches be examined by the abbess in company with a surgeon appointed by the directors, and those that are diseased separated from the rest, "lest the youths should catch their distempers."

The Stews, in Southwark, London, had laws that date back as far as 1162, in the reign of Henry the 2d; these laws being modified by Edward the 3d in 1345. These Stews were destroyed by Wat Tyler's mob in the time of Richard the 2d. They reappeared, however, and in the reign of Henry the 6th, were some eighteen in number, when they were again suppressed in 1546.¹

As this brief allusion to these old laws shows that the venereal disease existed many years prior to the discovery of America, the history of syphilis may be left to the more minute investigation of those who are interested in it.

¹ The reader will find many other curious historical facts connected with this subject by referring to the Lectures of Lawrence, Cooper, and others among the English surgeons.

SECTION I.

GONORRHŒA.

Gonorrhœa is the name given to an affection of the lining membrane of the urethra of the male, and of the vagina and urethra of the female, which consists in inflammatory action, the effects and characters of which are strictly analogous to those of inflammation as seen in other mucous tissues, and which is to be treated and will be relieved by the same measures as would be applicable to an inflammation of any other mucous membrane.

Gonorrhœa may be defined as a purulent discharge from the urethra of the male, or the vagina of the female, combined with inflammatory symptoms when the result of impure sexual congress. The derivation of the term shows some of the very erroneous notions that were entertained respecting this complaint in early times, as it is derived from two Greek words ($\gammaωνη$), sperm, and ($\rhoεω$), to flow, it being apparently regarded as connected with the secretion of the testicles.

Synonyms.—This affection has various synonyms, such as *blennorrhagia*, and *blennorrhœa*, from $\betaλεννα$ (mucus), and $\rhoεω$ (I flow), which is an equally erroneous term, for the disease does not consist of a flow of mucus, as this term would indicate. The English name for the complaint, *Clap*, is derived from the French word *Clapier*, a name applied to brothels in France, and was intended to designate it as the disease contracted in brothels. The French term *Chaudepisse* is derived from the fact that there is usually more or less sensation of scalding in urinating, or *ardor urinæ*, as it is termed, at the commencement of the disorder. The disease is also spoken of as *a running*, and as *the secret disease*; the latter term being equally applicable to syphilis.

Complications.—Some of the complications of the disease demand especial attention, and have received particular names. Thus, we have *Balanitis* ($\betaαλανος$, glans), which is a term applied to an inflamed condition of the mucous membrane of the head of the penis and prepuce, resulting in a purulent or muco-purulent discharge, this being also sometimes called the *external clap*.

The inflammation of gonorrhœa sometimes affects the prepuce

so that it swells to such a degree as to prevent it from being retracted and exposing the glans, this condition being called *phymosis* (Fig. 229), though the same is also a congenital malformation.

Fig. 229.

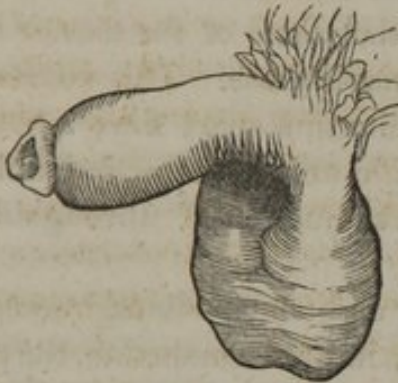


Fig. 230.



Fig. 229.—A side view of the manner in which the Prepuce covers the Penis in either Congenital or Acquired Phymosis. (After Miller.)

Fig. 230.—A view of Paraphymosis, the dark portion being the mucous membrane which lines the prepuce, and which is distended by serous infiltration of the submucous cellular tissue. (After Miller.)

Sometimes the skin is retracted behind the glans, and swelling of the mucous membrane takes place to such a degree as to prevent the prepuce from being brought down over the head of the penis, and then this condition is known as *paraphymosis*. (Fig. 230.)

Pathology.—In order to understand the pathology of gonorrhœa, it should be remembered that the glans penis is covered by a mucous membrane, which, after lining the prepuce, is reflected over the head of the penis, and enters the urethra, where it becomes continuous with the lining membrane of the bladder and of the ureters.

In the urethral mucous membrane are to be found a considerable number of follicles, which, when inflamed, are capable of pouring out a large amount of fluid, whilst they may continue in a state of inflammation even after the surface of the mucous membrane itself has taken on healthy action. These follicles sometimes become enlarged in size, and occasionally allow a small catheter to lodge in them, which, refusing to pass further, may give rise to the erroneous idea of a stricture existing at that point.¹

Etiology.—As the sole origin of gonorrhœa is an impure con-

¹ For an account of the treatment both of Phymosis and Paraphymosis, see the Operative Surgery, vol. ii. pp. 193 and 196, 2d edit.

nection, notwithstanding that many other sources are often charged with it by patients, it is evident that the male becomes infected by the discharge which collects upon the rugæ of the mucous membrane of the vagina in the female—this being wiped off by the penis as it enters in a connection; the tension of the parts distending the aperture of the urethra, so that some of the matter is thus permitted to lodge within the fossa navicularis. This matter, if at all virulent, is quite sufficient to excite in a short time a purulent discharge from the whole of the male urethra; the inflammatory action, unless checked, rapidly extending itself throughout the entire canal.

Symptoms.—In from three to six or eight days—though sometimes only a few hours may elapse—after an impure connection, the patient begins to experience a sense of tickling or tingling at the orifice of the urethra. On examining the parts, the lips of the urethra will now be found to be slightly swelled and inflamed, whilst the attempt to make water will create that peculiar sense of burning and smarting to which the name of *ardor urinæ* has been applied. After a few hours, the part becomes moistened with a slight colorless discharge, which consists of serum mixed with the ordinary secretion of the urethra; but in a very short time this discharge becomes more or less yellow from the admixture of pus. In a few hours more, true yellow pus will be effused, while, as the inflammation becomes higher in grade, there will be seen all the modification of pus seen in other inflammations; thus it may become green, or pinkish, and streaked with blood from a rupture of some of the congested vessels of the lining membrane of the urethra. As the disease progresses, effusions of lymph often take place into the corpus spongiosum directly beneath the urethra, whilst there is a constant afflux of blood to the corpora cavernosa, in consequence of which there are frequent and violent erections of the penis, though the organ does not become completely erect, but bends downwards in consequence of the inflamed mucous membrane of the urethra acting as a string to a bow. To this condition the term *chordee* has been applied—from the Latin word *corda*, a string. Chordee may occur at any period of an attack of gonorrhœa, though it seldom takes place until the inflammatory action has resulted in the secretion of pus, and there has been an opportunity for the thickening of the sub-mucous cellular tissue of the urethra. There is usually considerable pain accompanying chordee, which is due to the extension of

the inflamed mucous membrane, caused by the distension of the corpora cavernosa acting on the corpus spongiosum urethræ.

The progress of the inflammation now shows itself in its attacking the lymphatics of the penis, thus occasioning a sense of inconvenience and fulness, if not of actual pain in the body of the organ, and as the irritation extends from these lymphatics, to the glands of the groin, heaviness and soreness are complained of in this region, as well as a sense of weight in the perineum or in the testicles, though the latter is not generally felt until the end of the second or third week, the enlargement of the testicles, which is the result of the extension of the inflammation along the vas deferens to the epididymis, seldom occurring before the end of the third week.

If the inflammation continues and rises in grade, we may next notice its extension to the deeper-seated parts adjacent to the urethra, where it will be shown in abscesses of the prostate, cystitis, or even nephritis.

Varieties.—There are two forms of gonorrhœa, one of which is the *virulent* or true gonorrhœa, and the other the *benignant* or false gonorrhœa; the secretion of the menses, particularly if mixed with acrid fluor albus, or violent leucorrhœa, sometimes exciting a secretion of pus from the urethra of a delicate man if brought in contact with it in coition. Though the latter inflammation resembles the other, it differs in the violence of its symptoms as well as in its grade, and is therefore also designated as *spurious gonorrhœa*. The same condition has also sometimes resulted from the irritation created by the introduction of a bougie. True gonorrhœa, or the violent form of urethritis, only ensues on intercourse with a person who is at the time laboring under a similar purulent disorder.

Diagnosis.—The best mode of diagnosis between these forms of urethritis is the color of the discharge, which, as true gonorrhœa is a higher grade of inflammation than the spurious, is greenish or pinkish in its tint, whilst that of the spurious form is white or yellowish. The ardor urinæ, chordee, tendency to epididymitis, &c. also give evidence of the presence of a grade of mucous inflammation in the true gonorrhœa, which is seldom or never seen in the spurious disorder, the inflammation in the latter case usually passing off in a few days, and creating little or no ardor urinæ.

Prognosis.—The prognosis in gonorrhœa will depend upon circumstances. If the patient presents himself at the moment at which the swelling of the lips of the urethra and slight ardor urinæ

are first noticed, he can often be cured in from three to five days. If, however, the disease has lasted for some days or weeks before he applies to the surgeon, and the inflammation has thus created considerable change in the tissue of the urethra, it will generally continue from three to five or seven weeks, or even as long as two or three months, particularly if from time to time the patient is guilty of indiscretions in food and drink.

Treatment.—The treatment of gonorrhœa may be divided into three different stages: the prophylactic, the abortive, and the curative.

1. *Prophylactic Treatment.*—The best prophylactic measure is to abstain from exposure to the cause. But when the patient has had a suspicious connection he may do something to prevent the development of gonorrhœa by washing thoroughly with soap and water, and urinating as soon as possible after the intercourse, in order to remove any irritating matter which may have collected in the urethra.

2. *Abortive Treatment.*—Should, however, the disease develop itself, the abortive treatment may be resorted to under certain conditions; thus it is particularly applicable to the state of the parts found at the beginning of the complaint, when the thin serous discharge, or that resembling the white of an unboiled egg, first appears, and before inflammatory symptoms have developed themselves; in other words, during the first twenty-four or thirty-six hours of the disease. The abortive treatment consists in changing the action in the part, and substituting for the existing irritation or inflammation one which may be excited by means of the nitrate of silver applied either in the solid form or the strong solution. If used in its solid form, Lallemand's instrument for cauterizing the urethra may be employed.¹ If the solution seems preferable, ten grains of the salt to the ounce of distilled water should be injected, but it should be thrown in by the surgeon himself with a glass syringe, care being taken not to bruise the orifice of the urethra with the instrument. When this solution is well injected it should be retained in the canal a few minutes by grasping the end of the urethra and penis with the thumb and forefinger, when it may be ejected by the patient making efforts as in urination. Before using this solution, the urethra should however be well washed out either

¹ See Operative Surgery, vol. ii. p. 200, 2d edition.

by the patient urinating or by the surgeon injecting tepid water. The injection of the nitrate of silver, as thus practised, creates considerable pain, and acts by forming a white pellicle over the inflamed surface, which protects it from the irritation of the urine for the next twelve or twenty-four hours, while in the meantime it sets up a new and healthy inflammatory action. The next day the parts will be found slightly swollen, and the discharge perhaps more copious and pinkish than it was previously, or it may even be streaked with blood. An injection of sulphate of zinc, from one to three grains to the ounce of water, should then be ordered, to be used four or five times a day by the patient himself, after special directions, when the cure will generally be effected in from three to five days, the patient abstaining from drinks of all kinds, in order to diminish the amount secreted by the kidneys, though he may take his usual food. The abortive treatment is, however, very seldom applicable to an attack of gonorrhœa, because patients do not apply to a surgeon at a sufficiently early period, but wait until pus is seen in the discharge, when it is too late to employ it advantageously.

3. *Curative Treatment.*—The curative treatment of gonorrhœa is that which is most frequently required, as it is applicable even to the highest inflammatory stage, and is very varied in the means to be employed. The indications to be observed are: 1, to combat and check the unhealthy inflammatory action; and 2, to relieve the weakness which is left in the parts. In carrying out the first indication, and attempting to check inflammatory action, antiphlogistic measures should be employed both locally and generally, especially by taking blood locally. Thus, if the inflammation runs high, we may commence by abstracting blood freely from the perineum by means of leeches, directing the application of enough to take six or eight ounces, whilst immediately afterwards a free purge should be given. After this such articles may be employed as, by impregnating the urine, and being thus brought in contact with the surface of the urethra, will alter its character, as well as act on the inflammation. These articles are to be found in the balsams and terebinthines. That they act by coming directly in contact with the urethra, is proved by the fact that patients with gonorrhœa, who labor also under fistula in perineo, in consequence of which the urine passes out without touching the diseased urethra, are not benefited by these internal remedies, whilst so soon as the fistula

closes sufficiently to enable the urine to again pass through its proper canal, the patient begins to improve.

We may also employ locally the large class of astringents with a view of checking the secretion.

Some of the prescriptions that may be advantageously resorted to in the administration of the terebinthines are as follows, the combinations being such as render them acceptable to the stomach. Many of them are used in Ricord's Hospital, or in some of the military hospitals of France, and have been tested in my own practice.

The following is an old prescription, which I have employed very largely in practice, and which I have given when the discharge was green and ichorous, and the ardor urinæ quite marked, without finding it too stimulating:—

R.—Pulv. cubebæ \bar{z} ss;
Bals. copaibæ \bar{z} ij;
Ferri sulph. exsicc. \bar{z} j;
Terebinth. Venetii \bar{z} iiij.

Divide into boluses of ten grains each, one to be taken three or five times daily. As there is a difficulty in making this formula into pills, Canada balsam may be substituted for the Venice turpentine.

If the patient who is to take balsam, &c., prefers the form of mixture to that of pill, the following may be given:—

R.—Bals. copaibæ,
Pulv. cubebæ, aa \bar{z} j;
Liq. potassæ \bar{z} ij;
Pulv. acaciæ gum \bar{z} ss;
Aquæ rosar. f \bar{z} vj.—M.

S.—A tablespoonful may be taken three times a day.

The following is used by Ricord so frequently that it is called, in Paris, his favorite. It is particularly applicable to the weak and debilitated constitutions which are to be found in his wards, and which are also occasionally met with in our own cities, and especially in those of the tuberculous diathesis.

R.—Pulv. cubebæ \bar{z} vj;
Ferri carb. \bar{z} iiij.
M. et ft. pulv. dein in chart, iij, dividend.
S.—Take one powder three times a day.

The following English formula contains an article not usual in these prescriptions (Potassæ chloras), which, it is thought, exercises a peculiar influence in these complaints. It contains also a quantity of rhubarb, with a view of acting upon the bowels.

R.—Pulv. rhei \bar{z} ss;
 Liq. potas. \bar{z} iss;
 Potassæ chlorat. \bar{z} iij;
 Aq. menth. pip. f \bar{z} vj.—M.

S.—Take a tablespoonful two or three times a day.

In the early treatment of the gonorrhœa of high livers, whose diet, &c., has disordered their digestion, and created furred tongue, with highly acid urine, I have found this a useful combination.

Injections.—Besides these internal remedies, great benefit will be derived from the use of alterative and astringent substances, as injections, as soon as the first violence of the inflammation has subsided. In connection with the use of injections it may be mentioned, that much needless fear sometimes exists in the minds of patients, lest the injecting material should get into the bladder and cause cystitis, but, as a general rule, there is no danger of throwing an injection, into an inflamed urethra, any farther than the accelerator urinæ muscles or the bulb of the urethra, as the contraction of these muscles on the urethra will usually check its further progress. A simple precaution will, however, make such an accident impossible. Thus, if the patient sits down on the edge of the bed or of a chair, and places a roll of bandage, or a folded stocking, just behind the scrotum, in such a manner that his weight will make it press firmly upon his perineum, the urethra will be firmly closed. But when it is remembered that all attempts at injecting the bladder, except a catheter is first introduced, are usually very imperfect, it will be perceived that, under ordinary circumstances, cystitis is not likely to supervene on the use of an injection, and that when it supervenes it is rather due to the extension of the original urethritis.

As the chordee not only creates pain, but also produces a curvature of the penis, it not unfrequently—if the patient has had gonorrhœa for some time, or has had several attacks of it—leaves an effusion of lymph in the cells of the corpora cavernosa, which will subsequently prevent their proper distension.

In the treatment of chordee it will often be advisable to caution the patient, particularly if he be of an irritable disposition, against

attempts at *breaking the erection* by bending the penis violently, as these efforts may do serious harm, and can certainly never give any relief. As the chordee is due to an irritation of the urethra, the proper means for its relief are such as are suitable to the relief of irritation elsewhere. A very simple plan of treatment consists in directing the patient, as soon as he feels the erection, to spring out of bed and stand with his feet on a cold hearth; or to dip the penis and perineum into cold water by stooping over a basin; or to put his feet in the same, though the chordee will be very apt to recur as soon as he gets warm again in bed.

The patient should also be directed to sleep with very light bed covering, and to take a cold hip-bath at night, whilst two grains of camphor and one grain of opium may be given in a pill at bedtime, the camphor being useful by acting directly upon the urine, as well as affecting the cerebellum as a sedative. As there are, however, many persons who are unable, or who imagine they are unable to swallow a pill, the same effects may be obtained by directing them to drop upon a lump of sugar forty drops of laudanum, and twenty drops of the tincture of camphor. If the opium is for any reason contraindicated, extract of hyoscyamus, conium, or lupulin may be substituted for it.

In the treatment of gonorrhœa, it will be found that the anxiety with which the patient looks forward to his restoration to health, often arises not so much from the trouble of the running or the pain of chordee, as it does from the fact that the stains made upon his linen by the discharge are likely to lead to the discovery of the origin of his complaint. Even in those cases in which this is a matter of indifference, the soiling of the linen is unpleasant, and may readily be avoided by directing him to wear a proper sheath for the organ during the continuance of the disease. Such a sheath may be made—like a large finger-stall—of linen lined with oiled silk, or still better, of India-rubber cloth, which being attached to two tapes, and made to pass round his hips, may readily be drawn over the penis, so as to cover it entirely, and yet be slipped off for the purpose of urinating.

When warmth and moisture are required to be applied to the penis, a very convenient and cleanly mode of accomplishing it is by means of a sheath made of spongio-piline and moistened with hot water before it is drawn over the penis.

During the whole course of the treatment of gonorrhœa, the pa-

tient should also be directed to wear a suspensory bandage, in order to guard against congestion of the scrotum and epididymitis or swelled testicle.

There are various forms of astringent and alterative injections that prove useful in the treatment of gonorrhœa; thus, after the action of the parts has been changed in the abortive plan of treatment, we may not only use the sulphate of zinc as already recommended, but acetate of lead may be substituted for it, or the two may be used together in the proportion of one grain of each to the ounce of water. In fact, any of the mineral astringents may be employed in the proportion of one or two grains to the ounce of water, except the sulphate of copper, which should never be used stronger, at first, than half a grain to the ounce.

There are some combinations of these articles which are very useful in cases that have lasted some time before being seen, or in those in which the abortive treatment has not been employed, as will be presently stated.

The idea which was formerly prevalent, that it is necessary to wait till the inflammatory stage of the disease has entirely passed away before resorting to the use of stimulating injections, has, however, been exploded by numerous observations, and my own plan of treatment is to employ injections in all cases where the ardor urinæ is not very marked.

It sometimes happens, however, that a patient will suffer extreme pain from their use, or that he cannot immediately bear the repetition of them, particularly after the abortive injection of the nitrate of silver has been employed: and under these circumstances much comfort will be obtained from first resorting to the following injection:—

R.—Muc. sem. lini Oj ;
Pulvis opii grs. x.—M.

S.—Inject as often as may be necessary.

Another injection which is exceedingly useful in those cases which suffer from chordee, contains camphor, and is as follows:—

R.—Pulv. camphoræ ʒss ;
Vitellum ovi j ;
Aquæ fontan. Oj.—M.

S.—Inject frequently.

Should this not relieve the ardor urinæ and chordee, the following may be substituted:—

R.—Pulv. opii grs. xij;
 Aq. font. fʒix;
 Liq. plumb. subacet. gtt. ix.
 Misce.

This should be well shaken before being injected, and is an excellent sedative and slightly astringent injection.

Should the disease, from want of proper treatment, have continued for some length of time, certain sequelæ will be likely to appear and require attention. Thus the inflammation may travel down to the bulb of the urethra, and thence to the caput gallinaginis and along the vas deferens, to the epididymis, so as to create epididymitis. Or, travelling still further, it may produce inflammation and abscess of the prostate, or even invade the mucous coat of the bladder and create cystitis.

§ 1.—EPIDIDYMITIS.

Synonyms.—Epididymitis has several synonyms: thus it was called by the old surgeons *hernia humoralis* and *orchitis*; whilst, by the people, it is known as *swelled testicle*. The term epididymitis, which is strictly correct, although the inflammation may extend from the epididymis to the testicle itself, indicates the true condition of these parts when consequent on an attack of gonorrhœa.

Etiology.—Epididymitis may result from other causes as well as from gonorrhœa, though the latter is its most common source. When consequent upon gonorrhœa it generally shows itself as follows:—

Symptoms.—About the third, fourth or fifth week the patient notices a cessation or diminution of the discharge from the urethra, and at the same time begins to perceive a slight sensation of weight in the groin, when on pressing upon the cord it will be found to be slightly swelled and painful, thus showing the extension of the inflammation along the vas deferens. These feelings of uneasiness are then propagated along the back of the cord towards the testis, and, producing heaviness in the scrotum, are soon followed by swelling of the epididymis, the globus major and minor beginning to enlarge, and continuing until they are sufficiently enlarged to

cover the whole testicle. As the inflammation goes on it may extend to the tunica vaginalis testis, and produce true hydrocele, or to the scrotum, and produce cedema or inflammatory congestion; or, as already remarked, it may involve the tunica albuginea and the proper structure of the testis itself, though this is very rare. These symptoms, if sufficiently violent to create constitutional disturbance, will also give rise to the ordinary symptoms of irritative or inflammatory fever. As the discharge from the urethra generally diminishes before the swelling in the testicle is noticed—owing to the metastasis of the inflammatory action—the idea was formerly held, and is still believed in by the vulgar, that the discharge causes the swelling; and hence we often hear the expression that “the clap has fallen into the testicles.”

Diagnosis.—In regard to the diagnosis of epididymitis there is generally but little difficulty in arriving at a correct conclusion, the history of the case and the accompanying symptoms generally referring the disorder to its true source. Should, however, the patient be disposed to deny the origin of the complaint, a very few days, by bringing back the discharge, will add considerably to the facility of diagnosis.

Prognosis.—The prognosis of epididymitis is favorable, and under ordinary circumstances a cure may be expected in about nine days; this being a marked improvement upon the old plan of treatment, which seldom cured under three weeks.

Treatment.—The treatment of epididymitis is based upon the general principles of the treatment of inflammation elsewhere; thus leeches should be at once applied to the cord or to the perineum, but *not to the scrotum*, where their irritation would only increase the existing inflammation. For the first three days the patient should also be kept in the recumbent position, with the testicle well supported by a handkerchief suspensory (see Fig. 49, page 205), in order to prevent it from drawing upon the cord. At the same time warm cloths should be applied, and covered with oiled silk, as in the warm-water dressing; or, if it is more agreeable to the feelings of the patient, the cold-water dressing may be used. After twenty-four or forty-eight hours, or when the first violence of the inflammatory action has passed, means may be resorted to in order to relieve the parts of the effusions which ensue on the inflammatory action, and this may be accomplished by continuous and firm pressure of the affected testis, a plan first suggested by the late Dr.

Hartshorne, of Philadelphia, who applied it by means of a narrow bandage as early as the year 1800.

About the year 1835, Frick, of Hamburg, recommended that the pressure should be made in these cases by means of strips of adhesive plaster, and suggested a firm and easily contrived dressing, which may be applied as follows: Shave the scrotum entirely free from hair, and force the testicle gently down to the bottom of it, where it should be held by surrounding the cord just above the testicle with the thumb and forefinger of the patient or an assistant. A strip of adhesive plaster about three-fourths of an inch wide being now warmed, should then be made to surround the cord, just below the thumb and finger, and when thus applied, will hold the testicle firmly to the bottom of the scrotum, and prevent it from slipping away from the compression to which it is subsequently to be subjected. After thus steadying the testicle, begin in the centre of the oval tumor thus formed, and surround it with circular strips so tightly drawn that the patient will complain a little of the pain, and continue applying other circular strips from below upwards till the lower half of the tumor is covered, each strip being made to lap one-third of that which preceded it; after which cover in the remaining half in the same manner, whilst the small part at the bottom of the tumor, necessarily left uncovered by the circular strips, may be covered, and greater security given to the dressing by applying a few vertical pieces of the plaster. These strips, if properly applied, should cause sufficient compression to create some pain at the moment of their application, but this usually passes off in an hour, and in the course of six, eight, or ten hours the dressing will be found quite loose, and no longer painful, but, on the contrary, firm and comfortable. In forty-eight hours, as the swelling will have rapidly diminished, the strips should be tightened by applying over the whole dressing a few more broad and circular pieces of the plaster; in three or four days more the strips may be removed, when the testicle will be found to be reduced very nearly to its former condition, except the thickening in the globus major, which will be no longer painful. Under this treatment it is astonishing how rapidly the swelling disappears, whilst the patient is often able to move about to a moderate extent within twenty-four hours after the application of the strips.

Sometimes, however, owing to neglect of this treatment, there remains a certain amount of enlargement in the globus major, from

the effusion and organization of the lymph, which will leave an induration that will last some months. Sometimes, also, the testicle itself will continue slightly indurated, constituting one form of sarcocele, or, as it has been designated, chronic orchitis. In such a condition the treatment pointed out for the treatment of chronic inflammation, and induration of other structures, will be useful, as stimulating the action of the absorbents by local irritants, whilst such articles are given internally as will favor the liquefaction of the lymph. Locally, the use of iodine will be found highly beneficial, iodine ointment being rubbed upon the scrotum, after which the part may be covered with a piece of soap plaster, and the whole sustained by the use of a suspensory bandage; or frictions of mild mercurial ointment may be resorted to, care, however, being taken to carry none of these applications to such an extent as to inflame the skin, as this would only add to the existing inflammation, instead of diminishing it.

At the same time the administration of gentle doses of blue mass or calomel, given with the view of diminishing the plasticity of the lymph, will often expedite the cure. The gums should, therefore, be touched very slightly, as may be safely done by the administration of the protiodide of mercury in the dose of half a grain three times a day. Any other mercurial preparation may likewise be given in the same way; but it should be remembered that anything like profuse salivation, under these circumstances, is positively injurious to the patient, the object of the mercurial being merely to affect the lymph, and not to act as a revulsive.

Sometimes, from improper treatment or neglect in the first instance, the inflammatory action will result in a true abscess of the testicle, which will subsequently open and discharge itself, or which the surgeon may open. But if he notices in the orifice thus made for the escape of the pus, a white thready matter, which looks like a slough, it should be remembered that this is very often a portion of the rete testis, which, if pulled upon will come away in long shreds, and, thus destroying the structure of the organ, leave the patient completely emasculated, so far as that testicle is concerned. The general rule may, therefore, be laid down, that in any abscess about the testicle, all suspicious looking shreds of matter should be left untouched until fully thrown off by nature.

The hydrocele resulting from epididymitis, as already mentioned, demands precisely the same treatment as hydrocele resulting from any other cause.

§ 2.—GLEET.

From improper treatment, or as a result of indiscretions on the part of the patient whilst laboring under an attack of gonorrhœa, it often happens that the disease is imperfectly cured, and the inflammatory action not subdued, in consequence of which a slight discharge remains, which shows itself in the shape of a drop at the mouth of the urethra when the patient rises in the morning, or is seen occasionally through the day. This condition has been designated as *gleet*, and occasionally as *pin-head gleet*, in order to indicate the size of the drop matter found at the orifice of the urethra. Occasionally this slight discharge is due to the inflammation continuing to linger in the lacunæ of the urethra; or it may be due to the formation of a stricture. Under any circumstances, however, it may be taken for granted that there will be no discharge of pus from the urethra, without there being some inflamed or ulcerated surface from which it can proceed.

Under these circumstances a bougie should be introduced for the purpose of ascertaining whether any stricture exists, and, as the introduction of the bougie causes a slight stimulation of the membrane, it will very often suffice for the relief of the complaint. Should a stricture be detected, it is to be treated in the manner that will be detailed under the head of Stricture. If, however, the examination shows that there is no stricture, some stimulating injection, as that of the nitrate of silver, should be used with the view of modifying the chronically inflamed condition of the parts, and substituting for it an acute but more tractable inflammation, which will readily yield to treatment. In other words, gleet is to be treated on precisely the same general principles as an indolent ulcer. Several formulæ for such injections may be given for the sake of illustration:—

R.—Vin. oport. f℥iv;
 Acid. tannic. ℥j.—M.
 S.—Inject three times daily.

Another good injection in cases dependent upon simple debility, is the following:—

R.—Decoct. cinchonæ f℥viiij;
 Liq. plumb. subacet. f℥j.—M.
 S.—Inject three times daily.

Another injection which is particularly useful when a spot that is tender upon pressure can be found by carrying the finger along the course of the urethra, is as follows:—

R.—Hyd. chlor. mit. ℥ss;
Muc. gum acaciæ f℥xij.—M.
S.—Inject twice daily.

The following is particularly applicable to patients who are debilitated or of a scrofulous habit:—

R.—Tr. iodini gtt. xxx;
Muc. gum acac. f℥ij;
Aq. font. f℥vi.—M.
S.—Inject twice daily.

The following is useful in the case of old stagers:—

R.—Vin. aromat. f℥xiiij;—(of the French Codex. For formula, see page 118.)
Acid. tannic. ℥ij;
Ext. opii aquos. ℥ss.—M.
S.—Inject three times a day.

Where many attacks of gonorrhœa have been experienced, the following may be borne by patients whose urethræ have become indurated:—

R.—Zinci chloridi grs. viij;
Aq. font. f℥viij.—M.
S.—Inject once daily.

§ 3.—PROSTATITIS.

Another sequela of long-continued gonorrhœa is inflammation of the prostate, or *prostatitis*.

Symptoms.—A sense of weight is experienced in the perineum, and, on passing the finger into the rectum, an enlargement of the prostate can be distinctly felt. Prostatitis generally involves the two lateral lobes of the gland, and, when abscesses form, they are usually found in this situation; but the third lobe also not unfrequently enlarges, and that to such an extent as to obstruct the flow of urine. The period of the formation of pus is generally marked by distinct evidences of constitutional disturbance, as a chill, high fever, &c.

Treatment.—The treatment of prostatitis consists in applying leeches to the perineum; in the use of the warm hip-bath, and in

the gentle employment of laxatives to keep the bowels in a soluble condition; but purgatives, particularly aloetic purges, should be avoided, as they are only likely to add to the local irritation. If abscesses form they must be left to nature, as they seldom point in the perineum, owing to the relations of the deep perineal fascia; hence they are apt either to open into the urethra, or to form rectal, perineal or urethral fistula.

Should the enlargement of the third lobe of the prostate prevent the free evacuation of the urine, the use of a catheter will be demanded, as will be shown under the head of the retention of urine.

§ 4.—CYSTITIS AND IRRITABLE BLADDER.

Another of the sequelæ of gonorrhœa is irritable bladder, or sometimes the development of true inflammation of the vesical mucous membrane.

Symptoms.—At a period varying from three to six weeks from the commencement of the attack, a patient with gonorrhœa will sometimes notice a cessation of the discharge, and at the same time become conscious of some irritation about the neck of the bladder, as indicated by a constant desire to urinate. There is also present that peculiar sensation in the head of the penis which is complained of in cases of stone; this being due to precisely the same cause, to wit, irritation of the nerves at the neck of the bladder, producing an impression which is referred to the peripheral extremity of the nerve, rather than to its origin. The disease progressing, the patient experiences also uneasiness in the rectum, as is indicated by more or less tenesmus, which is very much like that seen in an ordinary case of dysentery. If the urine be examined under these circumstances it will be found to be variously affected. If the irritation is limited to the mucous coat of the bladder, there will be increased discharge from the mucous follicles, and the disorder of the urine will consist principally in the presence of a certain amount of muco-purulent or purulent matter, which will settle at the bottom of the chamber-pot, and which in marked cases, when the urine is decanted off, will be left behind in the shape of a tenacious jelly-like matter. Besides which, even in cases in which there is no apparent disorder of the kidneys, we are very likely to find in the

urine, when it has stood for some time, white phosphatic deposits, the amount of which will depend upon the extent to which the irritation has gone, as well as on the constitution of the patient. These phosphatic deposits are not merely concomitants of vesical irritation, but are also found in cases of irritation of the digestive apparatus, as after a too free indulgence in stimulating articles of diet, in wine, &c. They are found also after too great mental exertion of any kind.

The character of these deposits may be tested in various ways, as by the specific gravity of the urine or the application of heat, or its reaction with nitric acid, &c. &c.

Treatment.—The treatment of irritable bladder, or of cystitis, should it run so high as to deserve that name, will, of course, vary according to the grade of the affection. Thus, should the inflammation be acute, severe antiphlogistic measures will be required, as the symptoms may be such as will demand free general blood-letting, or, perhaps, free local bleeding, such as may be obtained by leeches to the supra pubic region, or to the cord or perineum, or to all these points at once. After these preliminary measures, depletion may be carried still further by means of antimonials. But purgatives of a brisk character, particularly such as have a tendency to act specially on the rectum, as aloes, &c., are contra-indicated.

Should, however, the disease have assumed a more chronic character, and present a lower grade of inflammatory action, such measures will be required as are likely to modify the neuralgic condition of the bladder. And this will be best accomplished by means of local applications; thus, cold water may be injected by means of a catheter into the bladder itself, or an alterative solution may be used containing one, two, three, or four grs. of the nitrate of silver to f̄j of water, beginning with the weakest solution, and increasing its strength if the exigencies of the case seem to demand it, and the injection causes no pain. If there is much pain in the region of the bladder, or should the patient suffer much after his alterative injection, we may substitute the liq. morph. sulph. diluted with about one-half of water.

Should either the disease itself, or the injections used produce tenesmus, as is not unfrequently the case, it should be treated precisely like the tenesmus arising in a case of dysentery, by injecting into the rectum sixty drops, or, if that does not suffice, a teaspoonful

of laudanum mixed with about a tablespoonful of a thin solution of starch, the patient retaining the enema by means of pressure with warm cloths against the anus. Moderate purgatives will, however, be required from time to time, in order to keep the rectum empty, lest the weight and pressure of hardened feces should aid in keeping up the irritation. Saline cathartics, such as Rochelle salts or the citrate of magnesia, are particularly applicable, but drastic or aloetic purges should be avoided for the reasons already stated.

The urine should also be tested from time to time and measures taken to make it as unirritating in its properties as possible; thus, if it is observed to be acid in its reaction, advantage may be expected from a moderate course of alkalies, &c.

Diuretics, as a general rule, should, however, be avoided throughout the complaint, and under this head may be included the free use of drinks of any kind, as anything that increases the quantity of the urine only adds to the vesical irritation.

With regard to the manipulation necessary in injecting the bladder, little need be said except to state that the use of the catheter is always advisable and generally absolutely necessary; it being most frequently impossible to inject a bladder except by its means. When the catheter has been passed into the bladder, a syringe should be adjusted to it and the injection carefully and slowly thrown in. The syringe for this purpose should be provided with two rings upon its cap, as well as one upon the piston rod, in order that it may be used with one hand while the other is employed in keeping the catheter in position. Sometimes the catheter employed for this purpose is a double one, so that the injection thrown in by one tube flows out by the other, which should be provided with a stopcock, that the injection may be retained for a short time if it be deemed necessary; but should it be inconvenient or impossible to obtain this instrument, a single catheter, with or without a stopcock, may be employed, and answers a very good purpose. With regard to the form of the catheter itself, it may here be stated that the usual manner of making a number of perforations in the vesical extremity of a catheter in order to favor the escape of the urine is always objectionable, and particularly in these cases. In the first place, the numerous little orifices are liable to be blocked up with mucus, and thus prevent the flow of urine; and in the second, if the instrument is to be retained in the bladder for any length of time, particularly if the urine is acid, these various points are liable to

oxidize, and thus becoming weakened, the point of the instrument may subsequently be broken off in the bladder. A much safer and more convenient form is that in which there is a large, round, or oval eye on each side of the instrument, as this eye can be polished to any degree of smoothness, whilst the instrument is firmer, and the orifice not so likely to be blocked up.

When chronic cystitis shows itself in the muco-purulent or purulent discharge, which has been described as vesical catarrh, advantage may be derived from the employment of stimulating diuretics—such as balsam copaibæ, cubebs, fluid extract of buchu and soda, &c. &c. An injection of the dilute nitric acid has also been recommended, and sometimes proved peculiarly successful. It may be used of a strength varying from two to three or four drops to the ounce of water, according to the irritability of the patient, but should not be strong enough to produce marked vesical tenesmus.

§ 5.—WARTS.

Another complaint, sometimes seen after gonorrhœa, is one in which certain growths are observed upon the prepuce or glans penis, which are designated as *Warts*, and sometimes as *Veneræal Warts*. They are generally the result of some external irritation, such as that produced by a balanitis, want of cleanliness, &c., and form around the corona glandis, or on the reflected prepuce, or on the head of the penis, and are, apparently, due to obstruction in the ducts of the follicles and to the distension and hypertrophy resulting from this. They are however generally very amenable to treatment, and, if small, may be destroyed by touching them from time to time with the nitrate of silver or sulphate of copper. If large, they may be snipped off with a pair of scissors, and the raw surface thus left freely cauterized with the lunar caustic.

Fig. 231.



SECTION II.

GONORRHOEA IN THE FEMALE.

Symptoms.—Gonorrhœa in the female is a discharge which is caused by active inflammation of the vaginal mucous membrane, and is not at first accompanied by that ardor urinæ which distinguishes the commencement of the disease in the male; the first symptoms noticed being usually an irritation about the vulva followed by an increase of the natural mucous secretions of the part. As the disease progresses this discharge becomes purulent in its character, then ichorous, and very irritating, so that as it runs down over the posterior commissure and fourchette it produces more or less excoriation, and gives rise to violent burning, with inflammatory swelling of the vulva. As the surface involved is very extensive, the discharge is generally quite profuse, requiring often the use of a napkin to preserve a tolerable amount of cleanliness, and to prevent the excoriation which is so apt to result from the acrid character of the pus. As the disease continues the urethra becomes involved, and then there is more or less ardor urinæ, as was the case with the male. On examining the parts carefully with a speculum, violent inflammation will now be seen in the labia minora and vagina, and sometimes excoriation and abrasion of the mucous membrane covering the os uteri, the whole vaginal canal being swollen and tender, so much so that the introduction of the speculum is sometimes intolerable from the pain.

Diagnosis.—As regards the diagnosis, it is often a matter of great moment, so far as the feelings of the patient are concerned, yet it is a matter of very great difficulty in some instances. Leucorrhœa, which is a very common complaint, may, particularly in a bad constitution, or where there is want of cleanliness, simulate gonorrhœa so closely as to render it difficult, if not impossible to distinguish them, the discharge being first mucous, then thick and purulent, and becoming finally yellowish or greenish. As a general rule, however, the irritation produced by leucorrhœa is much less marked than that created by gonorrhœa, and if the patient has ardor urinæ, a profuse greenish or yellowish-green discharge, more or less swelling of the labia, particularly the labia majora, with sympathetic enlargement of the glands of the groin, it will

be quite right to look upon the disease as gonorrhœa, particularly if the patient is likely to have been exposed to the cause which alone can produce it. The uncertainty of diagnosis, however, should make the surgeon very careful in expressing an opinion, particularly where medico-legal questions are involved, or where the expression of the opinion would produce domestic unhappiness and distress, and it is often best not to criticize the symptoms rigidly, as the mental suffering in these cases is often much more severe than the bodily, a lady not unfrequently bearing uncomplainingly the bodily discomforts of the disease whilst believing that she has no virulent disorder, who would suffer exceedingly at the idea of contamination on the part of her husband.

Treatment.—The cure of gonorrhœa in the female is generally much more readily accomplished than in the male. There is, it is true, a much larger extent of surface, and one more difficult to apply remedies to, than that of the male. As the urine also does not pass over much of the diseased surface, there is but little benefit to be derived from the use of those alterative diuretics which were recommended in the case of the male. The chief reliance, therefore, is to be placed in vaginal injections, and these, if judiciously administered, will rarely fail to accomplish a cure.

When called to a case supposed to be gonorrhœa in a female, the first thing to be done is to examine the parts, and, if possible, by means of a speculum, as we can thus ascertain the extent of the trouble and learn how far the mucous lining of the vagina is involved in the disorder. The speculum used in these cases may be a simple bivalve, trivalve, or quadrivalve, though a much better instrument is the fenestrated speculum recently made in Paris, but now for sale by most of our cutlers, by means of which the whole vaginal mucous membrane can be very thoroughly exposed, as it can be readily introduced without causing pain. Being satisfied of the condition of the vagina, some astringent injection may be ordered proportioned in strength to the grade of the disease. As a general rule, however, much stronger injections are advisable in the female than could be employed for a similar condition in the male. In the use of an injection, special directions should be given that the parts be first thoroughly cleansed by means of an injection of soap and water, when a strong infusion of white-oak bark, or a strong solution of alum, of sulphate of zinc, or some similar substance may be thrown into the vagina whilst

the female is reclining in a horizontal posture, with the hips raised by a pillow placed beneath the pelvis. The injection may be thoroughly introduced and held in the vagina by means of *Chase's syringe*, as this will permit the patient to retain it for some little time by pressing the shield against the vulva; or she may use the self-injecting apparatus, or clyso-pompe of the cutlers, or some similar means. The ordinary glass syringe, with little holes in the side, is of no use, being too small, and not bringing the injecting material in contact with the whole of the canal.

A very excellent plan of treatment is that suggested by Ricord. This consists in distending the vagina by means of charpie which has been soaked in some astringent or alterative solution, such as the sulphate of zinc, acetate of lead, nitrate of silver, etc. The vagina may be packed full of the lint thus prepared by means of the fenestrated speculum, and the solution be thus kept in contact with every portion of the walls of the canal for some time, so that its full effect can be obtained, the charpie being retained, if necessary, by means of a T bandage or napkin applied against the perineum. After forty-eight hours this packing may be removed, and a second or even a third or fourth application may be necessary; but usually the disease is said to be cured by this plan in a very short time.

The surgeon will sometimes be called upon to express an opinion in cases of what is supposed to be gonorrhœa in young females under ten years of age, on whom it will be asserted, or feared, perhaps, by the mother of the patient, that a rape has been attempted by a person laboring under gonorrhœa. Now it is important, under these circumstances, that the young surgeon should be acquainted with the fact that female children are not unfrequently attacked by a mere leucorrhœal discharge, which, in the irritable or uncleanly, may simulate ordinary gonorrhœa, worms, irritation in the rectum, scrofulous disease, want of cleanliness, and many other causes, giving rise to such a complaint; and there are many instances on record, in which men have been tried, and convicted, —most unjustly—of attempts to commit rape where there is no doubt that the discharge arose from perfectly natural causes. It should be remembered, therefore, in the investigation of such a case of supposed rape, that anything like an attempt at coition, fairly made upon a child of less than ten years of age, would produce

such an amount of bruising and laceration of the vulva as would be readily recognizable, and that in the great majority of cases of this sort there is not the slightest ground for the charge.

§ 1.—CONSTITUTIONAL RESULTS OF GONORRHOEA.

Rheumatism has been spoken of by some as being among the sequelæ of gonorrhœa; but this is an error, as there is nothing even in virulent urethritis in any way liable to affect the fibrous tissues. Rheumatism may coexist with gonorrhœa, or it may follow after it in those predisposed to such attacks, but there is no reason to believe that it is in any way connected with gonorrhœa, this disorder being a local and not a constitutional affection.

In the same manner, it has been said that a papular eruption sometimes follows gonorrhœa, and such is undoubtedly sometimes seen, a well-marked papular eruption sometimes ensuing in these cases, not, however, as the result of a constitutional contamination from the gonorrhœa, but as the consequence of the measures taken to relieve the discharge, it being entirely due to the too free use of the balsam of copaiba, which, by disordering the digestion, reacts on the skin. It is, therefore, a very simple matter, and may readily be checked by stopping the use of the balsam, and purging the patient thoroughly.

SECTION III.

STRICTURE OF THE URETHRA.

Another complaint, frequently a result of gonorrhœa, but very often arising from other causes, is an inconvenience resulting from the inflammation acting upon the submucous cellular tissue, and producing effusions of lymph. This lymph may simply involve the submucous cellular tissue, or may go further, and affect the corpus spongiosum, or the corpora cavernosa, creating an obstruction that is designated as a *stricture*. By the term stricture is usually meant an obstruction of any of the canals in the body, which is either the result of inflammatory action, or created by spasm of the muscles,

the latter creating such a contraction of the canal as will temporarily obliterate it.

Etiology.—The same causes acting upon any of the mucous canals of the body will result in stricture, precisely similar to that often seen in the urethra as the result of gonorrhœal inflammation; thus the œsophagus, for example, or the rectum, when inflamed, may become the seat of stricture.

Varieties.—Stricture of the urethra, for the purposes of methodical study, may be divided into three kinds.

1. *Spasmodic* stricture, or that resulting from mere spasmodic contraction of the muscles of the penis or of the perineum.

2. *Acute inflammatory* stricture.

3. *Chronic or permanent* stricture, or that due to effusion of various kinds into the adjacent parts.

Permanent stricture has also been subdivided into several forms, according to its extent. Thus, if the obstruction is extremely narrow, it is called a *thread-like* stricture; if a little wider, it is designated as a *ribbon-like* stricture; whilst the term *cartilaginous* stricture is sometimes employed to indicate the density of the obstruction.

General Prognosis.—Stricture of the urethra is usually a tedious complaint, and is not often seen until long after the exciting cause, if it be a gonorrhœa, has passed away. It therefore not unfrequently shows itself in men, many years after they have had gonorrhœa, because the morbid action in the urethra progresses so slowly that it is a long time after its commencement before it begins to attract attention.

Etiology of Stricture.—1. *Of spasmodic stricture.* When an individual has been living rather freely, indulging too much in eating and drinking, or has been to a ball, and partaken plentifully of stimulating articles of food or drink, and then walked home through the snow, or has been on a sleighing party, or on a frolic; in either case, on his return home, or before he enters a house, he will often have a desire to urinate, and find it impossible to void his bladder. The same condition is also found in certain fevers, and in accidents requiring the supine position, as fractures of the leg, &c., the patient frequently finding it difficult or impossible to void his urine for the first few days that he is confined on his back.

2. *An inflammatory stricture* is usually the result of irritation or inflammation in the urethra itself, which, by effusion, diminishes

the caliber of the canal. It is frequently combined with paralysis of the muscles of the vesical triangle, a striking example of which is often seen in gonorrhœa; where, when the patient urinates and suffers intensely from ardor urinæ, he is induced to hold his urine as long as possible, until when he again attempts to pass it, he finds he has lost the power of doing so.

3. *Permanent stricture* may be the result of repeated attacks of the spasmodic stricture, in consequence of the muscular fibres compressing the urethra, as is especially the case near the bulb; or it may ensue upon the inflammatory stricture, or on gonorrhœa, or blows, or ulceration, &c., which by creating an effusion of lymph in the submucous cellular tissue, diminishes the capacity of the canal to the extent of the deposit. This lymph, as originally effused as the product of inflammatory action, may subsequently become organized, and passing through the various grades of induration, sometimes creates a substance as dense as cartilage, which cuts like it, this stricture being hence often spoken of as the *cartilaginous stricture*.

As the permanent stricture is the most serious of these varieties, the symptoms, &c., of all strictures may be best studied under this head.

§ 1.—PERMANENT STRICTURE.

Symptoms.—The symptoms of permanent stricture are as follows: The first thing that calls the patient's attention to the parts, is the experience of some slight irregularity in the stream, or difficulty in urinating, or he may feel a certain amount of irritation at some one point which excites his attention; after which he will notice the presence of a slight muco-purulent discharge, which resembles that of pin-head gleet, and is often the origin of the latter disorder. As this discharge comes in contact with his linen it will make a stain, which is thick and somewhat like the spot caused by a little melted tallow. The urine itself, in certain conditions, is also capable of staining the linen, but this stain is a simple discoloration, while the stain produced by gonorrheal matter, by gleet, by the discharge from stricture, and other purulent discharges not only produces a discoloration, but communicates to the linen a certain amount of stiffness. After this the desire for urination becomes more frequent, and is shown by the patient urinating once, twice, or thrice, nightly,

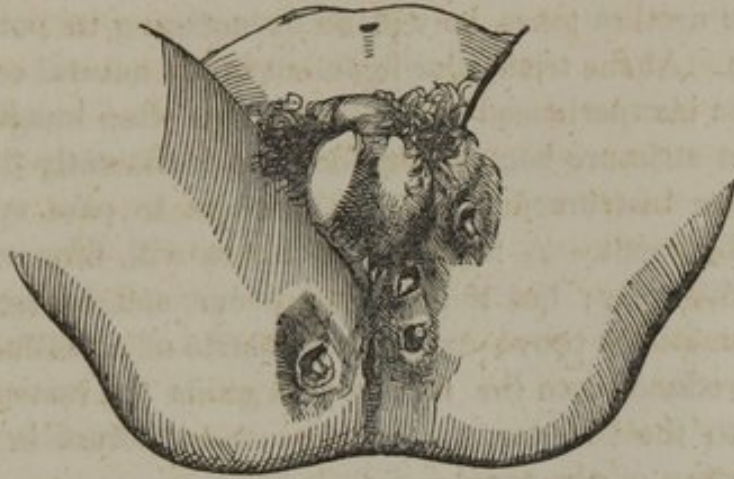
oftener than usual, and even more so during the day, whilst the evacuation of the bladder is not complete, being often unsatisfactory and creating more or less disposition to strain. The stream of urine is also irregular, being diminished in thickness, so that it may become as fine as a thin wire, whilst it not unfrequently takes a spiral direction, or becomes twisted and spatters as it escapes from the urethra. Owing to the varying caliber of the urethra at different points, and other irregularities in its size, the natural stream, it should be remembered, is itself always more or less spiral; but in stricture it is positively irregular and often forked, the spiral twist being a short one, and the coils separate, like those in a corkscrew.

After urinating the patient also often finds that he has not entirely emptied his urethra, but that a few drops more dribble away, soiling his shirt, or even soaking through and discoloring his clothes if their color is such that the urine can act upon the dye. An hour or two after this he again finds he desires to urinate, and in this effort is again only partially successful. In this manner the patient may work along for some time, experiencing more or less discomfort, but no actual suffering until on some occasion when he has been on a party, or become slightly intoxicated, or used for some time high seasoned stimulating food, or been exposed to cold and moisture, he suddenly finds that he cannot pass his water, or can only do so with great effort, and in small quantities at a time. This difficulty may, after a time, be partially relieved, but usually continues to some extent, the urine accumulating behind the stricture and producing dilatation which may even result in rupture of the urethra, when, as the urine is bound down by the perineal fascia it will burrow forward and escape into the scrotum, resulting in abscess, sloughing, mortification, and the establishment of fistulous orifices in the perineum (Fig. 232); or the entire scrotum may become enormously distended and slough so as to leave the testicle quite exposed. If the dilatation does not go so far as to result in rupture of the canal, it may yet create very serious consequences, as abscess of the prostate, &c., or the irritation may travel along the vas deferens to the epididymis, and epididymitis or swelled testicle result, or create numerous ulcerated openings behind the scrotum and before the anus, as before alluded to.

Seat of Stricture.—The seat of stricture varies very considerably, though it is generally found at those points at which the canal is bent or pressed upon by any cause. Thus, it is sometimes met

with at the point at which the canal first narrows, just behind the fossa navicularis, next at the point where the penis is bent when

Fig. 232.



A front view of the numerous Orifices sometimes present in Fistula in Perineo.
(After Liston.)

hanging in its natural undistended condition, or when attacked by chordee, or at the bulb where the canal is compressed by the contraction of the accelerator urinæ muscle, or at the membranous portion of the urethra, where it is exposed to pressure from the perineal muscles, from hardened fæces, &c. Stricture is, moreover, found at times in the true prostatic portion of the urethra, but this is due rather to a change in the prostate gland, than to any derangement connected immediately with the lining of the canal itself.

Diagnosis.—In regard to the diagnosis of stricture of the urethra, great caution will be required. The patient may have the pain, the frequent desire to make water, the dribbling of urine, etc. etc., and yet his canal be in a perfectly normal condition. Thus, many of the symptoms described may result from the presence of stone in the bladder, or the peculiar corkscrew-like stream of urine may be simulated by the compression of the urethra caused by the muscles when the penis is in a state of semi-erection, &c., so that the surgeon might readily be deceived were he to judge simply from the rational symptoms of the complaint as detailed by the patient, whilst if not careful in the introduction of the catheter or bougie, he may also be deceived even with the use of a bougie. Under ordinary circumstances, however, nothing is more certain as a means of diagnosis in a case supposed to be one of stricture than the introduction of an instrument, it being passed down the

urethra like a catheter.¹ But if the instrument is small, and the surgeon careless, he may engage its point in an enlarged lacuna, and suppose that spot to be the seat of a stricture. If, however, he will partially withdraw the instrument, and stretch the penis so as to make the urethra tense, he will, on disengaging its point, be able to pass it on. At the triangular ligament in the natural condition of the parts the inexperienced surgeon will also often imagine that he has found a stricture because he does not sufficiently depress the handle of the instrument to cause the point to pass up over the triangular ligament. A little manipulation will, however, readily avoid this difficulty; but if it should occur, and be troublesome, as it will sometimes prove even in the hands of a skilful operator, a finger introduced into the rectum will guide the instrument successfully into the bladder, unless there is a stricture in the membranous portion of the canal.

Sometimes, and especially in old men, a difficulty will be found in the introduction of an ordinary bougie or catheter, which is not due to stricture, but is owing to an enlargement of the third lobe of the prostate gland, in consequence of which it rises into the orifice of the canal, and opposes the entrance of the catheter. This may be obviated by giving the catheter such a curve at its point as would be created by passing it for a quarter of an inch into the barrel of a desk key, and then bending the body of the catheter gently downwards, so that when the catheter is held upright the point as far back as the end of the eye (Fig. 233) will be horizontal—or by introducing a gum elastic catheter with its stylet until the obstruction is reached, when the stylet being withdrawn a quarter of an inch the point of the catheter will be raised above the obstruction, and may then be readily made to pass into the bladder.

When a stricture truly exists, however, it will be found that none of these manipulations will enable the instrument to pass it, until, as the surgeon diminishes the size of the instrument, he is enabled to carry a small one through the obstruction, or is compelled to overcome it by caustic or incision.

Prognosis.—The prognosis of permanent stricture will, of course, depend upon the history of the case, the duration of the disease, and the character and habits of the patient. It will be favorable

¹ For the operation of Catheterism see Op. Surg., vol. ii. p. 202, 2d edit.

if the stricture has existed but a short time, if the patient is of temperate habits, and is faithful in following out the directions of

Fig. 233.

Fig. 234.

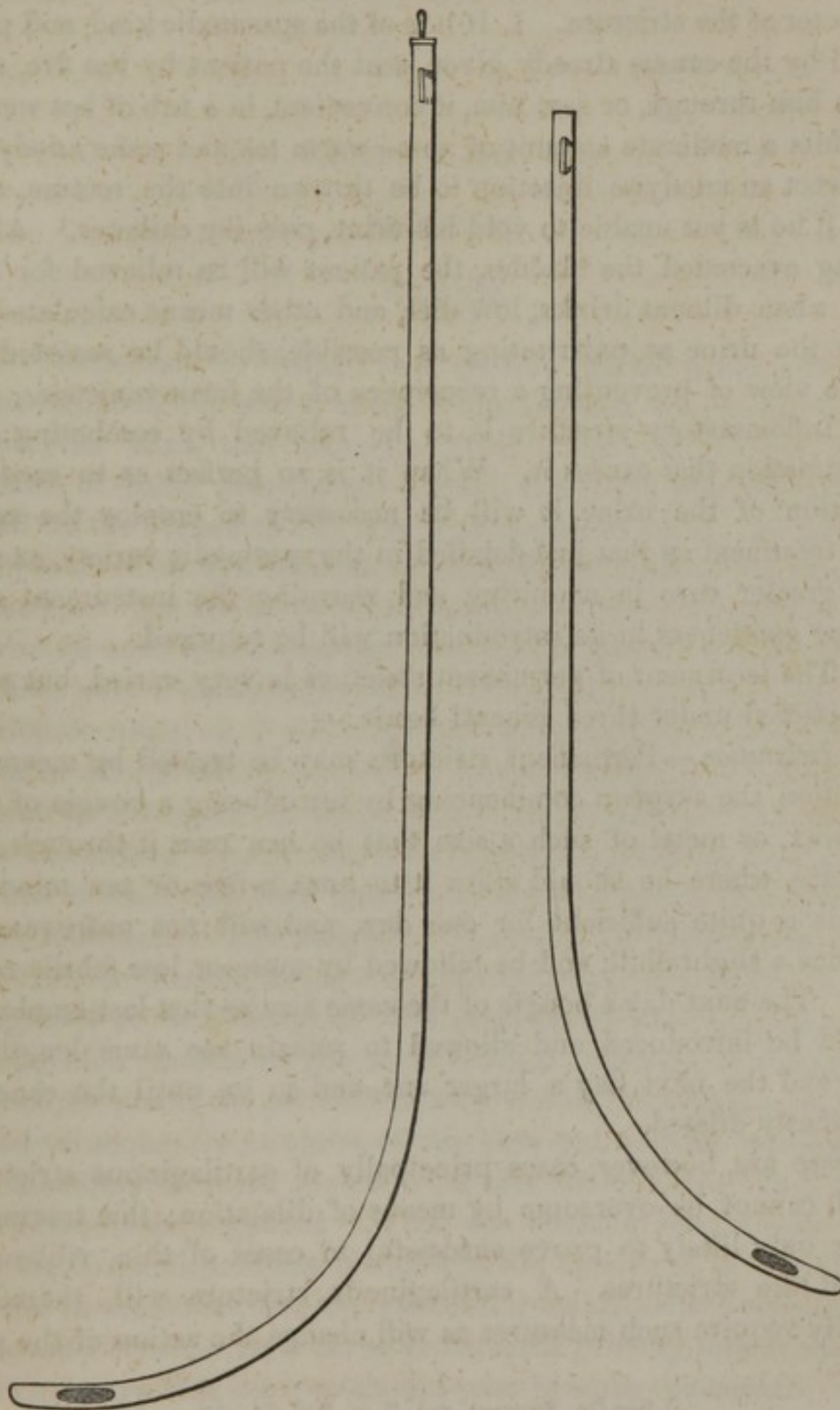


Fig. 233.—A side view of the Curvature of the Point of a Prostatic Catheter of half the natural size of the instrument. (After Miller.)

Fig. 234.—A side view of the ordinary Curve of the Catheter. (After Miller.)

his surgeon. If he is intemperate, or has had the stricture for some months, and particularly if it has acquired the cartilaginous consistency, the prognosis should be guarded.

Treatment.—The treatment will, of course, vary according to the character of the stricture. 1. If it is of the spasmodic kind, and produced by the causes already given, seat the patient by the fire, and warm him through, or seat him, if convenient, in a tub of hot water, give him a moderate amount of some warm tea and some anodyne, or direct an anodyne injection to be thrown into the rectum, and then, if he is yet unable to void his urine, pass the catheter.¹ After having evacuated the bladder, the patient will be relieved for the time, when diluent drinks, low diet, and other means calculated to make the urine as unirritating as possible, should be resorted to with a view of preventing a recurrence of the inconvenience.

2. Inflammatory stricture is to be relieved by combating the inflammation that causes it. When it is so perfect as to cause a retention of the urine, it will be necessary to employ the same local treatment as that just detailed in the spasmodic variety, except that greater care in anointing and warming the instrument and greater gentleness in its introduction will be required.

3. The treatment of permanent stricture is very varied, but may be classified under three general heads:—

1. *Dilatation.*—Permanent stricture may be treated by means of dilatation, the surgeon commencing by introducing a bougie of cat-gut, wax, or metal of such a size that he can pass it through the stricture, where he should allow it to remain five or ten minutes, as this is quite sufficient for one day, and will not unfrequently produce a slight chill, and be followed by more or less febrile reaction. The next day a bougie of the same size as that last employed should be introduced, and allowed to remain the same length of time, and the next day a larger one, and so on until the canal is sufficiently dilated.

There are, however, cases principally of cartilaginous stricture, which cannot be overcome by means of dilatation; this treatment being only likely to prove successful in cases of thin, ribbon or thread-like strictures. A cartilaginous stricture will, therefore, usually require such measures as will change the action of the part

¹ See Op. Surgery, vol. ii. p. 202, 2d edit.

completely, either by cutting through it or overcoming it by means of caustic, the details of each method being given in the *Operative Surgery*, vol. ii. p. 206, 2d edition.

CHAPTER II.

SECTION I.

SYPHILIS.

SYPHILIS may be defined as a specific disease which affects the whole system, but which, at its commencement, is characterized by a peculiar ulcer, that takes the French name of chancre, and is capable of being propagated—though this name was originally applied by the French to any sore with hardened edges. In studying the peculiarities of a chancre, we should first consider the character of its pus. As this is the origin of syphilis, being specific or peculiar in its nature, and capable, when introduced beneath the skin in another part or in another person, of reproducing a sore precisely similar to itself, or, if absorbed into the blood, of creating constitutional effects which will result in the formation of other sores similar or analogous to the primary one, just as the pus of cow-pox introduced beneath the skin reproduces exactly the original vesicle or scab, and then goes on to the production of a constitutional affection. The sore thus produced by inoculation of the pus from a chancre, being the starting-point of syphilis, is often designated as the *primary sore*, the attack as primary syphilis, whilst those which result from the constitutional infection, or the absorption of the pus of the primary ulcer, are called *secondary sores*, being noted subsequently as ulcers of the skin and mucous membranes; the disorders of these tissues from this source being often designated as *secondary syphilis*. When the constitutional disease goes still further, and produces changes in the ligaments, in the fibrous tissues, in the bones, &c., the affection is called *tertiary syphilis*.

Seat of Chancre.—In order to produce the primary sore or chancre, it is necessary that the pus should pass beneath the cuticle; hence we find the most common seats of the disease are points where the cuticle is the thinnest and most likely to crack or be ruptured;

such as the frænum of the prepuce, which is often so violently distended during coition as to create a rupture of the cuticle covering the part. The frænum is, perhaps, the most frequent seat of chancre, whilst next we have the corona glandis, or the part just behind it,

Fig. 235.



The common seat of Chancre—the sore presenting the characters of that with an indurated base, and which is designated as the Hunterian Chancre. (After Acton.)

Fig. 236.



Chancre of the acute Phagedenic variety, seated around the Corona Glandis. (After Acton.)

where the mucous membrane is reflected from the penis upon the prepuce, this being also very apt to be stretched during copulation, in consequence of which it becomes abraded or cracked. The next most frequent seats of chancre are outside of the body of the penis; upon the nipple of the female, or upon the lips and tongue. It is also to be found in the eyelids, from rubbing the eyes with the hands, on which there may be chanceroous pus. In the female it is found upon the labia minora, near the meatus urinarius, upon the fourchette, within the vagina, upon the os uteri, &c.

Symptoms.—The symptoms of primary syphilis and of chancre are as follows: In from two to four days, after an impure connection, there is seen on the prepuce, or corona, or on the body of the penis, or upon the labia minora or majora, or within the vagina, a red inflamed spot; which is combined with a certain amount of smarting or stinging, sufficient in the penis to give rise to an afflux of blood to the part, and cause a marked irritation and disposition to an erection, this erection, by stretching the parts, aiding in the extension of the sore, the little red inflamed spot, at this early period, exhibiting only the ordinary characters of unhealthy inflammatory action. The cuticle covering it, however, soon becomes elevated by the effusion of serum beneath it so as to make a little vesicle, the serum of which shortly assumes a yellow color from an admixture of pus, and finally becomes quite purulent. The dis-

tended vesicle then bursts, and discharging itself, leaves a slight superficial abrasion or ulcer. In this condition this ulcer is a simple ulcerated surface, secreting, it is true, a specific pus, but yet susceptible, after a light cauterization, of being healed by the ordinary treatment of inflammation elsewhere. After the ulcer has progressed for a few hours it however becomes changed in its appearance, owing to the efforts of nature to prevent the absorption of pus, this being accomplished by means of an effusion of lymph; in consequence of which the sore acquires defined edges, and more or less induration around its borders.

In the course of twenty-four or thirty-six hours after the first appearance of the abraded surface it will be found that the chancre has changed its early characters, and, instead of presenting a superficial abraded surface, secreting pus, has now taken on the character of a superficial slough, and is covered by a soft, pulpy structure, of various depths, this death of the tissue being in proportion to the virulence of the disorder. The efforts of nature to limit the extension of the disease now become more marked, the edges of the chancre become thicker and more rounded, and the sore acquires a greater apparent depth, owing to the effusion of lymph on its edges, whilst it obtains a hardened base, which can be distinctly felt by pinching the parts between the fingers, this base presenting the condition to which the term *Hunterian chancre* has been applied from the fact that this sore was first accurately described by the celebrated John Hunter. It should, however, be remembered that such a chancre commences precisely like the simple sore first described, it having become deeper and more rounded on its edge, precisely as the edge of an ordinary indolent ulcer is created from that of a simple healthy ulcer of the leg. As long as a chancre has not created a bubo it should also be recollected that it is perfectly amenable to proper treatment, and that it may be healed without the disorder contaminating the patient's system. But if the primary sore is allowed to progress unchecked, inflammation in the lymphatic glands of the region will next be noticed, a red line being observed to extend along the back of the penis in a line corresponding with the course of the lymphatics. The lymphatic glands will now become involved, and begin to enlarge either in the groin, constituting what is ordinarily designated as a *bubo*, or the lymphatics of the penis itself may enlarge and thus create a true abscess of the penis. When a bubo forms in the groin it will often run on to suppuration, when

the pus thus formed will prove to be precisely like that originally obtained from the woman, and if introduced beneath the skin of some other part, as upon the thigh of the patient, will produce another chancre precisely similar in all respects to the first one.

The pus from a chancre will usually stain the linen as did that of stricture, but, perhaps, in a more marked manner, producing a heavier tallow-like stain. This pus, moreover, has certain properties which may be described under the head of the Laws of Chancre which have been established chiefly by the talents and industry of M. Ricord, of Paris.

1. The pus from a chancre, or from its consequent bubo, whether upon the penis or the groin, will always reproduce a chancre wherever it may be inoculated.

2. It will produce an irritation that will travel along the lymphatics and create inflammation and suppuration in the first lymphatic gland.

3. It will develop irritation and suppuration in each gland that is involved, and the bubo thus formed will produce a pus of precisely the same characteristics as that formed in the original sore; that is, the pus from such a bubo, if introduced on the point of a lancet, beneath the sound skin of any portion of the body, will in three days create precisely such a condition as was seen in the formation of the original chancre.

Diagnosis.—From the description of the primary sore just given it will readily be seen that there are many conditions which a careless observer might confound with the earliest stage or the commencement of chancre. Thus, a man may have connection with a filthy woman, or he may himself be of filthy habits, in consequence of which, the mucous membrane covering his glans penis will become abraded, or the irritation produced by mere contact with the acrid matters of the female vagina, may produce a little vesicle, or a number of little vesicles, and these will be found upon the frænum and behind the corona, which, it should be remembered, are the most frequent seats of the primary sore; but these sores are nothing more than the *vesicles of eczema*. Then, again, it should be remembered that there is a true herpes of the glans penis, or of the prepuce, the vesicles of which are not unlike those seen in the commencement of chancre, these, when they burst, also creating a little superficial excoriation which may readily be confounded with chancre by an inexperienced observer. But the

surgeon may always make a correct diagnosis by noticing that the sore left by herpes never runs on to a deep ulceration like chancre; that it does not form a thick gummy pus; is not covered by a thick pultaceous slough, and does not produce a suppurating bubo, although at times it results in a mere sympathetic one, which generally disappears in a few days; or if these facts are not sufficient, the diagnosis can always be definitely settled by Ricord's experiment of inoculation; thus if the pus from a supposed chancre does not reproduce a chancre, it may be safely asserted that it is not a specific sore. Although, then, the diagnosis in the early stages of the primary sore is difficult, that between other sores and the Hunterian chancre may be readily made.

Treatment of Syphilis.—The treatment of a simple chancre, before it has become Hunterian, or before it has acquired an indurated base, is to be conducted upon general principles, the great danger being from the absorption of the virus from the surface of the sore. The indications for treatment, therefore, are clearly :—

1. To check or modify the secretion of pus from the chancre.
2. To prevent its absorption into the system.
3. To heal the ulcer left behind after the first two indications have been fulfilled.

With regard to the first indication, or the modification of the secretion of pus, it is to be accomplished by such means as will change the whole character of the sore, such, for example, as the application of caustic, a gentle cauterization with the nitrate of silver being generally found sufficient to answer that purpose, this being repeated the next day, or every other day, if necessary, until the sore is healed; the chemical action of the caustic and the healthy inflammation it develops being generally sufficient to alter completely the specific nature of this sore. But it should be remembered that the nitrate of silver is to be applied with a view to its alterative effects, and not in order to create a deep eschar and burn out the sore, as this is not required in this stage of the complaint, and creates an amount of irritation which the circumstances do not demand. If we have the Hunterian chancre to treat, a more powerful caustic will be demanded, as will be explained when considering the treatment of this sore.

If the nitrate of silver is not at hand, an alterative effect may sometimes be produced upon the surface of the sore by means of a solution of some one of the milder chlorides, such, for example, as

black wash, which may be made in the proportion of 3j Hyd. chl. mit. (calomel) to Aq. calcis f̄iv, lint saturated with the above solution being kept upon the sore.

As regards the second indication, it is best carried out by such means as will remove the pus from the sore as rapidly as it is formed, and this is to be found in a frequent change of dressings, the lint which is placed next in contact with the chancre being changed every two or three hours, whilst anything like the formation of crusts or scabs is to be studiously prevented, lest the pus accumulate beneath them and thus become absorbed.

As the inflammation produced by chancre is always of an unhealthy character, it will be found advantageous to moisten the lint with which the sore is to be dressed with some stimulating article, and a very excellent one is to be found in the aromatic wine of the French codex,¹ a preparation formed by the maceration of various aromatic herbs in claret wine.

Lint, wet with this solution, and applied to the sore, should therefore be changed at least every three hours until the application becomes too stimulating, as will be shown by its smarting, when the wine should be diluted with a little water. If the secretion of pus is very profuse, a small quantity of tannic acid may be added to the aromatic wine with a view of diminishing it, about ten grains of tannic acid being added to each ounce of the wine. But it should be remembered that it is possible to apply an astringent to such an extent as to prevent the development of granulations, and thus interfere with the perfect cicatrization of the sore, and any such accident should be guarded against by diminishing the quantity of the tannic acid.

The third indication—to heal the sore—is to be accomplished in precisely the same manner as the healing of any other ulcer, except that ointments and greasy applications do not seem to answer as good a purpose in the treatment of chancre as simple washes. If the sore does not heal with sufficient rapidity, it may be lightly touched from time to time with the solid stick, or with a solution of thirty grains of the nitrate of silver to the ounce of water. Before applying these articles, however, the surface of the ulcer should be gently wiped dry by pressing upon it a little piece of lint, and after the caustic has been applied the application of the

¹ See page 118.

lint should be repeated in order that it may remove any excess of caustic, which might otherwise spread and affect the sound tissues.

Thus far syphilis requires little or no constitutional treatment, a slight purge, attention to the condition of the digestive organs, &c. &c., being generally quite sufficient, the primary ulcer, after it has been cauterized, being treated precisely as if it had been produced by any other cause. The simple chancre thus early seen and properly treated is therefore a very simple affair, and much less troublesome than gonorrhœa. But if the patient allows the ulcerative process to progress, as he is very apt to do, on account of mistaken notions of the purity of the woman from whom, in truth, he has received it, a true Hunterian chancre may be developed, which will present the characters already described.

The treatment of this indurated or Hunterian chancre is more troublesome than that of the simple sore just described, as it does not yield to the simple stimulating applications which will heal a simple chancre, owing to the induration of its base by the effused lymph. Sometimes, on account of the bad constitution of the patient, or other causes, marked signs of unhealthy inflammation also develop themselves, and there is no longer a disposition to the effusion of lymph; hence as the inflammation is not limited, the ulcer spreads with greater or less rapidity. Such a condition is described as the *phagedenic chancre*, or if it sloughs with great rapidity, as the *sloughing phagedena*. This sloughing chancre will sometimes progress to such an extent as completely to surround the head of the penis with deep ulcerations, so as nearly to remove it, thus creating a loss of structure which is never afterwards replaced. Sometimes instead of an external chancre we may notice a chancre which is within the urethra, in consequence of which it is designated as a *concealed chancre*, though it can generally be seen at the edge of the fossa navicularis of the urethra, by opening the lips of this canal. It is said that this chancre may be found further in; but if this is true, it must be extremely rare, as it is a difficult matter for the inoculating pus to travel much further into the urethra than the fossa navicularis, and find an abrasion. The treatment of the concealed chancre is the same as that of the simple chancre when it is external to the urethra, its cauterization being accomplished by the introduction of the solid stick of caustic within the urethra, or by throwing in a strong solution, taking care to

limit its action by constricting the urethra behind the corona glandis.

The Hunterian chancre will require a more powerful caustic than that directed in the case of the simple chancre, as it is necessary not only that the sore itself, but its indurated base and edges should also slough out. In these cases the use of the caustic potash, or of the strong acid nitrate of mercury is preferable, as after the slough resulting from such an application has come away, it will leave a clean healthy ulcer without induration, and the treatment will be precisely the same as that detailed under the head of simple chancre.

The treatment of the phagedenic chancre, like that of other phagedenæ, must be prompt and active, as it is worse than useless to attempt to palliate it, or to reduce the unhealthy inflammation which is here present, by the use of the ordinary antiphlogistic measures. Such efforts, particularly if actively carried out by weakening the patient, always result in a more rapid spread of the disease, and there is, therefore, but one course to pursue, and that is to destroy the whole unhealthy surface, by cauterizing it with strong acid nitrate of mercury, as this is more certain, and penetrates more deeply into the ulcer than any other caustic. The application of caustic potash may accomplish the same thing, but it is not so well adapted to this purpose as the strong nitric acid. In the application of the acid, care should be taken to limit its action by the prompt application of sweet oil, or of the bicarbonate of soda, in solution.

Occasionally it will happen that the inflammatory action developed by the presence of a chancre leads to an effusion of serum or of lymph into the prepuce to such an extent as to produce phymosis. In such a case we should not operate until the chancre is healed, this being accomplished by means of appropriate injections beneath the prepuce, when the swelling will often be so much diminished that the phymosis can be overcome by mere manipulation; or if this is not the case, the operation can be safely performed without the risk of inoculating the edges of the incision.

The cicatrix left by a chancre upon the mucous membrane is a peculiar one, and one which never thoroughly disappears, whilst as it is depressed it always shows clearly that there has been a loss of substance. Sometimes this cicatrix is observed to have a thickened edge, or when felt gives the sensation of a little cartilaginous

induration beneath the mucous membrane or the skin, and it should be remembered that whenever such a cicatrix exists the lymph may contain the nidus of the disorder, and that the patient is liable to suffer from constitutional symptoms. The best plan that can be followed to prevent this, is again to apply caustic to the cicatrix, and, if possible, compel the entire induration to slough out.

§ 1.—BUBO.

The term *bubo*, which is generally applied to the syphilitic affection of the glands of the groin, is one also employed indiscriminately to designate all enlargements of the lymphatic glands, whether caused by syphilis or not, as the term means merely a swelling in the groin.

Symptoms.—The symptoms of bubo are as follows: There is fulness in the groin with pain, tenderness upon pressure, and swelling. As these symptoms increase and the swelling progresses, the pain becomes quite severe, because the enlargement is limited by the dense superficial fascia of the part, and when suppuration is established, the pus, owing to the same cause, has a disposition to burrow and travel in various directions. At last, the enlargement distends the skin to such an extent that it ulcerates and gives way; the pus is evacuated, and then an ulcer is left similar to the primary sore, though on a larger scale, presenting an ulcer with elevated rounded edges, with a kind of a slough at the bottom, consisting of the structure of the degenerated lymphatic gland, this being also capable of secreting a pus which, by inoculation, will reproduce another chancre.

Diagnosis.—As it sometimes happens that a bubo occurs in a case of simple gonorrhœa, it may become a question whether it is of syphilitic origin or merely a sympathetic enlargement produced by the irritation of the gonorrhœa, and this question can generally be determined with tolerable certainty by remembering the following facts:—

The gonorrhœal bubo generally presents us with an enlargement of several glands at the same time, because the irritation from urethritis is not sufficiently great to develop suppuration in one gland before another enlarges; whilst in the syphilitic bubo the inflammation so rapidly develops pus that one gland suppurates

before the next is attacked, and thus the syphilitic bubo generally involves but one gland at a time.

Sometimes there will be enlargement of the glands of the groin from a very simple cause, as when the patient stumps his toe, or cuts his corns too closely, or has a toe-nail ulcer, these causes being often quite sufficient to develop a sympathetic enlargement of the glands in the groin; but this bubo corresponds with that described as the result of gonorrhœa, two, three, or several glands being attacked at the same time. It has also not the same tendency to run on to suppuration that is found in the syphilitic bubo. A more difficult matter is to diagnose between the syphilitic bubo and that which is occasionally found resulting from mere irritation produced by cauterizing the chancre in its earlier stages with nitrate of silver. But the delay of a single day will enable the diagnosis to be readily made, as in that time the bubo produced by the irritation of the caustic will be much better, while that produced by the syphilitic virus will be worse. When a patient has a sympathetic bubo at the same time that he is suffering from both concealed chancre and from gonorrhœa, it will, however, be difficult to decide whether the bubo is produced by the gonorrhœa or the chancre, except by a careful inspection of the orifice of the urethra, on the edge of which the chancre will generally be found, as the pus from the urethritis under these circumstances may create a chancre if employed for inoculation.

Treatment.—The treatment of the simple sympathetic bubo, or that due to a virulent gonorrhœa uncombined with chancre, is to be based on the general principles of inflammation, the irritation in the gland being checked by soothing applications to the source from whence it came; whilst leeches around the bubo, cold cloths, &c., may, and probably will, check its further progress and prevent its suppuration. When its enlargement is slow, and the skin over it has not reddened, benefit may also be derived from the application of a blister for two or three hours as a revulsive, though this should not be allowed to vesicate, but simply to redden the part on which it is applied. But when the bubo is certainly syphilitic, when it follows the development of chancre, when one gland alone enlarges and is disposed to suppuration, no time should be lost in getting rid of the pus or of the entire gland, so as to prevent the absorption of the matter into the blood and the contamination of the patient's constitution. If the least point of suppuration can be detected, the bubo

should therefore be at once freely lanced, the pus discharged, and then the entire cavity cauterized, by rubbing in it caustic potash, the action of the potash being immediately checked by injecting olive oil. But if the bubo has not supplicated but is of some size, with the skin reddened and swollen, whilst at the same time an indurated Hunterian chancre exists on the penis, the entire gland should be made to slough out by the following prompt though painful means, so that the patient may be secured from constitutional taint. Give the patient a full dose of anodyne; then shave the groin free from hair, and apply a blister over the bubo for six or twelve hours, or until it vesicates sufficiently to remove the cuticle, after which apply to the denuded surface a compress of patent lint of the size of the bubo, wet with a strong solution of the sulphate of copper, say two drachms of the salt to the ounce of water; lay over this another compress of dry lint and bind the whole firmly to the part by means of a spica bandage. In between twenty-four

and thirty-six hours, this dressing may be removed and poultices or the warm-water dressing applied so as to favor the separation of the slough; these dressings being retained by the spica handkerchief of the groin suggested by Mayor (Fig. 237). If preferred, instead of the sulphate of copper the acid nitrate of mercury may be used; but, in this case, it is not necessary to remove the cuticle. In applying the acid, surround the part with a little elevated line of Basilicon ointment, and then spread the acid well over the part, allowing it to remain for a few minutes, when it should be neutralized with sweet oil. Some surgeons prefer for the same purpose the use of the caustic potash, which they rub over the bubo until the whole is converted

into an eschar. In either case, the slough should be deep enough to involve the entire gland, so that when the dead portion comes

Fig. 237.



A front view of the Handkerchief Bandage of the Groin, as suggested by Mayor, for the retention of poultices, &c., to this region. When a change of dressing is desired, it is only necessary to unpin the ends of the handkerchief and turn them back. In its application, fold a cravat; apply it round the back of the hips, and carrying the ends in the line of each groin pass them around and beneath the thigh so that they may be pinned as shown in the figure. (After Mayor.)

away the diseased gland may be removed, and a simple ulcer left which will be amenable to the ordinary treatment of ulcers.

The simple bubo from gonorrhœa requires a very different and much milder treatment—as applications of cold water; pressure, leeches, &c., to check the inflammatory action; or if it runs on to suppuration, an early evacuation of the pus should be practised, and then the sore cauterized lightly. If, however, the inflammatory action becomes chronic without going to such an extent as to induce suppuration, and an indolent induration of the glands is established, these should be treated by such means as will diminish the plasticity of the lymph, precisely as a chronic induration from inflammation would be treated in any other part, or arising from any other cause, as by the application of small and repeated blisters, inunctions with mercurial ointment, whilst some one of the preparations of mercury may be given in alterative doses in order to facilitate the removal of the lymph. The local use of iodine will also sometimes prove highly useful.

§ 2.—SYPHILIS IN THE FEMALE.

When syphilis shows itself in the female, it obeys the same general laws, and is amenable to the same treatment as when it manifests itself in the male.

Seat.—The most frequent seat of chancre in the female is around the meatus urinarius; upon the labia minora; upon the os uteri and upon the fourchette. It is, however, found at times upon other places, both upon the organs of generation and elsewhere.

Symptoms.—The symptoms of chancre are more marked, and the ulcers more apt to become phagedenic in the woman than in the man, from the fact that the healthy or diseased discharges of the bladder, the uterus, and the vagina flow over and still further inflame the ulcerated surface. As a consequence of this, large chancres are very apt to form upon the posterior parts of the perineum; or two chancres, one on each side, may unite at the fourchette, and constitute what is known as the *horseshoe chancre*.

Treatment.—Chancre in the female, if simple, is to be treated precisely like the simple chancre in the man, and if phagedenic or Hunterian, after the manner just alluded to; the treatment above given being equally applicable to both sexes.

SECTION II.

SECONDARY SYPHILIS.

Thus far we have considered syphilis simply as a local disease, but should the virus enter the system, should the bubo or chancre be improperly treated, should such an indurated cicatrix as has been just described be allowed to remain, or even when the sore has been well treated, and has apparently healed in the most favorable manner, but yet been attended by an enlarged gland, symptoms of blood poisoning may present themselves a few weeks subsequently. In this case certain constitutional symptoms will appear and present examples of the affections of the skin, of the mucous membranes, of the iris, &c., which have been designated as secondary symptoms, or as *secondary syphilis*.

Besides these, which are the constitutional symptoms of syphilis, there are other affections which are no less constitutional, but which are merely such as would be expected to arise from the irritation of a healthy local inflammation, and which are frequently seen in cases of ordinary ulcers upon the legs and elsewhere, such as disorder of the digestive organs, and consequent malaise, restlessness, want of sleep, emaciation, &c.

Symptoms.—About six weeks after the appearance of a chancre, sometimes even where the chancre has been healed, the bubo sloughed out, or even where there has been no marked bubo, the patient will begin to notice some little feebleness in his digestive organs, accompanied by a loss of appetite, and by a disposition to emaciation. This emaciation is often very marked, making the patient look older than he is, and producing in young persons an appearance of old age, the eyes being sunken from absorption of the fat of the orbit, the cheeks depressed from the loss of the fat beneath the malar bone, and the skin sallow and wrinkled.

At the same time the eyes will be heavy, and the patient will sleep badly, be irritable and dispirited, and have a quick pulse, while night-sweats will often be exceedingly profuse, thus resembling the condition which has been alluded to in the symptoms of hectic fever.

These symptoms will, moreover, be much augmented if the pa-

tient has been salivated, because then, in addition to the constitutional irritation produced by the disease, we have that created by the mercurial. At a period which varies, sometimes preceding, sometimes following, sometimes coincident with, and sometimes without any accompanying disturbance of the digestive organs, there will be noticed affections of the skin and throat, which are usually regarded as the efforts of nature to get rid of the virus of the blood, precisely as the eruption in smallpox is due to the efforts to throw off the blood poison which has produced the constitutional disturbance.

§ 1.—AFFECTIONS OF THE MUCOUS MEMBRANES.

The affections of the mucous tissues, as a consequence of primary syphilis, usually begin as a slight irritation in the pharynx, of which the patient complains, and which he compares to the irritation of ordinary sore throat; thus he will have some little hoarseness, and, perhaps, some little stoppage of the nose, precisely resembling that of an ordinary catarrh; the secretion produced by these irritated surfaces being so thick and gluey that he experiences a constant inclination to hawk in order to get rid of it. At the same time, or soon after he begins to experience difficulty in deglutition, and, upon looking into the mouth, the uvula and tonsils will be observed to be swollen, and the back of the pharynx to have a peculiar dark mottled appearance, more or less of the tint of copper, which is quite characteristic. These mottled spots rapidly take on ulceration, and then present many of the characteristics of the primary sore; thus they are unhealthy in their character, and are disposed to spread, sometimes rapidly becoming phagedenic, and speedily destroying not only the uvula, but the whole soft palate, or travelling forwards and making oftentimes a direct communication in the roof of the mouth, between the mouth and nose. Symptoms of inflammation in the mucous membrane of the nostril may also present themselves, and be shown by an increased discharge from the nose, which is acrid, and excoriates the sound skin with which it comes in contact. As the inflammation progresses, it next attacks the periosteum of the spongy bones of the nose, so that caries of these and the neighboring bones is often induced, from which proceeds the usual stinking discharge of diseased bone, thus creating the affection

which has been already designated as *ozæna*. As the caries progresses, portions of the spongy bones are discharged with the pus, the nose becomes flattened, the soft parts become involved, and ulcerate, and are completely destroyed, so as to create a horrible deformity. With these symptoms conjunctivitis and iritis are frequently observed, the changes produced by which have been already detailed under the head of Diseases of the Eye.

§ 2.—AFFECTIONS OF THE SKIN.

At various periods after the creation of a chancre, say about six or eight weeks, but often independent of any affection of the throat and nose, affections of the skin begin to be noticed, and these are first exhibited as spots or taches of various kinds, like those of measles. These are reddish in their color and about the size of a split pea or larger, appearing first, as a general rule, on the palms of the hand, on the skin of the face, and then upon the skin of the front of the chest, following in this respect the laws of eruptions generally. The light red color which they present at first, speedily becomes darker, and finally assumes that copper color which is regarded as characteristic of syphilitic eruptions. After this various other skin diseases may appear; these corresponding with ordinary skin diseases in their general characters, though they are modified by their syphilitic source, and are hence called *syphilides*. Thus we may have eczema or any other vesicular eruption; or any one of the papular affections; or those of the pustular class, these pustular syphilides being extremely characteristic, as they contain an amount of pus greater than usual, and are more disposed to dry and form crusts which are very prominent, being formed of scabs of several layers. When these crusts separate from the skin, a deeper ulceration is also left than is commonly found after the separation of a crust in the ordinary pustular affections.

Sometimes a tubercular disease of the skin is seen, by which term (tubercular) is here to be understood an affection presenting large pimples, from the size of the end of the little finger to the size of the end of the thumb, these being caused by a deposition of lymph beneath the skin. These pass, among the unprofessional, under the name of bumps, and are not unfrequently found upon the face.

The pustular affections are also very apt to attack the face,

where they assume the shape of the circle, thus resembling some of the forms of porrigo, and when found around the forehead receive the appellation of the *corona veneris*.

These various skin affections need not be here described in detail; suffice it to say that they are more marked in character than the ordinary skin affections, and are darker in color. In addition to affections of the skin we may also have affections of the appendages of the skin, as the hairs and nails, the follicles of the hairs becoming impaired in their vitality and the hairs dropping out, so that the individual becomes bald. His eyebrows also not unfrequently fall off and he presents the condition known as *alopecia*.

Occasionally the growth of warts will also be noticed as a result of venereal contamination, these warts being precisely similar to those which follow gonorrhœa, and requiring the same treatment. Condylomatous tumors (Fig. 238) are also found upon various portions of the skin, presenting true elevations of the skin or mucous

Fig. 238.



A full view of numerous Condylomatous Tumors as seated around the Anus and Genitals of the Male, though found also in the Female. (After Acton.)

membrane. A very common seat of these condylomatous tumors is around the anus, where they show themselves frequently quite numerous, and in sizes varying from the tip of the finger to that of the thumb, or even larger.

Treatment of Secondary Syphilis.—When a patient presents him-

self laboring under the catarrhal affection, which, so far as the throat is concerned, is the first evidence of constitutional infection from the syphilitic poison, he might be supposed to be suffering under a simple pharyngeal irritation as the result of cold, or of the excessive use of tobacco. But the history of the complaint will generally undeceive the surgeon. Besides the history of the disorder, the diagnosis will also be influenced by the fact that these simple inflammatory affections produce a diffused redness, which, although it may be dark, has not the peculiar mottled appearance of the syphilitic complaint. In this stage, however, the local treatment of both forms is precisely similar, and the surgeon may therefore direct the use of some astringent gargle; such, for example, as sage tea and honey, with the addition of a little borax or alum; or a much better application may be found in a strong solution of nitrate of silver, fifteen or twenty grains to the ounce of water, well put on with a camel's hair pencil. If the disease has progressed still further and resulted in ulceration, so that the back of the pharynx or uvula, or the sides of the tonsils are affected, they should be frequently touched with the solid stick of the nitrate of silver, or with what is better, a camel's-hair pencil dipped in a strong solution, $\mathfrak{z}\text{j}$ of nitrate of silver to $\mathfrak{f}\mathfrak{z}\text{j}$ of water. Between the cauterizations the patient may also use a gargle of vinegar and water, of alum water, or some similar article, and should be put under appropriate constitutional treatment, the details of which will be referred to presently. The ulcers upon the tonsil or uvula should not, however, be confounded with the little adherent patches of lymph or mucus which are sometimes seen as the result of an ordinary pharyngitis, and which can be wiped off by means of a dry camel's hair pencil, a manipulation which should always be practised upon an ulcer in this situation before cauterizing it.

If the disease has progressed still further, and *ozæna* is presented, it is to be treated so far as local applications are concerned, as *ozæna* produced by any other cause. Some detergent and astringent wash may, therefore, be used as an injection, and when the odor of the discharge is very offensive, it may be corrected by means of some of the mild chlorides, $\mathfrak{z}\text{ss}$ of chloride of lime, or the same quantity of Labarraque's solution of the chloride of soda, being put into four ounces of water, and gradually increased in strength as it is used, until, when injected into the nostril, it creates smarting.

The local treatment of the *affections of the skin* is to be conducted upon the same general principles as are applicable to them when they proceed from other causes. In cases of vesicular eruption, if there is evidence of inflammatory action in the part, it must be overcome by warm mucilaginous baths, some alterative being given and an astringent ointment applied, such as the following:—

R.—Hyd. chl. mit. ℥ij;
Plumb. acet. grs. xv;
Axungiae ℥j.—M.
S.—Anoint the part.

A similar plan is to be followed in the papular eruptions, but here, instead of the warm baths, vapor baths can often be advantageously used; and, if no more convenient mode of obtaining it is at hand, a vapor bath may always be prepared extemporaneously by wrapping the patient in a blanket, within which hot bricks covered with wet towels are placed. This may be repeated four or five times weekly. If the patient has one of the pustular diseases alluded to above, or any of the scaly affections, such as psoriasis or lepra, or even ichthyosis, they should be treated upon general principles. The scales or scabs may always be removed by means of some alkaline ointment, and a very good one is as follows:—

R.—Sodæ carb. ℥ss;
Axungiae ℥j.
M. et ft. unguentum.

The ulcer left after the scab or scale is removed may then be treated with weak red precipitate ointment, or with the alterative ointment of calomel, as given above.

As regards the constitutional treatment of secondary syphilis, it should ever be borne in mind that it is to be conducted upon general principles. Let us at once get rid of the pernicious idea that in syphilis it is necessary, in order to remove one poison from the blood, to introduce into it another. General principles are here all that is essential, and when alteratives seem necessary, let them be prescribed precisely as though the disease arose from any other cause, such means being employed to diminish the plasticity of the lymph as would be resorted to in other complaints.

When a gentle alterative is indicated to modify the condition of the blood, as well as the capillary action, as, for example, when the skin diseases begin to appear, or when the throat is first affected, the most judicious article that can be employed is the

iodide of potassium, in doses of from three to eight grains, three times a day, and given in solution in water, in syrup, or in the compound syrup of sarsaparilla, according to the fancy of the patient or the practitioner. I say according to their fancy, for it is a mere matter of taste, the compound syrup of sarsaparilla as found in the shops being generally inert, and often containing no sarsaparilla at all. But it should be remembered that the iodide of potash itself will, if carried to some excess, produce an eruption or sore throat, and an enlargement of the salivary glands, which looks not unlike that which is the result of salivation. For this reason, large doses, and a too persevering use of the drug, should be avoided.

But although the use of the iodide of potash, particularly when combined with diaphoretics, such as Zitman's decoction, or the decoction of guaiacum, will in many cases suffice, yet there is a class of affections in which it is not sufficiently potent to remove the disorder, and especially where an effusion of lymph threatens to destroy important organs (as in the case of syphilitic iritis), unless some measures be speedily taken to diminish its plasticity. Under these circumstances we should not hesitate to employ mercurials. Some of the special circumstances under which we should be justified in administering mercury are cases of Hunterian chancres with indurated bases, which remain indurated notwithstanding the application of the strong caustics which have been directed; or cases of *dry scaly* eruptions in the skin, with *chronic* ulcerations of the throat, *not disposed to phagedena*; acute iritis, nodes, &c. The question whether mercury could judiciously be directed in syphilis is one which, in former times, excited much discussion, and which is still debated at the present day. But at present it is the opinion of many surgeons, and it is certainly my own, that in the cases just detailed, alterative doses of mercury may be given with advantage, these being, however, always suspended so soon as the patient experiences a slight disposition to tenderness about the gums.

The idea of the necessity of salivation in syphilis has long since been exploded, though formerly such a course was considered essential to its cure, and many can doubtless recall the horrors of some of the public institutions of Philadelphia, when mercury was given for the purpose of salivation in the syphilitic wards. Then it was not uncommon to see patients leaning out of their beds, with

their heads over basins, their tongues lolling out, parotids swollen, and the saliva running in a stream, simply because they had syphilis; thus literally carrying out the idea of old Boerhaave, that "unless the patient could be made to spit four pounds a day, he could not be cured."

When, then, it is desired to obtain simply the alterative effects of mercury in the cases detailed, it should be very cautiously given, and stopped the moment there is a moderate amount of redness or irritation about the gums. The best preparation for obtaining these alterative effects without profuse salivation is Donovan's solution, or the *Liq. Hydrargyri et Arsenici Iodidi* of the *Pharmacopœia* (solution of the iodides of mercury and arsenic). This may be given in doses of five drops twice a day at first. If it is found to produce irritation of the digestive organs, as shown in diarrhoea, &c., it may be omitted for a day or two, and recommenced when the system has recovered from its bad effects. At the same time, diaphoretics should be steadily given; or the protiodide of mercury may be administered in doses of $\frac{1}{4}$ to $\frac{1}{2}$ gr. twice or three times a day. By these means, we will generally get rid of all the symptoms; whilst, if the patient is salivated, the constitutional effects of mercury will be superadded to those of the syphilitic disease, and the patient suffer for years, particularly if he has a tendency to the tubercular diathesis. The indiscriminate use of mercury in syphilis is therefore objectionable, but there are cases in which its judicious use is the only means of regulating the progress of the affection.

If the mercury has, however, been *incautiously* given, the best way of checking the excessive salivation thus produced, is by the use of the iodide of potash, which will eliminate the mercury from the system. At the same time, the alterative effect of the iodide will be obtained.

SECTION III.

TERTIARY SYPHILIS.

Symptoms.—The tertiary symptoms of syphilis are those which are shown in the affections of the fibrous tissues and bones, as in rheumatism, in enlargement of the joints, in periostitis, in enlargements of the bones themselves, in nodes, in neuralgic pains in the

bones, osteoscopes, &c., the effects of the diseases of the bones being necrosis or caries, all of which should be treated upon the general principles laid down in connection with the diseases of the bones.

CHAPTER III.

SPERMATORRHŒA.

AFTER studying the evils resulting from improper sexual intercourse, we may now pass to the consideration of a complaint which is a great annoyance both to the patient and surgeon, which causes an immense deal of unhappiness, and the treatment of which has been very empirical, as its true pathological condition is apparently unknown, owing to the fact that it seldom or never causes death. Much obscurity has also been thrown around this subject by the misapprehension of honest observers and the mental distress of patients created by the duplicity of quacks.

Spermatorrhœa is a term the derivation of which—σπέρμα, sperm, and ρεω, I flow—points out one of the most marked symptoms of the complaint, to wit, a flow of semen, which shows itself at frequent and short intervals, and is the result evidently of a morbid irritability of the organs. To understand readily some of the conditions which may create emissions, it should be remembered that the rectum passes directly in contact with the vesiculæ seminales and the prostate; the latter, when enlarged, not unfrequently encroaching upon its cavity, so that hardened fæces passing along the rectum, and pressing upon the prostate and vesiculæ, may lead, particularly when those organs are enlarged, irritable, and full of semen, to a seminal discharge, which, accordingly, in persons of costive habit, &c., is not unfrequently found to take place during efforts at stool.

The complaint is a very ancient one, and not, as has been asserted in some works upon the subject, a disease of modern origin. It is distinctly alluded to in Leviticus in contradistinction to gonorrhœa, and is also described by Hippocrates. In more modern times, we find mention of it made by *Wiseman* in 1782, and by Frank, and others.

It has, however, been recently very minutely studied by Lallemand, of Montpellier, in France, and his name, with that of Curling, of England, is at present closely associated with the subject.

Lallemand describes the complaint as existing in two forms; one in which the emissions take place during the night, which he designates as *nocturnal emissions*, or *nocturnal spermatorrhœa*, and one in which they take place during the day, which he designates as *diurnal spermatorrhœa*. Now either of these conditions may exist to a certain extent without constituting a diseased action or creating any results which are injurious to the patient, and if this fact could only be impressed upon the minds of the latter, a great deal of mental distress and one of the most marked evils of the disorder would be avoided, as it is very common for patients to labor under the greatest distress on account of their belief that they have spermatorrhœa, who have nothing more than a perfectly natural emission; and it is easy to see how this may happen: A healthy man, in whom the vesiculæ seminales are full, and who has no sexual intercourse, will not unfrequently suffer from more or less turgescence of the organs of generation, accompanied with some dulness of the ordinary train of thought, whilst there will be more or less tendency to thoughts about coition. Under these circumstances nature will frequently relieve him by creating a seminal discharge during the progress of a lascivious dream; or during the day, he may go to stool, and his bowels being constipated, the pressure of the hardened fæces upon the vesiculæ and prostate gland will lead to an emission, accompanied by an erection more or less complete. This emission under these circumstances generally contains a large quantity of prostatic fluid and a smaller number of spermatozoa than that which is perfectly natural, and so far from being evidence of disease is really a proof of vigorous health and a full performance of the functions of the testicle and its adjacent organs.

That such a diurnal discharge is perfectly natural, may, I think, be inferred from the fact that a similar emission not unfrequently occurs under the same circumstances in the dog, this animal being often seen when straining at stool to have a discharge from the urethra; whilst the same thing takes place under certain circumstances of excitement in the stallion and in the bull. Such emissions, therefore, if occurring but occasionally, say once a week, should be looked upon merely as an effort of nature to get rid of the surplus of a secretion, and not as in any way injurious to the

patient, but on the contrary a wise provision for the relief of his brain.

With regard to nocturnal emissions, when they are not more frequent than once in two or three weeks, they also, if the individual is otherwise in good health, should be regarded as a perfectly natural result; but if the discharge occurs two or three times in a night, without erection or with very imperfect erections, then the condition should be looked upon as a morbid one requiring treatment, lest in the sequel it lead to serious consequences, and result in a loss of nervous power, in paralysis of the muscles of the part, in impotence, &c.

In these cases the discharge, as first seen, will present under the microscope many of the characteristics of natural or healthy sperm; though soon a diminution will be observed in the number of the spermatozoa, whilst an increase in the watery elements of the discharge will be simultaneously noted.

Etiology.—The causes which may result in the production of the complaint are very varied, and may act directly upon the brain and spinal cord, or be purely local in their character; thus, it may be produced by excessive coition; by masturbation; by stricture of the urethra; by the presence of worms in the alimentary canal, particularly of ascarides; by congenital phymosis; by irritation in the prostate and vesiculæ; or by the congestion of these parts, which may be caused by too long sitting, as in the case of students and others leading sedentary lives; or it may be due to excessive exercise on horseback. Of these the most common cause is certainly masturbation.

An irritable condition of the urethra and vesiculæ seminales being thus once established, emissions may be brought on by reading lascivious books, by loose conversation, and by indulging in lascivious ideas; or they may occur totally independent of any such causes.

In investigating the symptoms of spermatorrhœa, some light will be thrown upon their etiology if we remember that the irritation which is at first local from the excitement created in the genital organs, is soon extended to the spinal marrow from whence these organs derive their nerves, as well as to the brain; whence it is communicated to the sympathetic system, and creates all that train of phenomena which may be described as follows:—

Symptoms.—At various periods after the establishment of the efficient cause (masturbation) and the occurrence of the emissions,

the latter become more frequent, and the patient experiences a sense of fatigue, particularly in the morning, when he awakes from a sleep which has been broken by a nocturnal discharge. At night he also becomes restless, and in the day is sleepy and heavy; is melancholy, cowardly, and anxious about his health, often so much so that the surgeon will be astonished at the accuracy and minuteness of his observations upon his own condition. In addition to this, he not unfrequently has a dogged downcast look, and is unable to look any one in the face, whilst his features become emaciated, and his eyes sunken, and with dark lines beneath them. At the same time symptoms of nervous disturbance will be observed, the patient complaining of irregular pains in the back, stomach and limbs. There is also irritation felt during micturition, and when derangement of the digestive organs appears, a train of symptoms is developed which very much resembles those produced in the female by prolapsus uteri, or by irritable uterus; the patient suffering from loss of appetite, whilst he is troubled with flatulence and hears the wind rumbling about in his bowels; has a suffocating sense of stricture in his œsophagus, often amounting to a true globus hystericus, and has a true salivation resembling the condition of the pregnant woman, and described as "spitting fips," that is spitting small pieces of thick, tenacious mucus or lymph mixed in the saliva, which assume, when they strike the floor, the appearance of a small coin. To get rid of this matter the patient keeps up a continual hawking, which resembles that which occurs in secondary syphilis, whilst he suffers from water-brash, and has not unfrequently a true morning sickness resembling that which occurs in the female during the first months of pregnancy.

The pulse is quick, irritable, and peculiar—so much so that, after some experience, the surgeon will frequently guess at the disease simply from the pulse, as it resembles no other pulse except that resulting from the excessive use of tobacco, being a quick, irritable, windy sort of pulse.

There is often dyspnoea, which is sometimes quite severe, especially after ascending a flight of stairs; there is pain in the chest, and a tickling in the palate, which is not unfrequently due to elongation of the uvula; whilst he expectorates freely, and imagines that he is going into a consumption. All these symptoms, though annoying to the patient, are in no way dangerous to life, and should be looked on simply as due to nervous derangement. That the

cerebral functions are deranged, is evinced by various symptoms; thus, the patient does not sleep soundly, and is subject to nightmare; cries out in his sleep, is restless, and has troubled dreams. He also suffers from vertigo, ringing in the ears, deafness, and irregular action of the optic nerves; vision being impaired, and motes floating before the eyes, &c. As evidence of the mental disturbance, a change in his disposition will be noticed, particularly if the disease is the result of masturbation, the passions in this latter case being misdirected; as he is no longer satisfied with the female, but turns aside from the most attractive and prefers the practice of masturbation to the pleasures of the sex. He, therefore, usually shuns the society of women, prefers solitude, and is melancholy and reserved. The nervous derangement is also shown by its effects upon the other functions; thus, the urine presents abundantly those phosphatic deposits which are generally found in any case of irritation of the digestive organs, whilst it also contains more or less mucus, and a few spermatozoa.

Prognosis.—The prognosis of this complaint must necessarily be guarded, as there is no disease so difficult to cure, or one which presents less certainty as regards the result of the treatment.

This uncertainty is necessarily the result of our want of knowledge of the true pathology of the complaint; *post-mortem* examinations having shown nothing very definite, ulceration or even irritation of the urethra having been rarely observed; while inflammation of the vesiculæ seminales, and inflammation and abscesses of the prostate gland, with congestion of the spinal marrow, congestion of the cerebellum, irritations of the mucous membranes of the throat and stomach, have been noted when there was no spermatorrhœa.

Treatment.—The treatment of spermatorrhœa may be divided into three heads—1. The moral treatment; 2. The local; 3. The constitutional treatment. In the moral treatment, the physician must be aided by all the knowledge that he can gain of the character of his patient. If he is depressed in spirits, or if he is anxious about his health, he must be freed from the idea that the discharge from which he suffers is acting as a drain upon the system; an idea which always alarms and depresses him, and one of which he should be promptly disabused, by telling him that the loss of a drachm or two of semen, daily, cannot possibly be attended with such terrible consequences as are attributed to it, though he generally thinks he

is fully posted on this subject from having read the accounts of those who prey on society by magnifying the evils of this disorder, and forwarding their lying pages to all sections of the United States. Having thus consoled him as much as possible, and in a measure relieved the mental derangement, all causes competent to produce a disordered condition of the parts should be removed; and if he has been practising masturbation, it must be given up. Let him be convinced of the impropriety of the practice; let him endeavor to check every unchaste thought; let him abstain from reading lascivious books, etc. etc., and much will be gained towards the cure of this most annoying mental and physical malady, by means which have been correctly designated as the moral treatment. The local treatment consists in such measures as would be adapted to local congestion, or neuralgic irritations elsewhere. When the condition of the parts is simply a congestion along the canal of the urethra, as will be shown by the pain caused on passing a bougie into the bladder, it may often be very much, if not entirely, removed by the occasional distension which results from frequently carrying a bougie of wax throughout the canal, and especially through its vesical portion. When the instrument is introduced under such circumstances, a considerable degree of tenderness will often be noticed between the bulb and the membranous portion of the urethra, or in the neighborhood of the prostate gland, this tenderness being there greater than it is at any other point. When it is excessive, inflammation in that region may be suspected; and if this suspicion is confirmed by the fact that the simple passage of the bougie rather increases than relieves the irritation, Lallemand's instrument may be resorted to, for the purpose of lightly cauterizing the seat of the supposed inflammation, or ulceration. In these patients, cauterization of the urethra is really beneficial; and there are also cases of supposed impotence in which the local stimulation of the caustic proves highly useful, by creating an irritation which is transmitted to the spinal cord, and results in erections; but I am satisfied, from considerable experience, that the universal and indiscriminate application of the nitrate of silver to cases of spermatorrhœa has done much harm.

If the discharge is the result of congestion and enlargement of the prostate gland, as is not unfrequently the case, it will contain much mucus, but few spermatozoa, showing that it comes chiefly from this gland. This derangement should, therefore, be treated

precisely as it would be under any other circumstances. If the exciting cause is constipation, it must be overcome by laxatives and by injections of cold water into the rectum, which will not only aid in overcoming the want of action in the bowels, but serve to allay the irritation in the vesiculæ seminales and prostate gland.

In lunatic asylums, or among young lads, in whom masturbation is not uncommon, and whose mental condition is often such that we cannot control the practice by moral means, benefit will often be derived from a blister applied to the penis, which will make the organ sufficiently sore to compel the patient to let it alone.

Advantage will also sometimes be derived from the use of the stimulating diuretics, such as cubebs, copaiva, &c., whilst injections into the urethra of calomel and mucilage are sometimes beneficial. The following formula, for example, may be employed:—

R.—Hyd. chl. mit. ℥ss;
Muc. g. acac. f ℥ viij.—M.
S.—Inject once a day.

But this, like the caustic, is only applicable to those cases in which there is marked irritability of the lining membrane in the course of the urethra, the emissions ensuing on imperfect erections.

The constitutional treatment of this complaint is, however, the most important, and is to be found in the use of such means as are calculated to relieve congestion of the spinal marrow and cerebellum; and in tonics and other means calculated to remove the digestive derangement, as quassia and iron, whilst cold douches may be applied to the spine, or blisters to the region of the cerebellum, &c.

Should the progress of the disease result in impotence, advantage will sometimes be found from the use of nux vomica, according to the plan of Tissot, of Paris, from $\frac{1}{84}$ th to $\frac{1}{48}$ th of a grain of strychnia being given twice a day, and pushed till it begins to produce slight muscular twitchings precisely as would be done in an ordinary case of paraplegia, but using, if possible, greater caution. As regards the use of stimulating articles with a view of producing erections in these cases of impotence, they may be set down as of little or no value, and may sometimes prove positively injurious. The muriated tincture of iron is occasionally beneficial, but merely as any other preparation of iron would be by improving the condition of the blood; upon cantharides or upon phosphorus no reliance can be placed. This *idea* of impotency—for it is usually only an idea—is the most annoying symptom in the complaint; as

individuals will not unfrequently be found who have had more or less of seminal emissions for years without giving it a thought; until having read some vile advertisement, or unprincipled book, and, perhaps, formed a contract of marriage, they become alarmed and consult a surgeon in regard to their powers. Under such circumstances, no one need hesitate about advising the completion of the contract, as a few weeks will then certainly cure the patient.

PART XIII.

AFFECTIONS OF THE KIDNEYS AND BLADDER.

CHAPTER I.

STONE AND GRAVEL.

THE next of the affections of the genito-urinary organs to which attention may be directed, is that known as *Gravel* or *Stone*, terms used to designate the formation in the kidneys, and the lodging in various parts of the urinary passages, of certain particles of calculous matter which, when arrested in these passages, are liable to accumulate from fresh particles being added to them, and thus present themselves in the form of *gravel*, or attain such size and solidity as justly entitle them to the name of *stone*.

SECTION I.

OF GRAVEL.

Varieties.—The sabulous matters found in the urinary passages have been variously classified; in the first place they are divided according to their size, being, when finely pulverulent, spoken of as *sand*, *sediment*, or *deposit*, the last two terms being, however, objectionable, because there may be a sediment or deposit in the urine, which does not consist of calcareous matters, it being caused by the presence of blood, mucus, pus, or semen. The term *sand*, as expressive of the general character of the disorder, is therefore preferable. When sand aggregates to a moderate extent it is called *gravel*, the larger masses resulting from still further aggregation, receiving the name of *stone* or *calculus*.

Etiology.—The disposition to the formation of gravel in the urine is to be found in connection with a state of the kidneys by no means precisely understood. Very often it is hereditary, father and son for many generations laboring under the complaint. As the disease consists essentially in a vitiated action on the part of the kidney, any cause capable of producing or sustaining this disordered action may become the cause of the complaint. Thus, it will be found that among the predisposing causes are certain kinds of food, especially those which abound in the nitrogenized elements, whilst certain drinks are also said to aid the diathesis in favoring the formation of stone; persons who use much hard cider being said to suffer, whilst the disorder is more common in districts where the water is highly impregnated with limestone than elsewhere. Climate, clothing, or any change of circumstances which, by modifying the action of the exhalants of the skin, throw an increased burden upon the kidney, may also become the cause of stone.

These facts are important, because after a stone has been removed from the bladder by operative interference, if the patient be not watched, and the exciting causes removed, or the tendency of the diathesis carefully counteracted, it may be reproduced. It should, therefore, be borne in mind that the *kidney* is the source from which the mischief comes, pathological observations having often revealed the fact that, under these circumstances, this gland is diseased to a considerable extent, every possible variety of disordered action being seen in it that could be the result of inflammation.

Chemical Composition.—The chemical composition of gravel is varied, though it generally consists of the combination of uric, lithic, oxalic, or phosphoric acids with certain bases, such as lime, ammonia, magnesia, soda, silica, iron, &c., or with a peculiar substance, recently described, under the name of *Cystine*.

To that peculiar state of the constitution which predisposes to the formation of these compounds in the urine, the term *Lithogenesis* or stone producing diathesis, is applied; and in speaking of the specific deposit which the diathesis induces, the name of the acid that predominates in the gravel is usually prefixed to it; thus we have the uric or lithic acid gravel, as well as that of oxalic and phosphatic acid.

Uric and Lithic Acids.—The most common of all the varieties of gravel are those composed of the uric or lithic acids, these gene-

rally occurring in combination with ammonia, and constituting a urate of ammonia, or one to which the term ammoniaco-uric or lithic sediment has been applied. Sometimes, when the ammonia is extracted by some abnormal acid in the urine, a pure deposit of uric acid is thrown down which looks, when examined by the naked eye, very much like grains of Cayenne pepper; whilst, under the microscope, it presents various crystalline forms, which are generally some modification of the rhombic prism (Fig. 239). When the deposit consists almost purely of lithic acid, it is designated as the crystallized lithic or uric acid deposits, and generally presents itself in the form of what is known as *red gravel*.

Of the urate of ammonia, or amorphous lithic acid deposits, there are two forms. The first consists of the urate of ammonia (Fig. 240), combined simply with the coloring matter of the urine, and constituting the yellow sediment which is found in the urine, particularly in connection with gastric or intestinal irritation, the sediment depositing generally after the urine has cooled; whilst in the second form, the urate of ammonia is intermingled or combined with more or less of a substance called purpurine, this substance being derived by chemical change from the coloring matter of the blood. This combination forms the *lateritious sediment* of fevers, rheumatism, gout, &c., and the pink sediment of certain organic diseases.

Fig. 239.



Crystals of Uric Acid. (After Bird.)

Fig. 240.

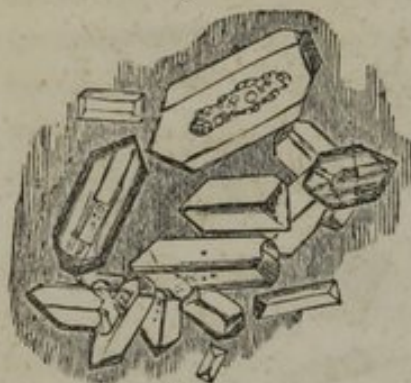


Urate of Ammonia under the Microscope. (After Bird.)

Treatment.—The lithic acid diathesis is to be combated by attention to diet, exercise, the state of the skin, and the condition of the general health; there being perhaps no class of remedies more serviceable than those which will relieve the kidneys by keeping up a proper action in the skin.

Phosphatic Gravel.—Perhaps the next in frequency to the gravel of uric acid are those of the various phosphates. These deposits may be the triple, or ammoniaco-magnesian phosphates;

Fig. 241.



Crystals of the Ammoniaco-magnesian Phosphates. (After Bird.)

or they may consist—though more rarely—of phosphate of lime, or of the combinations of the two (Fig. 241). These deposits have a peculiar white appearance, which is easily recognizable, and when they consist simply of the triple phosphate, present beautiful, minute, brilliant white crystals, which assume various forms.

The urine in these cases is pale, and of a low specific gravity, and the deposits are frequently found in the urine of healthy persons after severe mental exercise.

Treatment.—The treatment consists in abstaining from mental exertion, and in building up the system by means of tonics and gentle stimulants, with the use of nitric or nitro-muriatic acids, internally.

Oxalic Acid Gravel.—The oxalic acid constitutes another variety of gravel, and generally presents itself under the form of the oxalate of lime (Fig. 242). The particles of this compound have a great tendency to agglutinate, and a patient laboring under this diathesis generally suffers, sooner or later, from the symptoms of stone. The urine is usually clear, and of a pale yellow or citron color, of moderate specific gravity, inclined perhaps rather to be high than

Fig. 242.



Oxalate of Lime under the Microscope. (After Bird.)

otherwise; and if it be allowed to cool, will throw down oxalic acid crystals, which, if examined under the microscope, present various forms, which are generally some modification of the cuboidal prism, though there is a dumb-bell-shaped crystal sometimes met with that is exceedingly charac-

teristic. The causes, or perhaps it would be better to say the conditions often accompanying this diathesis, are gout, rheumatism, &c. &c.; irregular habits of life, and exposure to depressing agents of any kind, being very liable to terminate in the production of this diathesis.

Treatment.—The treatment of the oxalic acid gravel consists in the employment of measures calculated to prevent the formation of the acid, or to destroy it when formed. For this purpose, the internal administration of benzoic acid was once supposed to be a specific, and nitric acid has also been recommended. Alkalies should be carefully avoided.

SECTION II.

CALCULUS, OR STONE.

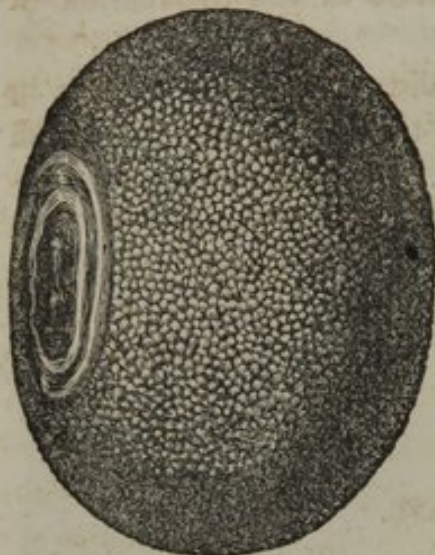
When any of these sabulous deposits find in the bladder a nucleus, such as a drop of blood or of mucus, or a grain of wheat, a bit of straw, or any substance which the morbid imagination of a patient may have led him to introduce, or which has entered accidentally, they accumulate upon it, and go on to such an extent as to result in the formation of a true stony mass or calculus. The calculi thus formed are to be regarded as foreign bodies, and act as such, producing irritation of a serious character in the mucous membrane of the bladder, the effects of which are felt by the whole system. The vesical irritation and inflammation thus resulting may even be so severe as to cause the death of the patient, post-mortem examinations showing pathological changes in the coats of the bladder caused by this irritation; they being sometimes enormously thickened, whilst the ureter is distended and sacculated, and the whole urinary apparatus presents appearances which almost prevent the recognition of its original structure.

Varieties of Calculi.—The various kinds of calculi may be thus briefly described:—

That of *uric* or *lithic acid*, and its compounds, is the most common, constituting two-thirds of all calculi. They are seen of various colors, often presenting a fawn or yellowish hue, though sometimes they are so dark as to deserve the appellation of a mahogany color. In shape, they are generally of a flattened oval, and if a section is made, they will be observed to consist of concentric laminæ, arranged

around a central nucleus; each layer showing its distinct character by a variation in the color. (Fig. 249.) The surface is either faintly

Fig. 243.



Uric Acid Calculus, showing its finely tuberculated surface. (After Gross.)

tuberculated (Fig. 243), or more often smooth. In size they vary from the circumference of a hazelnut to that of a hen's-egg.

The *oxalic acid calculus* is next in frequency, and generally presents itself in a form which, from the character of its surface, is described as the *mulberry calculus*. It is tuberculated, but irregularly spherical, and is nearly always single. In its formation it has generally a nucleus of some foreign substance, or of some other variety of urinary concretion. (Fig. 244.) The tuberculated surface is often rough and sharp-pointed, and therefore it is that the symptoms of this variety

are generally more severe, in proportion to the size of the calculus, than those of any other class. (Fig. 246.)

Fig. 244.



Fig. 245.



Fig. 246.



Fig. 244.—Nucleus surrounded by Oxalate of Lime, and this covered by concentric layers of Urate of Ammonia. (After Gross.)

Fig. 245.—Triple Phosphate surrounding a Mulberry Calculus. (After Gross.)

Fig. 246.—Oxalate of Lime, or Mulberry Calculus. (After Gross.)

In size, these calculi are seldom larger than that of a walnut, or of a small egg. In texture, they are extremely hard, and are susceptible of polish.

The stone formed by the *phosphates* (Fig. 245) has a grayish-white

color, and is quite soft; and it may, therefore, generally be very readily crushed.

The appearances of some of the other varieties are shown in Figs. 247, 248, 249, the details of which must be sought in Monographs.¹

Fig. 247.



Fig. 248.



Fig. 249.



Fig. 247.—Calculus of Ammoniac-Magnesian Phosphate, entire, exhibiting its shining crystalline surface. (After Gross.)

Fig. 248.—Cystic Oxide Calculus. (After Gross.)

Fig. 249.—Section of an Alternating Calculus, chiefly composed of uric acid. (After Gross.)

Symptoms.—As it is apparent that calculi originate in the kidney, the earliest symptoms of the tendency to the formation of these bodies will usually be found in connection with this gland; thus there will be pain in the loins, this pain being at times much more severe than at others, and resembling, when at its height, the pain of colic, for which it may be mistaken, particularly when accompanied, as it sometimes is, with vomiting, and a peculiar sense of constriction in the epigastric region, as if the patient was bound around the stomach with a cord, the urine being scanty, high-colored, and often mixed with blood. There is also very apt to be a burning sensation in the urethra, due to sympathetic irritation.

When gravel or a pebble passes into the ureter, if its size is such as to present any obstacle to its free passage, a new train of painful

¹ See a Practical Treatise on the Diseases, Injuries, and Malformations of the Urinary Bladder, the Prostate Gland, and the Urethra. By Samuel D. Gross, M. D. Philad., 1855.

symptoms are rapidly developed; thus there will be pain in the course of the ureter, violent spasmodic contraction of the cremaster muscle, the testicle being often drawn quite up to the external abdominal ring, a fact which is of much value as a means of diagnosis, whilst if these symptoms continue for from twenty-four to forty-eight hours, there will very often be present more or less febrile reaction, heat of skin and diminished secretion, this condition being usually terminated by sudden relief. The suddenness of the relief experienced by the patient is another diagnostic sign of importance, and is caused by the passage of the stone from the ureter into the bladder. All these symptoms are sometimes so severe as well to deserve the name which is often applied to them of *nephritic colic*.

Treatment of Gravel, or Nephritic Colic.—As the passage of a pebble through the ureter is very painful, it requires prompt and efficient treatment, the indications of which are to allay the pain and favor the passage of the pebble by such means as will induce relaxation of the system, the quickest mode of doing which is by the administration of anæsthetics, the best being the mixture of ether and chloroform, one part of the latter to three of the former, which is now generally resorted to for the purposes of etherization both in the clinical service of the University of Pennsylvania as well as in that of the Philadelphia Hospital, Blockley. In the relaxation induced by partial anæsthesia—for it is not necessary to carry it to the fullest extent—the passage of the calculus will be favored both by gravity and by the action of the urine. If, however, anæsthetics are not at hand, or are from any cause contraindicated, the same thing may be accomplished, though not quite so efficiently, by the use of opiates: and if in spite of these measures the calculus lingers in its passage through the ureter, the effect of an active purgative may be tried.

One point in the treatment is of great importance, and yet is often overlooked, and that is, until the pebble has passed completely from the kidney into the bladder, and the patient is entirely relieved for the time, the use of diuretics should be carefully abstained from, for it will readily be understood that the great danger in the passage of the pebble through the ureter is that it may cut through it, and thus give rise to urinary infiltration into the abdominal cavity, or that, blocking up the ureter, it may dam up the urine, which, accumulating behind it, may produce distension and rupture of the canal, the latter danger being greatly increased by the increased secretion of the kidney while the pebble is in the ureter;

but after the pebble has passed into the bladder, mild diuretics and diluents will often be useful by allaying pain and irritation.

Having reached the bladder, the pebble may afterwards, if not too large, be passed by the urethra, and to favor this the mild diuretics and diluents above spoken of are also serviceable. But most frequently it remains in the bladder without causing any inconvenience until attention is directed to it by the gradual setting in of all the symptoms of stone in the bladder.

Stone in the bladder may be found in all ages, in all climates, in patients of all habits and temperaments, and in both sexes, though more frequent in the male than in the female, on account of the larger size and shorter length of the female urethra, which therefore permits an incipient calculus to escape.

Stone has also been found in children at birth of such a size as proved that it must have existed for some time in the foetus in the womb, whilst it has been found in old men—as well as in all intermediate ages. Children, however, are rather in the majority, as of 5376 cases recorded by Civiale, 2416 were in children, 2167 in adults, and 793 in very old persons.

Of the children, 1946 were under 10 years of age.

This complaint also prevails in all climates, though some seem more favorable than others, owing to a variety of causes, among which the character of the waters of certain streams perhaps plays an important part. Among our own States, according to the work of Dr. Gross, of Louisville,¹ the disease is most common in Kentucky, Ohio, Tennessee, and Alabama; less frequent in Pennsylvania, Delaware, Maryland, Virginia, North and South Carolina, Louisiana, and Arkansas; while Missouri, Iowa, Michigan, New York, &c., are comparatively exempt. In New England, Canada, Texas, Mexico, and California, it is much more rare.

As regards the color of the patients, the white man suffers more than the black, and it is said to be a rare thing to see a negro affected with stone. Out of a very large number of cases seen by me in this country and in Europe, including a close observation of Civiale's wards for many months, I do not remember to have noticed more than two cases in the negro.

Symptoms.—The symptoms which generally accompany the pre-

¹ A Practical Treatise on the Diseases, Injuries, and Malformations of the Urinary Bladder, the Prostate Gland, and the Urethra. By Samuel D. Gross, M. D. Philad., 1855.

sence of stone in the bladder are as follows: There is a difference to be observed in the manner of urinating, the stream being frequently and suddenly arrested by the stone coming over the orifice at the neck of the bladder and closing it. In a few moments after, the stream will again begin to flow freely, as the stone has rolled away. The patient now begins to complain of pain, and this pain—which is due to the irritation about the neck of the bladder, like many other irritations upon the course of nerves which are referred to their peripheral extremities—is noted at the head of the penis. This pain at the head of the penis, due to irritation in the neck of the bladder, is not merely one of the symptoms of stone; but is generally found to accompany any irritation of the neck of the bladder produced by other causes. Thus, it is often found accompanying the neuralgia of the neck of the bladder, which sometimes occurs in connection with spermatorrhœa; and is also found as one of the symptoms of cystitis. The pain at the head of the penis, is, however, more marked in cases of stone than in the other disorders, owing to the permanency of the cause, and leads the patient, particularly if a child, to handle the penis, and pull upon the prepuce constantly. As a result, the prepuce becomes very much elongated, and phymosis is induced, so much so that it is sometimes difficult to introduce a sound, whilst the fingers of the little patient, from the constant dribbling of urine, have the cuticle macerated, and the finger-tips shrivelled, so as to resemble a washerwoman's fingers. As the rectum is closely in contact with the bladder, it shares in the vesical irritation, and there is tenesmus, this tenesmus being not unfrequently accompanied with prolapsus ani.

The urine at first is clear, and may or may not present, when allowed to cool, characteristic deposits. But by and by it becomes muddier or dark-colored from an admixture of mucus or of blood, and may contain little particles of stone, which have been broken off and escaped.

All these symptoms are liable to be much aggravated in spells, there being then intense pain and great constitutional disturbance, accompanied sometimes by more or less febrile reaction. Under these circumstances, the patient is said to be laboring under a *fit of the stone*.

The symptoms of stone in the bladder, though often very marked, are sometimes quite obscure, and the surgeon has occasionally no reason to suspect in the least the presence of a stone, until it is

accidentally discovered by an instrument passed into the bladder for some other purpose. Very often, although the symptoms are such as fully to justify a belief in the presence of stone, and the "fits of the stone," so called, are frequent and severe, the general health of the patient does not appear to suffer; the bloom still rests on the cheek of the child, and the frame of the adult preserves its strength, whilst in other cases the constitution suffers greatly, and the patient emaciates and sinks rapidly.

Diagnosis.—A patient being suspected, from the symptoms which have been described, to be laboring under stone in the bladder, its presence may be positively recognized by means of sounding. Sounding consists in introducing a *sound* or solid instrument shaped like a catheter, but made of steel, into the bladder until it touches the stone, when the presence of the latter can be detected by the sensation caused by the contact of the sound with the stone, as well as by the click or sound emitted, this sound being sometimes made audible over a large room by means of a sounding-board which can be attached at pleasure to the top of the sound. The sound should not be more curved than that represented in Fig. 250, lest, as the stone lies in the *bas fond* of the bladder, the instrument may ride up over it, and escape it altogether; nor should the surgeon be satisfied that there is no stone present, when the patient is laboring under the ordinary symptoms, until the examination has been made several different times, and with instruments of different curves.

Prognosis.—The prognosis in a case of stone will depend very much upon the circumstances of the case; thus, if the health of the patient is good, the stone moderate in size, and the case one suitable for lithotrity, the prognosis will be favorable; while, if the general health of the patient is exhausted and broken down, the prognosis will be grave. If lithotomy is required, the dangers of the operation must always be taken into consideration in giving a prognosis; whilst in both operations it should be recollected, that after the removal of the stone, if the diathesis is not combated and overcome, the stone will be reproduced.

Fig. 250.



A diagram showing the ordinary Position of the Calculus, with the sound entering the bladder. (After Liston.)

Treatment.—The treatment of stone is of two kinds—the first, being palliative, and the second radical.

As the irritation of a fit of the stone is very great, a palliative plan of treatment becomes necessary to relieve its violence. Thus an attempt may be made to render the surface of the stone smooth if it is rugged, by the injection of mucilages into the bladder, or the free administration by the mouth of alkalies and diuretics. When the patient is suffering acutely, resort may be had to various other plans of obtaining relief. Of these the simplest is to seat him in a warm hip-bath, which is generally useful by relaxing the spasmodic contractions of the bladder. If this is not sufficient, an anodyne injection, consisting of a teaspoonful of laudanum in a little starch-water, may be given, or resort may be had to a moderate use of anæsthetics.

In the radical treatment, besides the operations of lithotripsy, or of lithotomy,¹ various methods of effecting the removal of the stone have been proposed; thus it has been suggested to disintegrate it by means of chemical substances injected into the bladder when they are diluted to a proper degree. Instruments have also been invented to pass into the bladder, and expand and surround the stone, which is then to be disintegrated by means of stronger chemical agents injected into the cavity of the instrument. But all these modes are purely theoretical, and have never attained any marked results.

¹ See Operative Surgery, vol. ii. p. 243 *et supra*, 2d edit.

PART XIV.

AFFECTIONS OF THE TESTICLE AND CORD.

CHAPTER I.

AFFECTIONS OF THE TESTICLE.

SECTION I.

HYDROCELE.

HYDROCELE is a collection of serous fluid within the cavity of the tunica vaginalis testis, the term being derived from two Greek words, ὕδωρ, water, and κηλη, a tumor, signifying, therefore, a watery tumor.

Anatomical Relations.—The tunica vaginalis testis, as was mentioned in connection with the subject of hernia, is that portion of the peritoneum which was originally pushed before the testicle in its descent from the abdomen into the scrotum. In its new position this portion forms, therefore, a double envelop for the testicle, and its connection with the abdomen having been obliterated, it constitutes a closed sac, as is the case with the other serous membranes. Like these, the tunica vaginalis testis also secretes a certain amount of halitus in the natural condition of the parts, which serves to lubricate and facilitate the motion of the testicle; as without this the delicate structure of the testicle would be exposed to contusion whenever the patient crossed his thighs.

Etiology.—Various disorders may cause this natural secretion of the tunica vaginalis testis to become inordinate in quantity. Thus, inflammatory action may produce it, as is the case in those hydroceles which ensue upon epididymitis, orchitis, or blows. Sometimes it occurs suddenly after great muscular exertion; and in one case a

very considerable hydrocele resulted in the course of half an hour after the individual had lifted a barrel of flour from the ground into a wagon;¹ other cases are also on record, and should be borne in mind, lest a tumor from hydrocele, of sudden occurrence, be confounded with hernia. Generally, however, the causes of hydrocele may be stated to be those which are likely to develop chronic inflammatory action in a serous membrane. When such causes exist, and fluid accumulates in the tunica vaginalis testis, a tumor is formed, which, beginning at the bottom of the scrotum, gradually rises upwards, until it may extend all along the cord, as high as the external abdominal ring. It sometimes happens that a part of that portion of peritoneum which was pushed down before the testicle, remains around the cord, and having contracted adhesions both above and below, forms a closed sac, communicating neither with the abdomen nor with the tunica vaginalis testis. When in such a state of affairs an effusion occurs, a condition is presented which is described by writers as *hydrocele of the cord*, a tumor being formed along the course of the cord, which fluctuates, is translucent, and presents the other symptoms hereafter detailed.

Symptoms.—When the effusion is limited to the proper tunica vaginalis testis, the tumor begins below, and gradually ascends, becoming larger and larger, but it does not enter the external abdominal ring, and unless it is complicated with hydrocele of the cord, produces no thickening of the cord itself. To the touch, hydrocele presents generally a sense of fluctuation, such as would be expected from any collection of fluid. But if the parts are excessively distended, or if, as sometimes happens, the tunica vaginalis has become dense, and more or less ossified, the sense of fluctuation may be partially or entirely absent; a fact which should be borne in mind, in order to prevent the confounding of such a case of hydrocele with other hard tumors of the scrotum. As a general rule, then, the symptoms of a hydrocele may be stated to be: 1. The formation of a tumor at the bottom of the scrotum. 2. The sense of fluctuation; and 3, the translucency of the tumor. The last is the most positive sign, and may be employed to facilitate the diagnosis by the following arrangements: Let the room be darkened, and seat the patient upon a table, chair, or edge of the bed; then grasping the tumor in the hand, so as to force the fluid well down into the scrotum, hold a candle or a lamp upon the opposite side

¹ See Am. Journ. of Med. Sci., vol. xiii., N. S., p. 85, 1847.

from the eye of the surgeon; when, if the tumor is a hydrocele, it will appear sufficiently translucent to enable the surgeon to recognize the position of the testicle, as a dark mass, this being generally of the normal size, and in the posterior part of the scrotum. Still, however, this test is not an infallible one; as it may happen that the tunica vaginalis testis is thickened by disease, or the fluid distending it may be rendered opaque, either by the presence of blood in consequence of the rupture of some small bloodvessel, or from some other cause. In this case, the tumor will not be translucent. As a general rule, however, the fluid in hydrocele is of a pale straw color, and the test of transmitted light is an exceedingly satisfactory one.

Diagnosis.—It has been already mentioned that hydrocele may be confounded with scrotal hernia. The latter, however, begins at the external abdominal and descends, and creates, moreover, a tumor, to which a certain amount of succussion is communicated when the patient coughs, which is not the case with hydrocele, except in congenital hydrocele, in which, as was stated in connection with the subject of hernia, the communication between the peritoneum and the tunica vaginalis testis is not closed, and in which, therefore, the same succussion is perceptible. If the hernia is reducible, its reduction by the taxis will dispel any doubts which may exist as to the nature of the case.

Hæmatocele, or a collection of blood within the scrotum, will, at times, present a train of symptoms which might be confounded with hydrocele. Generally, however, a diagnosis can be made by means of transmitted light. The fluctuation of hæmatocele, moreover, is usually much less distinct than that of hydrocele; but obscure cases will sometimes present themselves in which it becomes necessary to resort to an acupuncture needle, or to a small trocar and canula, by means of which a diagnosis may certainly be made; as, if the tumor is a hæmatocele, nothing but blood will escape from the puncture. Should it, however, be a hydrocele, the escape of the characteristic straw-colored fluid will at once reveal the nature of the case. Should it happen, as it sometimes does, that a hernia is present, and is punctured with the little trocar or needle, the trifling wound thus made will generally heal without doing any serious mischief, but such an event should be avoided.

When the hydrocele is complicated with hernia, the difficulty in the diagnosis is increased. If the hernia is reducible, this

fact will at once insure a diagnosis, whilst, after the reduction of the hernia, the patient should be treated for hydrocele, as if no such complication had existed. If, however, the hernia be irreducible, the difficulties of the diagnosis will be materially increased; though transmitted light in such cases will usually show the hernia as a dark mass in the upper part of the tumor, while the hydrocele will appear translucent below. The tumor formed by a hydrocele, if of any extent, is usually smooth, the distension having completely obliterated all the wrinkles of the scrotum, though this condition is also produced by other tumors, as well as by hydrocele. A hydrocele is often of such size as to bury the penis completely, the position of the organ being only marked by an irregular depression, similar to that made by the umbilicus.

Prognosis.—The prognosis of hydrocele will depend upon circumstances. As it is generally possible to evacuate the fluid which distends the tunica vaginalis, the prognosis, in most cases, will be favorable as regards the result of the operation. But, unless some means be resorted to for producing inflammatory action, and thus gluing together the walls of the cavity in which the accumulation of fluid has taken place, after the manner directed in some one of the operations for a radical cure,¹ a fresh accumulation will occur, and all the inconvenience of the disease be reproduced. The prognosis of the operations for the radical cure is generally favorable; the dangers being either of the inflammation going too far and producing sloughing, or that it shall not go far enough, when a reproduction of the disease will follow. If the disease be not treated at all, yet is its prognosis favorable so far as the mere question of mortality is concerned; though it produces inconvenience from its size, and often interferes materially with the proper performance of the generative functions; otherwise it is comparatively harmless.

The treatment may be either palliative or radical.

The palliative treatment consists in the puncture of the tumor with a bistoury, a trocar and canula, or some similar instrument, and the evacuation of its contents. Such a puncture should be boldly made so as to penetrate the tunica vaginalis testis. After the operation the patient will at once be enabled, with the aid of a suspensory bandage, to resume his ordinary avocations; and, in some few cases, may go a year or even eighteen months before

¹ See Operative Surgery, vol. ii. p. 234, 2d edition.

another operation will be required ; but, in the great majority of instances, the disease will be reproduced in from ten days to three months. The operation for the radical cure, therefore, is much the more satisfactory mode of procedure, and should be resorted to whenever the circumstances of the case will permit it.¹

SECTION II.

HÆMATOCELE.

Hæmatocele (αἷμα, blood, and πηλη, a tumor) is, as its name imports, a collection of blood within the cavity of the tunica vaginalis, this being generally the result of some sudden injury. As its diagnosis has been pointed out in connection with hydrocele, it is unnecessary to recapitulate it.

Treatment.—In the treatment of hæmatocele, the same general principles are to be observed as would be applicable to the management of an effusion of blood elsewhere. Thus, the action of the absorbents should be stimulated, and efforts made to produce contraction of the tissues; leeches should also be applied to the cord, but not to the testicle itself, where the bite of the leech, by developing a certain amount of inflammation, would only add to the mischief, a remark which is true in most other conditions of the testicle for which leeches are required. After local depletion, much may be done by stimulating and irritating frictions, such as those of iodine ointment, or of iodine ointment and the oil of tobacco mingled as in the following formula:—

R.—Ung. iodinii ʒj ;

Ol. tabac. gtt. xx.—M.

S.—Apply to the tumor once or twice a day.

The quantity of the oil of tobacco may be increased to thirty or forty drops if required, where there is not much susceptibility, as in the case of the scrotum of a laboring man. Care must, however, be taken not to carry this application far enough to vesicate, as the local inflammation thus developed would do mischief instead of good.

¹ For the account of the operation see *Operative Surgery*, vol. ii. p. 342, 2d edit.

SECTION III.

VARICOCELE.

Varicocele (*varix*, a distended vein, and *νελη*, a tumor), or, as it is sometimes called, *circocoele* (*κίρκος*, a varix, and *νελη*, a tumor) are terms which are often indiscriminately employed to designate a varicose enlargement and distension of the spermatic veins; but the term varicocele is that which is most expressive of the character of the disorder.

Etiology.—The causes of varicocele are varied, being any that will induce congestion of the veins by interrupting the circulation through them. Among these may be mentioned ligatures around the abdomen, it being not uncommon in young men who wear very tight waistbands to their pantaloons, and avoid suspenders; or it may be due to the congestion of the testicles occasionally induced by extreme continence, or it may follow the improper application of a truss, or result from constipation. As it more frequently affects the veins of the left than those of the right testicle, various reasons have been assigned for this peculiarity, but the most correct is that advanced¹ by Dr. Brinton, of Philadelphia, who found it to be due to the fact "that a very perfect valve exists at the entrance of the right spermatic vein into the cava, whilst there is no valve at the termination of the left spermatic in the emulgent vein."

Symptoms.—Varicocele is generally attended by a sense of fulness in the scrotum; with a dull heavy pain in the back, and in the line of the cord when the patient is erect, but which is relieved by holding up the scrotum, or when he lies down, whilst the patient is often depressed in spirits, and fearful of losing his virile powers; the scrotum also becomes much relaxed, and the nutrition of the testicle may become so imperfect as to cause its atrophy. On feeling the scrotum or cord between the thumb and forefinger, a collection of enlarged vessels will be noticed which give a sensation that has been compared to that caused by a number of earth-worms in a bladder.

Diagnosis.—Varicocele is not unfrequently confounded with hernia and especially omental hernia, as it may, when large, be acted on

¹ Am. Journ. Med. Sciences, xxxii., N. S., p. 111, July, 1856.

by the patient's coughing, owing to the action of the diaphragm upon the abdominal contents. But a diagnosis may be made simply by placing the patient in the horizontal position, when both a reducible omental hernia and a varicocele will disappear; then pressing firmly on the external abdominal ring, direct the patient to stand up, when the hernia will be prevented from escaping, though the veins will gradually fill and become distended notwithstanding the pressure.

Prognosis.—The prognosis of varicocele is favorable. When due to engorgement of the testicle, sexual intercourse removes all difficulty, whilst various operative measures will accomplish a cure and enable the testicle, if wasted, to recover its former condition.

Treatment.—The treatment consists in removing all pressure from the abdominal veins, as by avoiding tight pantaloons and keeping the bowels free; in supporting the scrotum by the use of a suspensory bandage; by bathing the parts night and morning in lead water, and by never applying an inguinal truss to the external ring, there being comparatively few cases of varicocele which will not be relieved by these means, though they are often designated simply as "the palliative cure." A more thorough change in the condition of the veins may, however, be effected by operative interference, as by ligating the veins, excising a piece of the scrotum, or compressing the veins by an instrument.¹

SECTION IV.

SPERMATOCELE.

Spermatocele (σπέρμα, sperm, and ὄγκος, a tumor) was the term by which the older surgeons designated the enlarged condition of the scrotal contents that has just been alluded to as varicocele. There is, however, occasionally met with a true spermatocele, in which the tumor is formed by the globus major and minor of the epididymis, enlarging to a moderate extent from accumulated secretion.

Symptoms.—Spermatocele creates a violent pain in the testes of a neuralgic character, but unaccompanied by any evidences of inflammatory action, the patient, though unable to touch the part,

¹ See Operative Surgery, vol. ii. p. 228, 2d edition.

not suffering from heat or redness of the scrotum, or effusions around the tunica vaginalis testis. At the same time he is more or less troubled with erections, but is not the subject of spermatic discharges.

Etiology.—This condition, which I have more than once met with, is apparently due to an engorgement of the rete testis and epididymis, and is apparently caused by an obstruction of the spermatic secretion in those who have formerly been accustomed to constant sexual intercourse, though it may also be noted in vigorous men who have practised perfect continence, and in whom the momentary cause has been a slight contusion of the testicle, either whilst riding on horseback, or from other blows.

Diagnosis.—The simple enlargement of the globus major unaccompanied by the inflammatory symptoms, &c., of gonorrhœal epididymitis, usually suffices for the establishment of a correct diagnosis.

Prognosis.—The prognosis is favorable, relief being promptly afforded by appropriate treatment.

Treatment.—As the suffering is acute, and the disorder might result in acute orchitis, or inflammation of the testicle proper, the treatment should be prompt, and may be best carried out by seating the patient at once in hot water, by applying leeches to the cord, by supporting the testicle by a suspensory bandage, and by administering an active purge of ten grains of calomel and ten of jalap with a half grain of tartarized antimony, which in twelve hours will usually relieve the pain, though the enlargement of the globus major may continue for some days, or until relieved by seminal emissions.

SECTION V.

TUBERCLES OF THE TESTIS.

Under the title of scrofulous disease of the testicle, surgeons formerly described an affection which more thorough investigation showed to be due to the deposit and softening of tubercles in the affected structure. Having, when in Paris, in the year 1839, had my attention specially directed to this disorder, I published in the

*Medical Examiner*¹ a paper on the subject, which is now offered as affording a fair summary of the professional views on this complaint, most of the article being reprinted as originally published.

Pathology.—"In the testicle, as in other organs of the economy, tubercles present themselves under two forms, either as isolated masses, forming the disseminated tubercles, or as infiltrated, and generally spread throughout the testis, epididymis, vasa deferentia or prostate gland. In the disseminated form, we sometimes find only a single tubercle, which presents the characters common to these bodies, but it is more usual to see four or five existing at the same time, under the form of little tumors, more or less regularly rounded, hard, almost insensible to pressure, movable under the scrotum, and firmly imbedded in the portion where they have been discovered, and of a size varying from a buckshot to a cherry-stone, or even a chestnut. When small, they lodge in the cellular substance between the tubuli seminiferæ without appearing to affect these tubes; but when of greater size, they invade the filaments of the testicle and destroy more or less of its substance. The infiltrated tubercles generally occupy the body of the testis, taking the place of its true substance, or when deposited in the epididymis, completely change the appearance of the part, presenting to the touch masses of different sizes, with a hardness altogether different from the usual elastic feel of the tube. In some instances, the epididymis is enlarged to triple its ordinary size, and seems to be completely injected with the tuberculous matter in a semiliquid state. This disease rarely confines itself to one testicle, though it is unusual to see both in the same state of development; but whether this arises from their proximity or from both being exposed to the same exciting cause, it is difficult to say. In a case reported by Berard, the left testicle, which was in the scrotum, had been attacked with the disease for two years, whilst the right, which had remained in the inguinal canal, had only commenced to suffer six weeks previous to his seeing it. When the epididymis is the portion affected, the tubercles commence most frequently in the globus major, and, in a majority of the cases, will be found to be formed by the isolated tubercles, and to be of easy diagnosis.

Patients.—Tubercles of the testis rarely attack children, at least till the years near to the period of puberty, as these organs are

¹ *Medical Examiner*, 1st series, vol. iii. No. 17, p. 261. Philad., 1840.

generally too little developed previous to this time, to admit of their deposition. In adults, they are found generally between the ages of sixteen and forty, attack, in preference, those of a lymphatic temperament, or in whom we might suspect tubercles elsewhere, and frequently follow the suppression of a gonorrhœa.

Etiology.—Many of the cases reported by Cruveilhier had had syphilis without gonorrhœa; others had received a contusion; others had suffered from repeated attacks of gonorrhœa, the last of which, however, had generally preceded by some months the appearance of the disease, and in others, the causes were unknown. In the few cases I have seen, the disease could generally be referred to the constitution of the patient, as a predisposing cause, though, in every instance, the exciting one was an external injury received in riding, climbing, &c., or from the rudeness and want of care in the treatment of a gonorrhœa. In one case, the commencement could be traced to a blow given by the fist of the patient whilst in a paroxysm of anger at the duration of a chordee, which he thought to conquer in this manner.

Symptoms.—The changes occurring in the development of the tubercles are seldom perceived by the patient at an early period, as the tumefaction of the scrotum commences without pain or change in the color of the skin, increases slowly, and can exist for months without other inconvenience than that resulting from the extra size of the part, and it is not until the tubercles are numerous, or reach an advanced state, that the signs of their existence become sensible to him. At this time the scrotum presents, frequently, a thickness and size double that which it has in the healthy state, and the tubercles present to the touch a well rounded form, with some little irregularities, also more or less rounded, and of the firm texture so well recognized when felt in the lungs. But after a certain time, which varies considerably, but is always tedious, the tubercles commence to soften and to pursue the changes so well known from the works of Bayle and Laennec; the scrotum, immediately over the tubercle, becoming of a more or less livid red color, or sometimes even bluish, and thinner and thinner till it terminates in ulceration, when the tubercle escapes in a yellowish pus-like liquid—generally furnished at the expense of the cellular substance—in which it is easy to recognize the caseous particles formed by the tubercle. If, instead of permitting the ulceration of the skin, and the escape of the tubercle by suppuration, it is cut into soon after its formation,

the matter will be found in a concrete form, and will escape, of itself, through the artificial opening, by the simple contraction of the surrounding parts. The course of these bodies to suppuration is not the same in all cases, as regards the duration; and in the same case, one nearly always progresses more rapidly than another, so that it is not uncommon to see in the same testicle, one abscess opened and discharged, and find newly developed tubercles still in a hard state within a few lines of it. When seated in the epididymis, their course to a discharge externally is always more rapid than when situated in the body of the testicle, the fibrous coat of the latter always opposing, strongly, a suppuration towards the surface. After the discharge of the matter, the scrotum presents an appearance highly characteristic of the disease. At this time we find one or more cavities or depressions, externally of an unequal surface, communicating with the cavities internally by a course more or less direct, but most frequently tortuous and fistulous. The internal cavities are points caused by the inflammation consequent on the suppuration of the tubercle, and are divided sometimes into little cells, by irregular partitions, the sides of which are filled with a softened tuberculous matter, which preserves the discharge for a long period. As these close—a termination much to be desired, but very difficult to obtain—there is left an irregularly depressed cicatrix, of the size of a small shot or pea, which always shows more or less loss of substance, and marks, forever, the fistulous opening caused by a softened tubercle. But most frequently these openings constitute the most annoying symptom in the case, as, after the tubercle is discharged, we do not find it easy to cause adhesion, owing to the movable nature of the parts, the constant discharge and the hardness of the parietes of the fistulæ. In some cases the difficulty is increased by the discharge of the seminal fluid, especially during dreams or the venereal orgasm. After the opening has remained a few days, nature attempts the cure by the formation of granulations about the fistulæ. Should the case be presented to us at this moment, it would not be difficult, at first sight, to mistake it for an ulcerated cancer of the testicle, from the tint of the skin, the increased size and hardness of the parts, and the fungous granulations; but a little reflection will solve the difficulty, and render clear the diagnosis.

Diagnosis.—Tubercles are never the seat of lancinating pains; their compression does not cause pain, at least till the surrounding

tissue is inflamed; their hardness is less than that of scirrhus, and greater than that of the encephaloid tissue; they are almost always numerous, and developed in the epididymis in preference to the testicle. Cancer, on the contrary, prefers the body of the testis. Tubercles also go through peculiar well marked changes from deposition to softening, their surface being smoothly rounded and circumscribed to the touch. Scirrhus on the contrary is generally irregular, is found in lobulated masses of an irregular shape, and seldom in its commencement prevents our feeling the healthy portions of the testis at a point *distinct* from its seat. Tubercles most frequently are developed indiscriminately, and if we feel the testis, it is in the intervals *between* each tumor, and when they reach the period of softening, their course is indolent, the discharge is peculiar, the lymphatic ganglions undergo no change, and the general health is not seriously affected. When, on the other hand, cancer ulcerates, its course is rapid, there is great sensibility even in the granulations, and the discharge is often colored with blood. In tubercles the matter is like pus, contains portions of the tubercle in a majority of the cases, and never is colored with blood, unless produced by accidental causes.

Prognosis.—Should the substance of the testicle have not been affected, we can generally distinguish its usual size and figure, and its functions will not be sensibly changed. But should the tubercles originate in its body, the affection is much more serious, as the seminiferous ducts can escape from the openings, as in the cases reported by Swediaur,¹ a consequent weakness or atrophy being produced. Dupuytren has remarked that in some cases where the disease existed a long time, “the testicle became softened, and fungous, and similar to the tissue found around the articulations attacked with white swelling.”²

Such is the usual course of the isolated tubercles to a cure by suppuration, and the question naturally presents itself, as to whether there are cases which can happily terminate by resolution? Many surgeons deny entirely the possibility of such a termination, but Mons. Berard affirms that it can. Delpech also states, that he has seen cases “in which tubercles already softened have caused ulcerations, whilst new tumors, presenting the same characters and appearance as the former at a like period, have disappeared completely,

¹ Dictionnaire des Sciences Médicales.

² Leçons Orales.

either under a proper treatment or by the increased action in the parts consequent on sexual intercourse or the changes of puberty." He further says, "that there are even facts to prove that this true resolution of subcutaneous tubercles, can be favored or decided by the continued action of cantharides over the part corresponding to the organic lesion."¹

In the infiltrated tubercles, the case is more serious and more difficult of diagnosis, as the matter is very generally deposited throughout the whole body of the testis and epididymis. It differs, however, from the isolated, in the changes which it produces, being more general and less sensible to the touch, as in the body of the testis the matter is developed in its very substance, radiating the whole length of the fibrous prolongations of the corpus Highmorianum, and penetrating to the centre. In this state the whole body of the testis enlarges gradually, has a variable hardness, according as the matter is near or far from the surface, and an insensibility to pressure entirely different from the natural state, little or no pain being produced by firm compression when the matter is in a crude state, and has filled a large portion of the testicle. When it is in the epididymis, we find the whole or large portions of it engorged and knotted, affording to the touch the sensation of their being filled with caseous matter in which some portions remain harder than others. In a case of infiltration of tuberculous matter in the epididymis, seen by Mons. Cruveilhier, the tunica albuginea was thickened so as to separate it from the body of the testis, the former of which was one tuberculous mass, so much enlarged, that it was almost impossible to find any sign of the primitive tissue, and the matter had softened in spots, the largest of which was in the globus major. In the isolated tubercles, dissection generally reveals a portion of the structure untouched by the disease, but on the whole the diagnosis is difficult between these and the infiltrated, the great difference being that the isolated form numerous globular tumors, *distinct* and salient at the surface, whilst in infiltration there is a general increase of the part in size and density without there being much alteration in form.

Tuberculous infiltration frequently destroys a part or the whole of the functions of the organ, and its cure is always difficult. As

¹ *Maladies Chirurgicales*, tome iii. pages 633 and 635.

a tuberculous affection, three questions of considerable interest present themselves:—

1st. Has the patient, affected with tubercles of the testis, necessarily the same bodies developed in the lungs?

When we consider that tubercles of the testis most frequently affect persons of a lymphatic temperament, and that they are developed at an age when phthisis pulmonalis is most common, we might reasonably fear that this complication would exist, at least in a great number of cases. Mons. Berard, however, cites but few where the disease invaded the lungs and the testicle at the same time; in all the others, the testicle alone appeared to be affected, and the patient offered no sign of a pulmonary affection, even some time after their cure.

2d. Ought the presence of tubercles in these organs to authorize the operation of castration, in order to prevent their development in the more important parts?

As we know nothing to prove that tuberculous matter when absorbed has the power of provoking the formation of these tumors in other organs, we might readily answer in the negative. Cruveilhier, however, regards this question as depending on *the seat* of the tubercles; and says, that when the tuberculous matter exists in the epididymis, we ought not to have recourse to castration, but that when it is in the body of the testis, the operation may be necessary to relieve the existing symptoms. Yet, as castration is sometimes fatal to happiness, he advises the attempt to cure the affection, even if obtained at the expense of an atrophied testicle, and the consumption of a long period in the treatment. Berard also opposes decidedly the operation of extirpation, preferring the cutting into and removal of the portion affected, to the entire removal of the gland. It ought, however, to be noted as an observation on the part of Cruveilhier, that where the *tuberculous* testis has been removed, the success has been nearly constant, and without a reappearance of the disease in other parts; whereas, the reverse is the case in the extirpation practised for cancer, the success being much less, and the relapses much more frequent.

3d. Can the tuberculous testis pass readily to a cancerous state?

The opinions on this point seem to be very much divided, many believing that it can. Nevertheless, Berard denies it entirely, and says that, in cases where the cancer has appeared to succeed tubercles, there has existed a complication of the two diseases. Cruveil-

hier likewise reports one or two cases of a similar complication, and one case under my own observation in the wards of Mons. Velpeau, at La Charité, supported the same opinion.

Salle St. Augustin. No. 38.—Pimber, cabinet-maker, aged 36 years, entered February 19, 1840, with an enlargement of the right testis. The testicle was of the size of an egg, oblong, irregular in shape, being larger at its upper portion, lobulated, and presenting different degrees of consistence. At the lowest part it is elastic, soft, painful on pressure, and evidently belongs to a sound part of the testicle; above this, on the inner portion towards the raphé, is a small fluctuating point, external to which is a harder portion, connected apparently with the firm lobulated structure, forming the enlargement at the upper extremity. The epididymis is readily felt at the lower part, in a healthy state, but at the upper is not to be distinguished from the mass of the testis; the cord is natural, the scrotum soft, relaxed, movable over the tumor, and exhibits two cicatrices, from which the patient says matter escaped nearly eight months ago. General health excellent; complexion good; has had both chancres and gonorrhoea, but was never mercurialized; he dates the disease back to 1838, two years since; does not recollect how it commenced, but believes the cause to have been a blow received in mounting a horse; the scrotum he states was always long, and wearing loose pantaloons, the parts were caught under him as he sprung from the ground to the horse's back. He was in the hospital eighteen months since, but left it, being unwilling to submit to treatment. Since that period, has undergone every remedy, as leeches, scarification, hydriod. potass., iodide of mercury, fumigations, &c., but without any change in the tumor, which has continued to increase, and progressed rapidly within eight or ten weeks. The operation of castration was performed on him, by Velpeau, February 24, 1840, by means of an incision in the scrotum, turning out the testicle and cord, the latter of which, with all its vessels, &c., was included in a ligature and divided by the bistoury. On opening the testicle longitudinally, several structures were presented. The upper portion was composed of an encephaloid tissue which occupied nearly the whole of the shell of the testis; near the middle was one large tuberculous mass, the size and shape of a chestnut, with one or two smaller ones near it. The cyst contained a fluid not recognized as peculiar to any of these portions, and the lower part of the testis was unaltered, with the exception of a small

tubercle near its centre; the epididymis was sound throughout. The wound was healed by granulation, and the patient is now, March 17, nearly recovered, having had no bad symptoms. The other testicle is perfectly healthy.

Treatment.—The constitutional means likely to counteract the lymphatic temperament of the individual, constitute the most important part of the treatment during the whole course of the disease, such as the use of mild tonics, especially the ferruginous preparations, and all those remedies which the knowledge of the predisposing cause of the disease would indicate. The avoidance of all means likely to produce a contusion of the scrotum, or an inflammation of the parts, ought also, it is hardly necessary to say, to be strictly enjoined. The local remedies will vary according to the state of development of the tubercles; thus, during their crude state, the employment of means likely to produce their resolution, as irritating friction, which, by increasing the circulation, may change the vitality of the part, as preparations of iodine, of mercury, or of cantharides, continued for some time, and afterwards covering the parts with a soap plaster and the constant use of a suspensory truss. Nevertheless, we must watch carefully the action of these substances, lest the inflammation should go too far, and produce a suppuration of the tubercle, a termination always to be avoided. The complaint of pain on the part of the patient ought, therefore, to be the signal for the use of emollients. But in most cases it will be in vain to attempt a resolution, as the natural tendency of tubercles here, as of other foreign bodies, is to an escape by suppuration, the tubercle not only producing an inflammation of the parts around it, but this inflammation causing suppuration, which will sooner or later terminate in ulceration.

When the matter is once formed, ought we to wait till fluctuation be perfectly distinct before opening it, or ought we rather to give a prompt issue to the softened portions?

Berard advises strongly an early opening, as tending to prevent any considerable thinning of the skin, and the formation of fistulæ or even a true abscess between the softened tubercle and the scrotum. The effect of allowing the natural discharge of this matter by ulceration cannot be better shown than by the following case:—

Salle St. Ferdinand. No. 10.—Paquier, aged 41 years, carter, entered the wards of Velpeau, on the 28th of January, for an affection of the testicle. In May, 1839, whilst loading his cart, he re-

ceived a blow on the testicle, from a bar of iron, which produced the pain and faintness usual immediately after an injury to this organ. It did not, however, prevent his continuing his work till towards September, when the swelling and hardness of the parts induced him to consult a physician, by whom he was leeches, kept in bed, and had ointments rubbed on the scrotum. After a continuance of this treatment, he was again obliged to resume his work, and continued at it without noticing particularly the parts, till the 8th of Nov., 1839, when it became painful and inflamed externally. This obliged him again to consult his physician, by whom he was leeches and afterwards poulticed, but was obliged to continue at his work till the end of December, when he was confined to his bed, and again submitted to treatment of a similar nature till an abscess opened in the lower part of the scrotum, when he was sent to the hospital from want of funds. On his entrance, the left testis was the size of a large egg; the scrotum very much relaxed; of the natural color, at the upper part, but below of a deep bluish-red, especially at the sides of the abscess, where the skin was very thin, ragged, and disposed to sloughing. The cavity made by the abscess would admit the end of the forefinger, and the matter had extended under the integuments of the perineum, where a second abscess had formed. This was freely opened by Velpeau, and gave exit to a pus-like matter, mixed with a little blood. A further examination of the testicle showed the epididymis to contain tubercles throughout its whole extent, presenting hardened masses, which I cannot better describe than by saying as if filled with peas, some of which had been mashed. The testicle also was enlarged, but seemed to be more the result of the inflammation near it than of disease in its substance, its sensibility and elasticity being preserved. The right testicle is perfectly natural, as is also the scrotum on this side of the raphé, but several tubercles in a crude state can be felt in the upper part of the epididymis, of which the patient is not aware, as he complains of nothing unnatural in this gland. His general health has always been good, and he has never before had an affection of the testicle, though he suffered from chancres when young.

After the opening of the abscess, Velpeau directed the use of cataplasms to the part, and good diet, under which treatment he continued for some time; the edges of the scrotum having sloughed off, and showed a tendency to granulation, when a change took

place, the ulceration seemed to have recommenced, and he has had several hemorrhages from the part, without it being possible to distinguish the point from whence it comes. He is now, March 26, 1840, still under treatment, with the prospect of having to submit to castration.

It hardly admits of a doubt that had this case been differently treated, previous to its entrance into the hospital, much of these results could have been prevented, as a free incision would have prevented the burrowing of the matter, and ulceration of the skin, and left the parts in a state more favorable to cicatrization. If, however, fistulæ are formed by the natural discharge of the matter, we must, after giving free vent to the discharge, attempt to provoke adhesion by stimulating injections, of which those of port wine, lime-water, a solution of sulphate of copper, of the nitrate of silver, or of tinct. cantharid. are those most constantly employed. Should the fistulæ still continue, the treatment must be persevered in, varying the injections, or adding thereto, as recommended by Berard, douches of sulphurous, saline, saponaceous or chalybeate waters. The removal of the hardened sides of the fistulæ by the knife, or by caustics, as the acid nitrate of mercury, will frequently hasten their adhesion. Notwithstanding, sometimes, the employment of all these means successively, the duration of the fistulæ will be tedious, but they will heal sometimes of themselves, though after a long period. In the case of a sailor, who entered La Charité, in October, 1839, for a contraction of the tendons of his feet, numerous tubercles of the testis in a crude state were found in the right testicle, whilst several cicatrices remained in the scrotum, from which, according to his account, matter resembling shreds of beef had escaped for a long time. He stated that when in Africa, nearly three years previous, he had bruised his testicles by falling on some rocks, but had never been treated for it. Some months after, matter was discharged from the scrotum, without his suffering very acute pain, and this matter continued to escape by different openings from time to time, during two years, when the fistulæ closed without treatment, and he thought so little of their existence, that he had said nothing of it on his entrance to the hospital.

The great difficulty of obtaining the resolution of tubercles, makes us foresee that their softening will bring on ulcerations in the scrotum, and fistulous openings, difficult to cure. Would it

not, therefore, be better to anticipate this termination, and incise at an early period the hardened and encysted tubercle? Would not also the wounds resulting from this operation be more disposed to a prompt cicatrization? In one case, where the brother of Berard recognized the presence of large tubercles in the testicle, a large incision made on the part caused the exit of the mass by means similar to the extraction of a kernel from a nut, and the cure was radical and prompt: but the testicle rested completely atrophied. Perhaps it would have been possible to have prevented this atrophy by incising the tubercle alone, and avoiding any injury to the substance of the testis, whilst in the epididymis it would most probably be always successful. It would, however, be only applicable to cases where the tubercles were isolated, when, as has been shown, the seminiferous tubes are rarely affected by their existence.

PART XV.

AFFECTIONS OF THE ANUS AND RECTUM.

THE connection of the rectum with the process of defecation, and the daily recurrence of this act, render the disorders of this portion of the alimentary canal a subject of interest, not only to the patient, as involving his comfort and general health, but also to the surgeon, owing to the difficulty sometimes encountered in removing the results of diseased action in a part which, besides being very liable to all the ordinary results of inflammation, is also exposed to the risks of a free hemorrhage, that cannot be readily controlled when the tissues have been incised.

Anatomical Relations.—Without entering into a detailed account of the structure of the rectum, it must suffice, at present, to call attention to the fact that the different coats which form this bowel are loosely applied to each other; that the rectum itself is surrounded by a free cellular tissue, which is more or less filled with fat, especially near the anus; and that, in addition to the arteries which supply it with blood, it is freely furnished with veins that anastomose in all directions, and form, at its inferior end, near the margin of the anus, a plexus, or network, that is designated as the *hemorrhoidal plexus*. This venous plexus lies in the cellular coat of the rectum, immediately beneath its mucous coat, and when enlarged by disease, also encroaches on the muscular coat. The internal sphincter muscle, it should also be remembered, is so freely traversed by this plexus of veins that, when hemorrhoidal tumors are formed, the muscular fibres are sometimes spread around the pile, and, in some instances, appear to constitute a small portion of the tumor, or are so incorporated with it, as to render it difficult to separate them. The hemorrhoidal plexus of veins communicates

directly with the inferior mesenteric vein, as well as with the hypogastric; hence, whatever compresses the abdominal contents, is liable to produce congestion of the hemorrhoidal plexus.

The disorders of the rectum may be briefly alluded to as those affecting the *anus*, or its external orifice; those affecting the adjacent cellular tissues; those which involve its *coats*, and those which develop changes in its *veins*.

SECTION I.

AFFECTIONS OF THE ANUS.

The skin covering the margin of the anus is liable, like the skin of other portions of the body, to the development of inflammatory action, which is here aggravated both by the friction of the cheek of one buttock against the other, as well as by the constant passage of the *fæces* over it. In addition to the ordinary results of inflammation of the skin, as congestion, suppuration, and ulceration, the integuments of the anus are especially liable to a form of vesicular disease that constitutes a true eczema—is the source of great annoyance to the patient, and is not unfrequently regarded as due to disease within the rectum, instead of being, as it frequently is, purely an external disorder of this region, though perhaps first excited by irritating discharges from the rectum.

§ 1.—ECZEMA OF THE ANUS.

Symptoms.—Eczema of the anus, like the eczema of other regions, is seen either as an acute, or, more frequently, as a chronic disorder. When acute, it is preceded by a constant sense of burning and itching, which the patient assigns to the chafing of the parts, and the continued itching of which usually continues to be one of the most annoying features of the disorder. A close examination will now show the edge of the fold of the buttock, as well as the margin of the anus, to be red, hot, moist, and abraded of cuticle, whilst at other points, minute vesicles, filled with serum, will be seen scattered around, as in the ordinary form of acute eczema of other parts. As

the fluid escapes by the rupture of these vesicles, it may be either clear, like serum, or slightly yellowish in its tint, staining the linen of the patient, and forming on the skin around the anus, when it dries, the thin white or yellowish scales which are characteristic of eczema; or, if the affection is chronic, it will leave the parts of a dark reddish color, with a slight crust on them, like that often noted on the legs, in connection with ulcers, and known as *chronic eczema rubrum*. Not unfrequently this irritation is also found upon the thighs and scrotum of the male, and on the pudendum and perineum of the female, being often the result, in the latter, of the irritation caused by leucorrhœal discharge.

Etiology.—Eczema of the anus may be developed by any cause that will induce congestion and superficial inflammation of the skin; thus, it is frequently the result and attendant of hemorrhoidal tumors, the capillary congestion created by the enlarged rectal veins, as well as the ichorous matter which flows from such tumors as are ulcerated, creating precisely the same condition of the skin about the anus that is seen on the legs, and has already been alluded to as one of the sequelæ of leg ulcers.¹ Fissure of the anus, fistula in ano, prolapsus ani, &c., may also give rise to this disorder, though the irritation thus caused is not unfrequently regarded merely as a symptom of rectal disease, and treated accordingly, whilst it may be a distinct complaint.

Diagnosis.—The presence of one or more vesicles in the neighborhood of the anus, with the characteristic itching and burning of eczema as seen elsewhere, usually suffice to render the diagnosis easy, when the parts are carefully examined by placing the patient on his back before a good light and then elevating and opening his thighs, so as to see clearly the entire perineum. When the examination is made from behind simply by opening the cheek of the buttocks, the folds of the skin, and the hair, &c., as found in the adult, often conceal the characteristic vesicles.

Patients.—Adults, both male and female, who are fleshy, constipated, and subject to hemorrhoids or fistula, are those mostly affected, though such as are thin and of the tuberculous diathesis also suffer from the complaint.

Prognosis.—The prognosis of eczema of the anus will depend

¹ See page 132.

upon the cause of the irritation. Usually, the patient can be readily relieved of the complaint when it is acute; but unless the hemorrhoidal congestion can also be removed, or when the disease is chronic, the prognosis as regards the cure should be guarded, the complaint being occasionally very difficult to cure, unless the functions of the rectum can also be restored to their normal condition.

Treatment.—When this external irritation of the anus is the result of constipation, or of a varicose condition of the hemorrhoidal veins, or of external piles, the administration of an active mercurial purge is always beneficial, the bowels being subsequently kept in a soluble condition by the administration of sulphur and magnesia, so as to correct acidity, after which the chief reliance must be placed on local remedies. These local applications should be regulated by the extent and character of the inflammation. If the eczema is acute, and accompanied by much burning and a free serous discharge, nothing will afford greater relief than frequent bathing with lead water, or the application of pieces of lint wet with the same, the lint being retained by the use of a T bandage; but when the disease is more chronic in its character, and presents a dry, scaly appearance, with intolerable itching, the warm water dressing—that is, lint saturated with warm water, and covered by a piece of oiled silk—will prove most soothing; or the patient may steam the part by sitting over a vessel of hot water; but poultices of all kinds are objectionable, owing to their adhering to the hair, so that they become a source of irritation; whilst if the latter is shaved off, the suffering of the patient will be increased in a day or two by the friction on the short ends that will grow again. Much relief from the itching may also be obtained from the following ointment:—

R.—Hydrarg. sulphuret. flavus grs. xv;
 Aconitiæ grs. ij;
 Pulv. camphoræ grs. v;
 Axungiæ ʒj.—M.

S.—Anoint the parts thoroughly, and rub it well in with a soft rag.

The dry, scaly condition may also be benefited after steaming by anointing the part with the following ointment:—

R.—Pulv. camphoræ,
 Sodæ carb., āā grs. x;
 Glycerin ʒj;
 Axungiæ ʒj.—M.

In the more chronic cases, especially if accompanied by a serous discharge, the following is also often very useful:—

R.—Hydrarg. chlorid. mit. ʒiiss ;
 Pul. plumbi acetat. grs. x ;
 Axungiae ʒj.—M.
 S.—Anoint the parts twice daily.

Should external or internal hemorrhoids exist at the same time, these should be appropriately treated, though even then the means above directed will prove highly useful.

§ 2.—FISSURE OF THE ANUS.

When a small deep linear or elongated fissure forms on the margin of the anus, and resembles very much the fissure seen on the lips in the condition usually spoken of as “chapped lips,” it is designated as *fissure of the anus*.

Etiology.—Fissure of the anus may arise almost without any appreciable cause, but usually it appears to follow on constipation in patients who strain violently, and in whom there is a deficiency in the ordinary mucous secretion usually found in the pouches formed by the extension of the mucous coat of the bowel between that portion of its longitudinal muscular fibres that has been designated as the “columns of the rectum.” Under these circumstances, the passage of the hardened and dry fæces apparently creates an abrasion or split in the mucous covering on the very margin of the anus, which soon develops such a spasmodic contraction of the fibres of the external sphincter ani muscle, as keeps the fissure open, prevents its healing, and thus exposes this linear ulcer to a continued irritation, by which its edges become thickened and hardened from the effusion of lymph. The spasmodic affection of this muscle is so constant and marked that writers have been at a loss to decide whether the affection of the muscular fibre was a cause or a consequence of the ulcer; but as the muscle lies beneath the membrane, and the latter is most exposed to the irritating causes just alluded to, it seems reasonable to regard the muscular affection rather as a result than as a cause of the fissure.

Patients.—Fissure of the anus is most frequently met with in adults, being rarely, if ever, seen in children, whilst it is much

more frequent in females than in males, probably in consequence of the greater tendency of females to constipation.

Symptoms.—Fissure of the anus first shows itself in the existence of a continued burning in one spot after going to stool, this burning and pain soon becoming of the most excruciating kind, and being accompanied by such a spasmodic contraction of the sphincter muscle as causes the fæces to escape as a narrow, flattened, tape-like piece, which is not unfrequently streaked with blood on the side which has touched the fissure, this being subsequently followed by a slight serous or purulent discharge, which amounts only to a few drops. The patient also is often unable to locate precisely the pain, which is sometimes complained of all round the anus, and extends to the bladder and down the thighs, or into the back in the course of the nerves. When the anus is carefully inspected externally, little or no change may be noted, though sometimes an external pile may be seen, near which a subsequent examination of the rectum by a speculum ani will discover the linear indurated ulcer. Any attempt to dilate the anus, even by the introduction of the little finger, will show that the sphincter is spasmodically contracted, whilst the introduction of the nozzle of a syringe will be intolerable. Under these circumstances, the patient should be thoroughly etherized, and then the anus being dilated by the introduction of the anal speculum, the fissure, with its indurated edges, may be recognized by a cautious examination.

Diagnosis.—Fissure of the anus, unless thus examined by a speculum, may be confounded with internal hemorrhoids, stricture of the rectum, fistula, &c.; but with the use of the speculum whilst the patient is in a state of anæsthesia the diagnosis may be rendered certain.

Prognosis.—The prognosis under a judicious course of treatment is favorable, and the cure usually prompt.

Treatment.—The indications for the treatment are to get rid of the induration—create a new and healthy ulcer and heal it as soon as possible. These indications may be best accomplished by the use of an anæsthetic, by a thorough dilatation of the anus by means of a speculum, and by the application of a piece of caustic potassa to the surface of the fissure so as to cause it to slough out, the further action of the caustic being immediately checked by washing the part thoroughly with olive oil, and then keeping the bowels free by the use of laxatives, the patient being directed to take a pint of thick

and cold flaxseed mucilage before each stool, so as to protect the ulcer from the irritation of the *fæces*. The subsequent healing of the ulcer is usually readily accomplished by anointing the part with belladonna ointment, and by the occasional application of the nitrate of silver. Injections of the infusion of rhatany (*krameria triandra*) have been found to be highly useful, acting probably through its astringency.

Rupture of the fibres of the contracted sphincter ani muscle by stretching it by the introduction of two fingers; or the division of the muscle by a subcutaneous section, are also said to prove useful by keeping the parts at rest, and permitting the approximation of the sides of the ulcer, and are worthy of trial, though the cauterization with the potassa is more certain in its results.

§ 3.—TUMORS OF THE ANUS.

The anus, owing to its proximity to the genital organs, especially in the female, often becomes the seat of condylomatous tumors as the result of syphilitic infection. When noted they should be treated in the manner directed for the removal of syphilitic warts. Any other tumors of this region, except those which are due to hemorrhoids, should be treated by extirpation like other tumors elsewhere, being sometimes due to obstruction of the sudoriparous follicles, or to true polypoid or lipomatous growths, the first being connected with the mucous coat of the rectum, and requiring the same treatment as polypi of the nose.

SECTION II.

AFFECTIONS OF THE RECTUM.

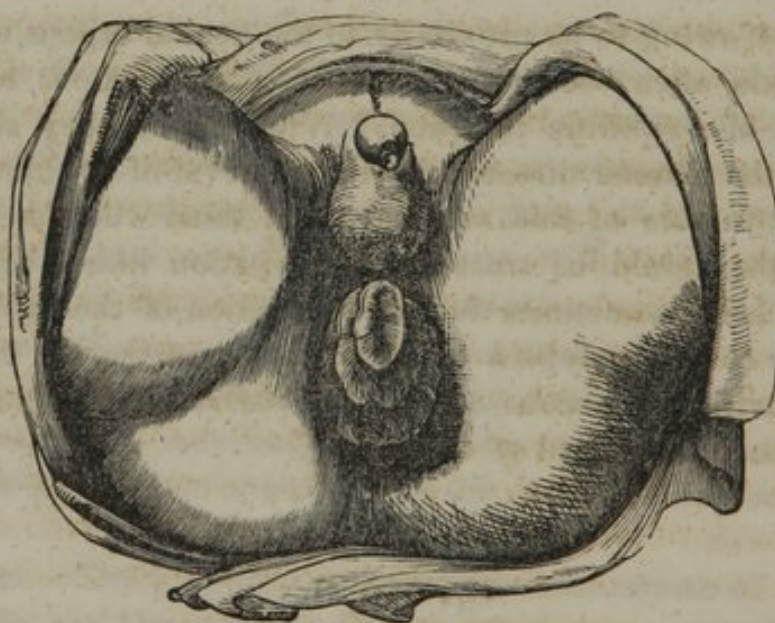
The affections of the *rectum* consist in the disorders which affect its mucous or muscular coats, its veins, and the cellular tissue exterior to the bowel. Some of these disorders, being only apparent at the anus, might have been placed under the affections of the anus; but as their origin is in the rectum, it is more correct in a systematic arrangement to locate them under the head of affections of the rectum.

§ 1.—PROLAPSUS ANI.

As the mucous coat of the rectum is very movable upon its muscular coat through the intervention of the cellular coat, it facilitates the escape of the fæces from the anus by protruding slightly over the edge of the sphincter ani muscle, as is well seen, though in a greater degree than in man, in the defecation of the horse. When thus protruded the action of the levator ani muscle again draws it within the sphincter, which closing firmly, retains it within its folds.

But when from various causes the sphincter ani becomes very much relaxed, or the levator ani loses its power, or the cellular tissue becomes infiltrated with serum, the protrusion of the mucous coat becomes more marked and permanent, or the bowel itself becomes invaginated and forms a tumor at the anus, which is

Fig. 251.



A full view of the Appearance of the Parts in Prolapsus Ani, showing the Circular and Concentric character of the Folds of the protruded Mucous Coat. (After Miller.)

known as *prolapsus ani*, or as "falling of the body," or sometimes is spoken of as "the body coming down."

Etiology.—The causes creating this condition in adults may be either such as tend to relax and weaken the attachments of the rectal mucous membrane, or such irritation as creates straining, and forces the bowel outwards, or it may be due to the extension of irritation from the bladder or adjacent parts—or to inflammation, as

after the tenesmus of dysentery. The various causes in children may be constant crying, straining long at stool, obstinate diarrhoea, dysentery, stone in the bladder, &c., whilst in the adult it also often ensues on constipation, on hemorrhoids, on the use of aloetic purges, or on the constant use of purgative enemata; the relaxation of the anus is also created in men by the free use of tobacco.

Symptoms.—After an effort at stool, a tumor is found at the anus, which is soft, pinkish, corrugated, and evidently covered by a mucous membrane which shows evidences of congestion if firmly constricted by the sphincter ani muscle, becoming darker and more purplish in its color, and inflamed, hot, and painful, if not soon replaced. When of long standing, the prolapsed portion becomes hard, firm, and resisting from the effusion of lymph into the sub-mucous cellular tissue, which renders it difficult to replace it, but when recent, the tumor will often disappear within the rectum by its own contraction, or may be readily replaced by the gentle pressure of the fingers. When a chronic, thickened and constricted tumor becomes more or less permanent in its position, congested, indurated, and difficult to reduce, and is then also violently constricted at the anus, it may inflame, suppurate, ulcerate, or slough off, as is sometimes seen in the chronic tumors of old people in almshouses and hospitals where the prolapsus has been long neglected.

Patients.—Prolapsus ani is met with at both extremes of life, being often seen in children under three years, and also frequently developed in adults over sixty years of age.

Diagnosis.—Prolapsus ani may be told from hemorrhoids or piles by the fact that the tumor in prolapsus is usually a mass formed of continuous and concentric circular folds around the anus, and presents a villous like surface, whilst hemorrhoids are more or less distinct tumors, resembling in size and color the intestine of a chicken if distended with indigo water and tied every half inch or two inches in length. Hemorrhoids also do not create as bulky a tumor as prolapsus ani—are much more painful, and bleed more freely, and whilst the tumor of prolapsus is returnable into the rectum in mass—hemorrhoids require to be replaced one after another. Prolapsus ani is common in young children, but hemorrhoids are not seen except in the adult. The fore-finger will also readily pass through the sphincter ani muscle without causing pain in prolapsus, as the anus is relaxed, whilst it is contracted and quite

painful in hemorrhoids. Condylomatous tumors being due to syphilis, can be told from prolapsus ani by the history of the case, and by the symptoms which have been already detailed.

Prognosis.—The prognosis of a recent prolapse of the rectum is favorable, but in the old tumors of aged adults it should be guarded; for, though the tumor may be returned, the sphincter ani muscle is usually so much relaxed, that it is difficult, and sometimes impossible to prevent the reproduction of the tumor at the next effort at defecation.

Treatment.—The indications in the treatment are, 1. To reduce the prolapsed rectum promptly; 2. To retain it within the sphincter ani; 3. To remove the cause of the disorder.

1. The reduction of the prolapsed portion of the rectum may usually be accomplished by placing the patient in the horizontal position, and anointing the entire tumor, as well as the fore or the first two fingers of the surgeon's hand with olive oil or lard; then, pressing upon the centre of the tumor, carry a fold of it up into the rectum within the sphincter ani muscle with the fingers of one hand, and pushing up another fold with the other fingers, retain the first until the second is nearly within the sphincter, continuing the manipulation till the entire tumor is restored, when a piece of cerate should be placed over the anus, and held there for a few hours by a compress and T bandage. The prolapsus of children does not usually demand so much manipulation, and, when once returned, does not require the employment of a compress, as it will remain reduced until the next effort at defecation. Much may be done, both in adults and children, to prevent the recurrence of prolapsus by requiring them to sit on a seat which is inclined at an angle of 45° to the horizon, so as to throw the weight of the intestines upon the abdominal parietes, and prevent the action of the muscles from compressing the rectum in a perpendicular line. The seat upon which they stool should also have a very small and narrow opening, not more than four or six inches wide for an adult, so as to support the cheek of the buttock, and thus aid in the lateral compression of the anus at the moment of defecation. If the prolapsus is due to constipation, laxatives should be constantly employed, whilst if it is due to the tenesmus of dysentery, injections of laudanum will prove useful, ascarides and worms in the bowels being removed by an appropriate treatment. The retention of the bowel after its production may generally be accomplished simply by the

use of a compress, or a pad attached to a vertical spring, which is fastened to a band around the pelvis, such an instrument being made by the cutlers, and often proving useful in the bad cases sometimes met with in old people. Sometimes it may become necessary to employ, for a few days, a rectal pessary, so as to give the mucous membrane an artificial support, especially if the sphincter ani is much relaxed. Should the tumor be very much congested and inflamed, it will be best to keep it constantly bathed with cold water for a few hours previous to attempting its reduction, or it may even require the local abstraction of blood by leeches around the base of the tumor.

In some cases benefit will be derived from injections of the infusion of rhatany, or weak solutions of the tinctura ferri chloridi, in the proportion of twenty drops or a drachm to the ounce of water, the strength being regulated by its stimulation, which should never be sufficient to cause pain. The decoction of white oak bark, or an ointment of ten grains of tannic acid to the half ounce of lard, a portion of which is to be placed within the anus, is also often highly serviceable.

When the sphincter ani and the verge of the anus are very much relaxed, an operation may be demanded, whilst the tumor may require the removal of a strip of the mucous membrane, or the application of caustic, or a ligature, for its radical cure in the chronic prolapsus of adults, as is described in the *Operative Surgery*, vol. ii. p. 334, 2d edition.

§ 2.—FISTULA IN ANO.

Fistula in ano is the result of an abscess in the neighborhood of the rectum, the term fistula being generally applicable to all abscesses which are discharged by narrow pipe, or reed like canals.

Etiology.—Any cause that will excite an inflammation around or in the rectum may, by creating a rectal abscess, become the cause of fistula in ano; thus hardened fæces, by irritating the anus, or the congestion of the mucous membrane consequent on straining, or the continuance of hemorrhoidal tumors, or the lodging of foreign substances across the rectum, as pieces of undigested food—or particles of bones, &c., taken in food—riding on horseback—as well

as external injuries from various causes, may all develop this condition.

Symptoms.—Fistula in ano being always preceded by an abscess near the rectum, its earlier symptoms are those of abscesses, as pain, heat, and swelling about the buttock, with heat and irritation of the rectum, and severe pain on going to stool. If the abscess opens outwardly, it also presents the usual evidences of abscesses beneath the skin, as tumefaction, redness, pulsatile pain, ulceration of the skin, and the escape of pus; after which the discharges may continue to become thinner and more sanious, so as to create excoriation and eczema of the margin of the anus, whilst the effused lymph on the borders of the abscess will give to the part a degree of density which prevents the sides of the abscess from collapsing, and thus creates a fistula. The orifice left by a fistula when it is external is usually small, being so small that it is sometimes difficult to introduce a probe into it, whilst it often presents the teat-like prominence with the little pit in its centre that is characteristic of fistula elsewhere. Sometimes this fistula is exceedingly sensitive, the introduction of a probe causing great suffering, this being usual in the acute cases; but in the chronic, the parts are quite callous—the skin is purple and thickened, and there is little inconvenience caused by an examination of the fistula with a probe. Sometimes a fistula in ano is associated with the development of tubercles in the lungs, the origin of the anal abscess having apparently been the deposition and softening of tuberculous matter in the cellular tissue around the anus. As a general rule, this variety of fistula is less sensitive than that consequent on an ordinary phlegmon, and is also associated with the general symptoms of the tubercular diathesis. Flatus and fecal matter are often mixed in the discharge of any fistula in ano when it communicates directly with the rectum.

Varieties.—Owing to the fact that the abscess which creates fistula may open at various points, surgical writers formerly described several varieties of this disorder, though all due to similar causes. Thus, when the abscess established an opening by pointing through the rectum, it was called an *internal* fistula. When it opened outwardly and near the anus, it was designated as an *external* fistula. When there was a direct communication from the skin into the rectum, it was spoken of as a *complete* fistula, and when it opened only inwardly or outwardly, it was described as an *incomplete* fistula. When the abscess was disposed to point outwardly, but the skin had not ulcerated, the condition was also often alluded

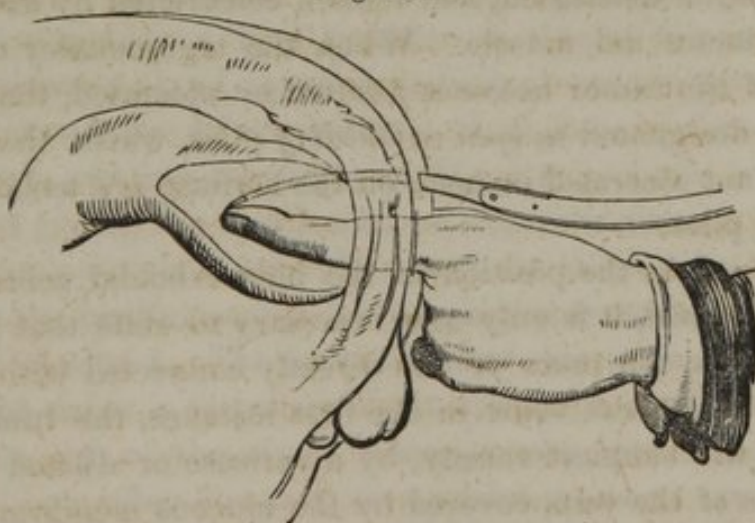
to as *blind* fistula, a very incorrect term, as such a condition was only that of a phlegmon or abscess near the rectum which had not opened. In fact, many of the symptoms often assigned to fistula in ano, properly indicate only an anal abscess, no fistula, or pipe-like cavity existing.

Diagnosis.—The history of the abscess, the slender depressed orifice of the fistula, the introduction of a probe, and the continued suppuration from one or more distinct points, suffice to render the diagnosis of fistula in ano quite easy if a thorough examination is made.

Prognosis.—The prognosis of fistula depends upon circumstances, as one which is due to a tuberculous abscess, or is associated with tubercles on the lungs would be more serious, owing to the pulmonary complication, than one occurring in a better constitution; whilst a recent fistula would be more readily healed than a chronic one. Generally, however, the prognosis as respects the fistula itself is favorable, most of them being susceptible of being cured; but the time, as well as the subsequent condition of the parts, will depend upon the patient's general health, and on the ordinary steps of inflammatory action in healing an indolent ulcer, the indurated fistula being nothing more.

Treatment.—The treatment of the abscess that precedes fistula in ano is that of other abscesses, *i. e.*, the application of heat and

Fig. 252.



A section of the Body showing the division of the Rectum and Sphincter Ani Muscle in the treatment of fistula in ano. (After Miller.)

moisture, the early evacuation of the pus, and the removal of all irritation in the part, by perfect rest; by quieting the action of the

sphincter ani muscle, and by the free use of laxatives. When a true fistula forms, it is necessary to prevent the action of the sphincter ani muscle by dividing it, and then healing the fistula by such general and local means as will remove the induration of its edges, and favor the formation of granulations. The section of the sphincter ani muscle may be accomplished by introducing a bistoury, and cutting outwards, as shown in Fig. 252, or by the use of a ligature.¹ The after-treatment is to be conducted by the application of such means as will hasten the formation of granulations, these being made to form from the deepest point before the edges of the skin are allowed to heal.

§ 3.—HEMORRHOIDS, OR PILES.

Hemorrhoids (αἷμα, blood, and ρέω, I flow) is the name which designates that condition of the rectum which is accompanied by the presence of several small tumors, from which blood not unfrequently flows.

Seat.—The usual seat of hemorrhoids is the lowest extremity of the rectum, or the margin of the anus.

Varieties.—Hemorrhoids are designated as *internal* and *external*, according as they are naturally formed within or without the sphincter ani muscle, though those which are usually internal may be protruded in defecation, and remain constricted by and external to the sphincter ani muscle. When the tegumentary or mucous covering of the tumor becomes fissured or ulcerated, they are also sometimes designated as *open* or *bleeding* piles, whilst those tumors which are not ulcerated or open on the surface, are usually spoken of as *blind* piles.

Pathology.—As the position of the hemorrhoidal veins has been already described, it is only now necessary to state that all hemorrhoidal tumors are more or less directly connected with some diseased action in these veins in the first instance, the tumors being formed in the simplest variety, by a varicose or dilated condition of the coats of the vein, covered by the mucous membrane or skin, resembling closely in their character the condition of varicose veins

¹ For the details of these operations, see *Operative Surgery*, vol. ii. p. 341, 2d edition.

in the leg. In other cases, the hemorrhoid is formed by effusions of lymph and blood into the subcutaneous cellular tissue, this forming the more solid and less vascular tumor generally seen in external piles. When hemorrhoids have existed some little time, and been frequently inflamed, the ordinary changes of inflammation are to be noted in and around them, such as induration of tissue, ulceration, suppuration, and an increased secretion, with a modification of the natural action of the mucous membrane. Sometimes the enlarged veins are so incorporated with the sphincter ani muscle that a few of its fibres will be found spread over or incorporated with the tumor.

Etiology.—The local causes of hemorrhoids may be anything that will create engorgement and distension of the hemorrhoidal veins, as straining from constipation, pregnancy, constant sitting on warm cushions, whilst the excessive use of tobacco, which relaxes the anal muscles and favors congestion of the part, with a plethoric habit, or the congestion created by irregular menstruation, &c., may act as predisposing causes.

Patients.—Hemorrhoids are seldom or ever seen in those younger than eighteen years of age, being generally met with in the prime of life, though they are not unfrequently found in those as old as sixty-five years. They may attack either sex, and especially those who lead sedentary lives, or are dyspeptic.

Symptoms.—As hemorrhoidal tumors are due to vascular changes in the rectum, which induce inflammatory and neuralgic irritation, the earliest symptom of their presence is that of fulness and irritation, or soreness about the anus, which is especially marked for an hour or more after an evacuation. Soon these sensations become more distinct, creating the sensation of a foreign body being in the rectum, and giving rise to a feeling of dissatisfaction, or a repeated desire to stool, the pain extending towards the sacrum and spine, or towards the bladder and down the thighs, from the nervous connections of the part. The fæces are now sometimes streaked with blood, or the paper is tinted, or about a teaspoonful of blood escapes towards the end of the stool, itching is also developed near the anus, this being often due to eczema, whilst the parts are constantly moist, and the linen soiled with pus or blood. The escape of blood usually gives temporary relief, but, if often repeated, creates evidences of anæmia. At the next stool the tumors may be more engorged, and the patient will recognize their presence with the

finger. If they continue to be constricted by the sphincter ani, or any irritation increases the afflux of blood to them, they also become more tumid, hot, and painful, and if now inspected, will be found violet-colored, smooth, shining, and exquisitely painful to the touch. As the irritation continues, the sphincter ani participates in it, and becomes spasmodically contracted, causing the patient to scream with the shooting character of the pain, whilst defecation creates horrible torture, the tumor then becoming much blacker and larger, and terminating sometimes—if left unreduced—in sloughing of the part after a day or two. Sometimes, on the contrary, the spasm passes off, and the tumor becomes less engorged, until, after 48 hours, it becomes flaccid, and the patient may be comparatively comfortable, or only suffer at the periods of defecation. The constricted condition, with the irritation and intense suffering just described, is usually said to be due to a *fit of the piles*. The long continuance of hemorrhoids usually causes great disorder of the digestive, circulatory, and nervous organs, the patient being liable to dyspepsia, flatulence, colic, and a sense of constriction, or of sinking about the umbilicus, whilst he is troubled with palpitation of the heart, a quick, irritable pulse, dyspnoea, and the other evils of anæmia. Not unfrequently his entire moral character is changed, becoming cross, peevish, irritable, and irascible, quarrelling with every one, and not unfrequently resorting to the use of alcoholic drinks or opium to deaden his sensibilities.

Diagnosis.—The knotted character of the tumors; their position on the side, and not in the centre of the anus; their violet color, their bleeding, &c., generally render the diagnosis of hemorrhoids easy.

Prognosis.—The prognosis of this disorder is decidedly favorable, unless complicated with bad prolapsus ani, in an old and broken-down patient, when it should be guarded; but I regard every case of hemorrhoids, not thus complicated, as susceptible of being cured, with safety to the patient, if Horner's operation is performed.¹

Treatment.—The treatment of hemorrhoids may be either palliative or radical. The palliative consists in administering, every day, before the patient goes to stool, an injection of a full pint of cold flaxseed mucilage, or of cold water, though the first is the best. Then the parts after defecation, should be well bathed in cold water,

¹ See Operative Surgery, vol. ii. p. 339, 2d edit.

the bowels kept free by mild purgatives, and some of the balsams, or terebinthines, be occasionally administered. The following is a remedy which will often prove serviceable, especially when the tumors are ulcerated, and bleed, as it acts directly on the mucous membrane:—

R.—Pulv. resinæ ʒj;
Bals. copaibæ fʒss;
Mel despumat. ʒivss.—M.

S.—A tea or dessert-spoonful at bedtime, each night, till the bowels become free, and the irritation is relieved.

Comfort will also be obtained from the use of anodyne and astringent ointments.

R.—Pulv. acidi tannici grs. x;
Pulv. plumbi acetat. grs. v;
Ext. aconitum nap. ʒss;
Axungia ʒss.—M.

S.—Anoint the part thoroughly.

When the tumors are external, attention should also be given to the existence of eczema of the anus, which should be treated as before directed.

The radical treatment of hemorrhoids consists in destroying the tumors in patches, by the use of nitric acid, and in their entire removal by the wire ligature; both of which operations are fully described in the *Operative Surgery*, vol. ii. p. 337, 2d edit. In the ancient method of treating hemorrhoidal tumors, when they were removed by simple excision, frightful hemorrhages sometimes supervened; the accounts of which have created so much alarm in the minds of patients, that very many continue to suffer for years from hemorrhoids, rather than—as they suppose they must—risk their lives by an operation. It becomes, therefore, the duty of every medical man to disabuse them on this point, and to assure them that, by the operations now performed, they can not only be safely relieved, but radically cured. Out of nearly 80 cases that have been operated on, to my knowledge—many of whom have been in my own practice—not one has died, or been in danger of death, from Horner's operation; whilst in but one has it been necessary to operate on the second side, after the tumor had been removed by a previous operation on the other.

§ 4.—IMPERFORATE RECTUM.

It occasionally happens that infants are born with such imperfections of the lower portion of the rectum, as prevents the escape of the contents of the bowels, or, in female infants, direct it through the vagina; and this condition is described as *imperforate rectum*. A similar condition of the rectum is also often accompanied by malformation of the anus, thus creating what is designated as *imperforate anus*. This defect may be created by the rectum terminating in a closed sac, an inch or an inch and a half above the perineum, or by a membrane closing the anus, and extending upwards, or by a fistulous communication between the rectum and vagina. In either case, operative measures will be promptly required, though the prognosis of the operation is positively unfavorable; only a few being entirely successful.¹

§ 5.—CANCER OF THE RECTUM.

Malignant deposits in the rectum may occur at any point of the bowel, but are most frequently situated around it just above its internal sphincter muscle.

Etiology.—The causes of cancer of the rectum are any irritation of the part acting on a patient of the cancerous cachexia.

Symptoms.—The local symptoms of cancer are, at first, those which have been described under the head of hemorrhoids. Sometimes it commences by a tubercular like mass, which is hard to the touch, and only causes a sense of fulness; but as it pursues the course which has been detailed when considering malignant diseases generally, it creates an ulcer of the fungus class, which gives exit to an exceedingly offensive, ichorous, and often bloody discharge, causes intense pain, and, as the growth increases, diminishes the caliber of the rectum until, at last, the latter becomes almost entirely obliterated, and the patient dies of hectic, which is augmented by the additional suffering caused by the sympathetic irritation of the bladder, &c.

Diagnosis.—When the rectum is examined by the finger, the

¹ For the operation, &c., see Operative Surgery, vol. ii. p. 331, 2d edit.

position and hardness of the deposit, combined with the constitutional symptoms, will generally suffice to enable the surgeon to form a diagnosis; but if doubt yet exists, the examination of the rectum by a speculum ani will generally show the characteristic appearances of the cancerous deposit, and ulcer as described elsewhere.

Prognosis.—The prognosis is unfavorable, the rectum being one of the most fatal and painful seats of cancer.

Treatment.—The palliative treatment consists in the employment of such measures as will regulate the condition of the bowels, as mild injections, laxatives, and diet, with the additional use of iron and tonics; whilst the administration of narcotics both by the rectum and mouth afford the greatest palliation to the sufferings of the patient. It has been suggested to extirpate the lower portion of the rectum when this would remove the disease, and it has been occasionally done; but as there is no good result to be thus obtained, a judicious surgeon would not expose a patient to the risk of such an operation when he well knows that the disease must return.

§ 6.—STRICTURE OF THE RECTUM.

Stricture of the rectum is often alluded to as a disease existing independently of other disorders, though most frequently it is due to the growth of the carcinomatous deposits just alluded to. An induration may, however, be caused by the syphilitic disorder of the bowel, which is due to unnatural intercourse, as is sometimes seen in Europe, or it may be created by a true tuberculous deposit in the cellular tissue, or in the adjacent glands, which, by forming tumors, may press upon and obstruct the caliber of the bowel. Very often, however, the stricture of the rectum, which is supposed to exist, consists merely of the spasmodic contraction of the sphincter ani muscle that has been already described in connection with the subject of fissure of the anus.

Symptoms.—The symptoms of stricture show themselves chiefly in the obstruction of the course of the fæces; in disordered digestion; in hemorrhoids; and in the development of fistula in ano.

Treatment.—The treatment is chiefly palliative, consisting in the dilatation of the anus by the cautious use of bougies and in attention to the digestion, whilst the pain is relieved by the free use of anodynes.

the first half of the century. In the second half of the century, the United States was a young nation, and its people were full of energy and ambition. They were determined to build a great nation, and they were willing to sacrifice everything for it. They were full of hope and optimism, and they were determined to make the most of their opportunities. They were full of life and vigor, and they were determined to live their lives to the fullest. They were full of love and compassion, and they were determined to help each other. They were full of faith and belief, and they were determined to follow their dreams. They were full of courage and bravery, and they were determined to face their challenges. They were full of wisdom and knowledge, and they were determined to learn from their mistakes. They were full of strength and power, and they were determined to achieve their goals. They were full of joy and happiness, and they were determined to enjoy their lives. They were full of peace and harmony, and they were determined to live in a peaceful world. They were full of love and compassion, and they were determined to help each other. They were full of faith and belief, and they were determined to follow their dreams. They were full of courage and bravery, and they were determined to face their challenges. They were full of wisdom and knowledge, and they were determined to learn from their mistakes. They were full of strength and power, and they were determined to achieve their goals. They were full of joy and happiness, and they were determined to enjoy their lives. They were full of peace and harmony, and they were determined to live in a peaceful world.

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PART XVI.

AFFECTIONS OF THE BLOODVESSELS.

CHAPTER I.

ANEURISM.

THE term *aneurism* (*aneurysm*, to dilate or distend) is one which is applied to a tumor formed in consequence of the distension of the coats of an artery. This tumor may be created either by a dilatation of all the coats of the vessel, or by rupture of its internal and middle coat and dilatation of its external layer; or by the rupture of all its coats and the formation of a tumor in the sheath of the vessel or in the surrounding cellular tissue.

Etiology.—Aneurism may be the result of disease, as softening or hardening, in consequence of which the arterial coats give way; or it may arise from their being punctured from various sources. But whether this dilatation involves the coats of the vessel as a consequence of disease, or the coats are wounded, and the tumor formed by the sheath of the vessel, or the surrounding cellular tissue, the general term aneurism is equally applied.

Varieties.—For the purposes of methodical study, all aneurisms may be divided into two principal classes, which are designated as 1, *true*, and 2, *false aneurisms*, though some authors have made a more elaborate classification, but the simpler one just stated is amply sufficient to meet the exigencies of the subject.

By a *true aneurism* is meant one which is formed by the preternatural expansion of all the coats of the vessel itself (Fig. 253), whilst under the same head are also placed such tumors in the course of the arteries as consist in a dilatation of one or more of its coats, the other being entirely ruptured.

But when the arterial coats are broken either by a wound or other external violence, or in consequence of disease, and the blood

Fig. 253.



The Appearances of True Aneurism as formed by dilatation of all the Arterial Coats—fibrin having filled the Sac but left the Canal clear—showing how Nature accomplishes a Cure. (After Miller.)

escapes into the sheath of the vessel or into the surrounding cellular tissue, so as to form an aneurismal sac, this condition is placed in the second class and designated by the general name of *false aneurism*. Of these two classes there are some subdivisions which indicate the character, extent, and condition of the tumor. Thus, in true aneurism, when only a small portion of the length of the artery is enlarged, the tumor is designated as *circumscribed*, and this class of aneurisms are called circumscribed true aneurisms, but when only a portion of the artery is involved, the tumor is spoken of as a *diffused* true aneurism.

False aneurisms, like the true, present also such varieties as are due to the extent of the disorder; thus, when the tumor is limited in its shape and involves but a portion of the limb, it is said to be circumscribed; but when the blood travels up and down the cellular substance of the part and forms a tumor of greater extent, the tumor is said to be diffused.

Symptoms.—There are certain symptoms which are created by aneurisms wherever found, whether true or false, the first of which are due to the action of the tumor itself. Very generally, simple inspection of the tumor will show that it pulsates distinctly, the elevation and depression of the surface consequent upon its pulsation being usually perceptible at some little distance. When the tumor is examined by the touch it generally gives an elastic sensation, and a pulsation can be distinctly felt which is synchronous with the pulsation of the heart, or has only such a varia-

tion as is consequent upon the time which it takes for the impulse of the heart to reach the tumor. Aneurismal tumors vary also in size in accordance with the caliber of the vessel, the dilatation of the anterior tibial artery being sometimes not larger than a pea, whilst the tumor of a larger vessel may reach the size of an orange, or even larger. Another characteristic of all aneurisms is their diminution upon pressure, whether applied upon the tumor itself or higher up along the course of the arterial trunk which supplies it, or upon the main trunk of the limb upon which it has its seat. This diminution is, however, more marked in true than in false aneurisms. When, in such a test, the pressure is entirely removed, the tumor usually rapidly resumes its original size, but in the event of the treatment of the disease by means of a continuous pressure, as will be presently explained, this dilatation does not supervene upon the pressure.

Aneurisms often produce considerable local pain if so situated as to press upon the nerves of the part, the pain varying in character and degree according to the amount of pressure and the connections of the tumor with the affected nerve. The same pressure upon the local nerves which produces pain may also create various muscular phenomena, such as cramp, spasm, &c.

The tumor itself, however, is usually free from pain, at least until it has attained such a size as to be painful from its mere tension. The skin over the tumor also remains for a long time unchanged, seldom presenting evidences of inflammation until the size of the tumor is such as to interfere with the capillary circulation; but when congestion supervenes a train of symptoms ensue which are similar to those which were explained in connection with the subject of tumors. When congestion of the capillary vessels of the skin induces inflammation in this tissue it soon induces ulceration and supuration, or sloughing, by which the aneurismal sac is opened, and violent and often fatal hemorrhages follow.

As the tumor grows its pulsation often diminishes, so that it is no longer noticeable at a distance, though the touch will still recognize it, even when quite feeble; at the same time the elastic character of the tumor diminishes, both these changes being due to changes within the tumor, which will be presently detailed.

Should the aneurism be so situated as to produce pressure upon any portion of the skeleton, absorption, or even caries of the bone, may ensue. Should the veins of the part be pressed upon, other

well-marked symptoms will appear, and as the return of the blood to the heart will now be impeded, there will be more or less leakage of its watery portions into the cellular tissue beneath the skin, which will produce oedema. Thus, for example, if the aneurism be situated in the iliac artery, and pressure is made by the tumor upon the iliac vein so as to impede the circulation in that vessel, oedema of the lower extremities will be the result.

All aneurisms, moreover, are liable to terminate in two ways, either by death or by cure, nature being capable, under some instances, of accomplishing a cure. When a cure is accomplished by nature it is generally consequent upon changes within the sac, re-

Fig. 254.



Fig. 255.



Fig. 254.—A view of an Aneurism produced mainly by Dilatation that has burst, the patient having died suddenly. (After Liston.)

Fig. 255.—Aneurism with a Double Cyst; the first having given way, the tumor became diffuse, but a second Cyst formed of the tissue around the artery. (After Sir C. Bell.)

sulting from a deposition of lymph upon its walls (Fig. 253); this deposition being the consequence of inflammatory action, or a

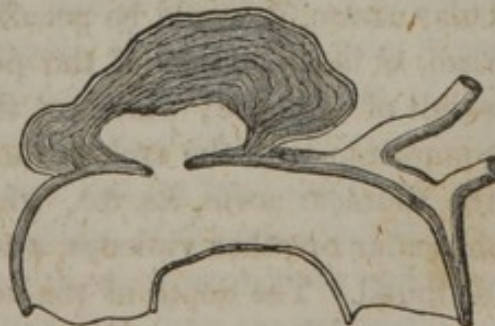
change in the circulation of the blood in the sac, this resulting in a laminated structure which gradually and layer by layer increases the thickness of the sac, until its cavity is closed. When the aneurism terminates fatally, it generally does so somewhat as follows: The aneurismal tumor grows larger and the sac thinner, owing to its constant distension from within, whilst the various structures between the tumor and the skin, as it first appeared, are removed by absorption, when the pressure encroaching upon the skin, ulceration occurs, or sloughing takes place, and the cavity of the sac being opened (Fig. 254), blood escapes with a sudden gush, and the patient dies generally upon the spot. But although this is a very common mode of termination, and although it may be stated in round numbers that nine out of ten of the cases of aneurism terminating fatally perish by hemorrhage, yet this is by no means universally the case, as a sac may form within the aneurism, as in Fig. 255. Death may also ensue from pressure upon the neighboring viscera; or it may be a consequence in aneurism of the arch of the aorta, or indeed in aneurisms of the thoracic aorta generally, of pressure upon the thoracic duct, or on the heart and lungs, &c. &c.

As might be expected from the nature of the disease, in every aneurism of considerable size, various pathological changes result, not merely in the parts affected, but even in the vessels at a considerable distance from the seat of the tumor, besides which we have various diseased conditions which are the result of pressure upon the surrounding parts.

As regards the artery itself at the seat of the tumor, the aneurism may be formed by a uniform dilatation of all the coats, this being the simplest and most common variety of what are called true aneurisms, whilst in another variety, as described by Breschet, of Paris, the dilatation involved merely the external and internal coats, the middle coat being entirely torn.

In a third variety, the external and middle coat having given way, the internal coat protruded so as to form the tumor; though from the delicacy of this coat it will readily be perceived that this form must be exceedingly rare.

Fig. 256.



A diagram of a True Aneurism of the Arch of the Aorta, the greater part of the Sac being filled with a clot, and the aperture of communication small.

(After Miller.)

A much more common form consists in rupture of the internal and middle coat, whilst the external is so distended as to form the tumor.

Diagnosis.—In diagnosing an aneurism, the surgeon will be guided by the fact that there is a tumor which is elastic and pulsates, whilst he will be aided in the formation of his opinion by its position as well as by the history of the case. Auscultation will also afford him admirable aid in attaining his diagnosis; as upon putting the ear upon the tumor, two varieties of sound will be perceived, the *bruit de soufflet*, or bellows murmur, and the *bruit de rape*, or the rasping or sawing sound; besides which the peculiar aneurismal thrill or *whirr* will be perceived, the latter being also recognizable by means of the touch.

The diagnosis between true and false aneurism is sometimes of importance, especially in regard to the treatment. Among the means by which it is to be made, not the least important is the history of the case. Thus, if the patient states that the tumor supervened upon violent muscular action and rapidly assumed the aneurismal characteristics, the surgeon might fairly be led to suspect a false aneurism; if, on the contrary, the tumor appeared gradually without any injury or violence done to the part, and especially if the age of the patient is such as would lead one to suspect those diseases which act as predisposing causes, he might reasonably regard the disease as a true aneurism. In making the diagnosis, therefore, the history of the case becomes of great importance.

The surgeon will also be much aided in his diagnosis by a careful examination of the tumor itself, as such an examination will often reveal several points of importance. For example, if the position and size of the vessel are such as to expose it to violent muscular action, it would be peculiarly liable to suffer from false aneurism, as in aneurisms of the popliteal artery, which are often the result of violence; while, on the contrary, in aneurisms found in connection with the arch of the aorta, with the innominate, or with the thoracic aorta, &c. &c., which involve vessels not exposed to muscular or other violence, a true aneurism will, as a general rule, be found. The depth of the vessel will also aid in the diagnosis, and, upon the same general principle, the artery least exposed to violence will be the least likely to suffer from false aneurism. But the best and most accurate mode of diagnosis between these two

varieties is to be found in the effects of pressure upon the tumor. If the aneurism be a true one, and especially if it be seen soon after its formation, it will be observed that pressure made over the course of the affected artery between the tumor and the heart will diminish to a greater or less extent the size of the tumor, very promptly, as the pressure upon the vessel cuts off the supply of blood and thus causes the collapse of the aneurismal sac, and a diminution in the size of the tumor. This collapse of the tumor depends, however, somewhat on the thickness attained by the walls of the sac, as old aneurisms with a sac very much thickened, will collapse less perfectly than others which are more flexible.

Pressure applied in precisely the same way over the vessel supplying a false aneurism does not, however, act with the same promptitude, because of the greater disposition in the false aneurism to the formation of clots, which, by blocking up the sac, prevent its collapse when the supply of blood is cut off.

Etiology.—The causes of aneurism may be grouped into two general classes, the predisposing and the immediate.

Among the predisposing causes may be mentioned the shape of the vessel, the points where it has a curvature being most apt to be affected. Old age is also a predisposing cause; and so are rheumatism and gout. So, also, the abuse of alcoholic drinks, old drunkards being said to be peculiarly predisposed; whilst sex has its influence, the disease being more common in the male than in the female sex, probably because man is exposed to more violent and continuous muscular exertion than woman. Various diseases in the coats of the vessels are also set down as predisposing causes.

Among the immediate causes are wounds and injuries to the arteries, sprains, violent exertion, and mechanical injuries of all kinds.

Prognosis.—The prognosis in the case of aneurism is generally serious, and should always be guarded. As a general rule, it may be set down that they will terminate fatally if left to nature, though this is not invariably the case, whilst the time which may elapse between the first formation of the tumor and its fatal issue will vary considerably, depending upon the position of the aneurism, the constitution of the patient, etc. etc. The prognosis as regards operations should also be made guardedly; very often they are successful, but very often, also, they fail, and no positive prognosis can be made under any circumstances.

Treatment.—In carrying out the general treatment of aneurisms, the surgeon should pay attention to the state of the general circulation; this being so regulated as to diminish the current of blood through the part, in order that, by diminishing its force through the tumor, it may favor the formation of a clot. In other words, the principles of Valsalva should be carried out, the patient being kept at perfect rest, whilst digitalis or aconite is given to diminish the action of the heart. The strong tincture of the root of aconite (Flemming's tincture) may be employed in the dose of one drop at first, and gradually increased if the patient seems to bear it, to two, three, four, or even five drops twice a day. Low diet, by its modifying influence over the action of the heart, may also be expected to prove useful in the general treatment, and so will occasional bleeding. But in bloodletting for aneurism, and especially in aneurism situated near the heart, care should be taken not to carry the abstraction of blood too far, lest the heart's action being once suspended in syncope, it never return.

The local treatment of the palliative kind would consist in the application of cold and astringents. The cold, which may act by somewhat diminishing the circulation in the tumor, should be applied in the shape of bladders filled with pounded ice; or cloths wet with cold water, combined with astringents, may very properly be employed. But little permanent benefit can be expected from such applications, and they are only of service when an aneurism which cannot be tied threatens to burst; in such a case, life may possibly be prolonged for a few days by means of cold and of astringents. Pressure upon the tumor, or upon the artery supplying the tumor, is, however, a very important means not only in the palliative, but in the radical treatment. This pressure has for its object the diminution of the circulation through the sac to such an extent as to cause it to be filled up rapidly by the concentric laminae of lymph already alluded to; but it should be borne in mind that the object of the pressure is merely to *diminish* the circulation through the sac, *not to interrupt* it altogether.

Pressure may be applied in the treatment of aneurisms in various ways. One manner is that which is spoken of as Guattani's method, from the name of the surgeon by whom it was first carried out, in which the whole limb is bandaged, graduated compresses being first suitably applied over the tumor and the course of the vessel supplying it.

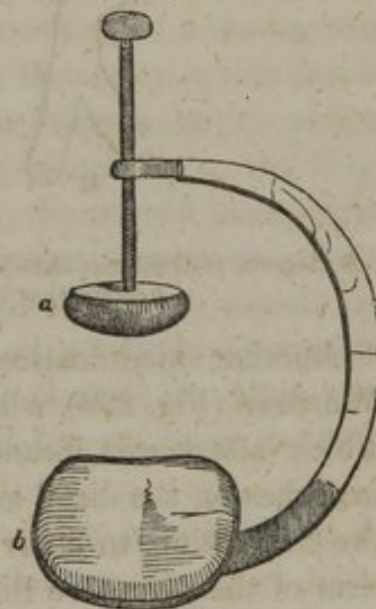
There are, however, serious objections to this plan of treatment, as it is difficult, if not impossible, to apply such a bandage with sufficient firmness to have any efficacy in the treatment of the complaint without interrupting the circulation in the whole limb. There are, moreover, few persons who can so accurately apply a bandage as to avoid making unequal pressure upon some one point, thus inducing neuralgic pains, oedema, &c.; and as it has been found far from being the most successful plan of treatment so far as the results of cases were concerned, it has been very generally abandoned.

Compression, as a remedial agent in the treatment of aneurism, has, however, been recently revived, though in a modified form, by the Irish practitioners, and particularly by Bellingham, of Dublin. This surgeon applied pressure in the course of the vessel, but so as only partly to interrupt the circulation through the tumor, making the pressure sometimes upon the tumor itself, but most generally at some little distance from the sac, upon the artery supplying the tumor, and between it and the heart, in precisely the same relative position that Hunter suggested the ligation of the artery for aneurism.

That the various modes of exercising pressure may be understood, it may be mentioned, in this place, though somewhat in advance of the subject, that Hunter suggested the ligation of the artery upon its sound structure at some little distance from the aneurismal sac, and between the tumor and the heart, and that it is on precisely the same principle that compression is to be applied, the femoral artery being compressed in the treatment of popliteal aneurism, &c. &c. (Fig. 258).

Brasdor, on the other hand, applied his ligature on the distal side of the artery affected (Fig. 258). And so, also, may pressure be applied particularly in those cases in which it would be impossible to apply it between the heart and the tumor, and it will be readily understood that the circulation being thus cut off on the

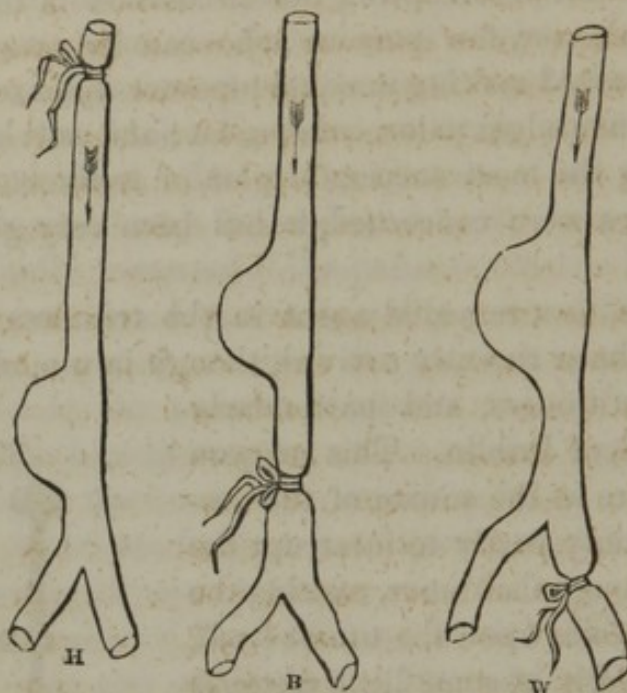
Fig. 257.



BELLINGHAM'S CLAMP.—*a.* Compress for the artery. *b.* Point of counter-pressure.
(After Miller.)

distal side of the tumor by pressure, a clot will form, and by its organization radically cure the aneurism.

Fig. 258.



A diagram of Hunter's, Brasdor's, and Wardrop's Operations for the cure of Aneurism, compression being capable of acting at similar points.

Another modification of the seat of the ligature was that of Wardrop (Fig. 258), who, when an aneurism existed upon a vessel which afterwards branched, applied his ligature to one of the branches on the distal side, expecting, by thus partially diminishing the circulation, to favor the formation of a clot. Thus, in an aneurism of the primitive iliac, Wardrop tied the external iliac, leaving the internal untouched, and pressure may be applied upon this principle, also, but not with such hopes of success as in the former methods.

The most successful mode of making pressure is, however, to make it between the tumor and the heart, with which pressure upon the tumor itself may advantageously be combined.

The means by which pressure upon the course of the vessel supplying the tumor can be effected, without checking the circulation through the whole limb, are various; one is through a tourniquet, which consists of two pads fixed upon shanks of steel, that are made to approximate each other by means of a screw, an instrument to which attention has recently been invited in the Eastern States, and which has been spoken of as a new invention, but which

really is very old, and was formerly described as Signoroni's tourniquet. This instrument, however, by its unvarying pressure upon a single point, is very apt to give such pain that it can seldom be borne.

A much better plan of effecting this pressure, is by means of the instrument which has been above described as Bellingham's compressor (Fig. 257), an instrument which has proved so useful, that out of thirty-nine cases of aneurism treated by means of it, thirty were cured. I have employed this instrument with such success, that in every case of aneurism to which compression was applicable, I would try it before resorting to so extreme a measure as the ligation of the artery, an operation which, in such a case, I should not look upon as justifiable if compression had not been tried.

In compressing, say the femoral artery, by means of Bellingham's plan, two instruments are necessary, each consisting of a steel spring, having at one extremity a pad, to compress the artery, which can be tightened by means of a screw, and, at the other, a larger pad, to act as a support, these instruments being placed upon the thigh so that they can be made to act alternately, the second being tightened as the first becomes painful, and the first then relaxed so as to keep up a uniform interruption of the current in the vessel; but *the compression should never be violent enough to entirely interrupt the current of the blood, but merely to modify and diminish it.* This pressure requires, if any success is to be derived from it, to be patiently persevered in for from ten to twenty days.

Another form of compression, and one which is suitable to the brachial artery, is that made by a spring which is connected with a strap, so as to buckle around the limb whilst the pad is capable of being pressed upon the artery by means of a screw. It is applied in the same manner as the clamp of Bellingham.

Pressure made upon the aneurismal tumor in this plan accomplishes a cure by effecting the same changes as are created by nature; the circulation being diminished in force, not sufficiently to destroy the life of the limb, but enough to favor to the fullest extent the formation within the sac of the lamellated fibrin already alluded to. Another advantage of the treatment by compression is that it involves little risk, may be made therefore by the most timid practitioner, and, if unsuccessful, does not interfere in the least with subsequent operative measures.

As the success of the treatment by compression will depend very

much upon the judgment that is shown in applying the force, it should always be borne in mind that the correct plan is to employ it so as to diminish the circulation, without interrupting it, the pressure being at all times judiciously graduated with a view to this object. It should, moreover, be recollected that continued pressure upon one point, even when slight, will endanger sloughing, and that this may take place to such an extent as greatly to complicate the case. The local symptoms should therefore be carefully watched, and the compression, when it becomes painful at one spot, be replaced by pressure at another.

The next plan of treatment is the application of the ligature, which, in its effects upon a diseased vessel, is the same as has been already described, in connection with the sound artery. It is not necessary, therefore, to repeat in this place what was said upon the action of the ligature in the arrest of hemorrhage from wounds (see p. 240), and these remarks will therefore be limited to such points as have not been previously mentioned, and have an immediate bearing upon the subject of aneurisms.

In old times, when the action of a ligature on a sound artery was very imperfectly understood, surgeons performed operations which were based upon peculiar views, great anxiety existing lest the ligature should not come away; its removal being supposed to be the result of the softening of the ligature. But in the diseased artery, and especially in aneurismal dilatation, they rather feared its cutting through the vessel too quickly. Thus *Scarpa* used a broad ligature, surrounding the vessel first with a little cylinder of waxed linen or muslin, to prevent it from coming off too soon, and over this he tied his ligature, but not tightly enough to cut through the middle and internal coats.

Now there are cases—as when an aneurismal tumor is at the same time complicated with ossification of the artery—in which it may be advantageous to resort to *Scarpa's* method, lest from the diseased condition of the arterial coats the ligature should come away before the clot is sufficiently firm, in consequence of which troublesome secondary hemorrhage may result. But a serious objection to his mode of operating will be found in the fact, that not unfrequently the internal coat is not sufficiently compressed to produce adhesive inflammation, and the external coat, moreover, is a very long time in ulcerating through; the ligature, therefore, takes many days to separate; whilst, except in the case of disease in the arte-

rial coats, the risks of secondary hemorrhage will rather be increased than diminished by this plan of treatment.

Another mode of applying the ligature in the treatment of aneurism was that of the old Greek and Roman surgeons—a plan which sprung from the fear which they entertained, and which we at the present day know to be ill grounded, that putrefaction might be set up in the cavity of the sac, after the interruption of the circulation through it. Accordingly, it was their custom to ligate the diseased artery both above and below the sac, after which they laid the sac open, and turning out its contents, removed the clots, sometimes even applying to it the hot iron. By this plan, however, and especially by the application of the cautery, the danger of secondary hemorrhage was infinitely increased; and as we now know how unnecessary was the fear of putrefaction in the contents of the sac, no surgeon at the present day thinks, as a general rule, of laying open the sac and incurring the consequent dangers of suppuration, suppurative phlebitis, or the occurrence of secondary hemorrhage.

Hunter, in England, who was about the first to modify the old operation, acted upon a different principle; his ligature being applied to the sound part of the artery at a considerable distance from the tumor, and between it and the heart, his object being to cut off the current from the seat of the disease, by interrupting the circulation through the main arterial trunk supplying the tumor. In this manner, the supply of blood being taken from the aneurism, the sac collapsed, its walls adhered, and the tumor was gradually obliterated; the artery beneath the seat of ligature remaining as a solid cord, whilst the clot behind the ligature, between it and the heart, rose as high as the next anastomosing branch. Meanwhile, as the circulation through the tumor was cut off, that through the limb was carried on by means of the anastomosing branches, Fig. 259. The

Fig. 259.



A view of the Enlargement of the Anastomosing Vessels, showing how the collateral circulation is carried on after the application of a ligature. *a*. Point where the femoral artery has been ligated. (After Liston.)

principles advanced by Hunter, in his mode of operating, are those now generally recognized as correct in all operations for the ligation of arteries, when required by aneurisms or wounds. Thus every ligature causes a diminution or cessation of the circulation in the main trunk, and an increase of that in the anastomosing branches, the enlargement of the anastomosing branches, after the application of the ligature, securing to the limb its proper supply of the vital fluid, and thus preventing its mortification.

The effects of this new course in the circulation are easily shown in any large artery: Thus, if a ligature be applied to the external iliac artery, the blood can no longer pass through the femoral to supply the limb; the vitality of the parts below the ligature is, therefore, at once diminished, as is shown by a diminution in the temperature, and in the sensation of the part; though both are merely temporary, as, after a few hours, the natural heat of the limb is restored, or it may even rise above the healthy standard, in consequence of the rapid enlargement of the anastomosing branches, and the irritation created by the operation. The anastomosing branches which enlarge to restore the circulation in the limb, vary, of course, with the artery that is tied, but in the case of the iliac artery they would be the external mammary and epigastric, with the various other connections between the branches of the internal iliac and the femoral on the back of the thigh.

Brasdor's operation for aneurism, as has been already alluded to in connection with the subject of pressure, differs from Hunter's in principle, the ligature being applied on the distal side of the tumor, in consequence of which the blood accumulates in the aneurism, and a clot is formed, that fills the whole sac, and rises as high as the first anastomosing branch. Now, there are cases where this is the only operation applicable, or indeed justifiable; take, for example, the case of aneurism of the innominata, the application of the ligature being here a difficult operation, and one which every surgeon would not be able to accomplish; whilst its fatal results are well known. Here, Brasdor's operation would prove particularly useful.

It sometimes happens that there are two arterial branches given off from the distal side of the aneurismal sac, the enlargement occurring, for example, at the very point at which the artery branches. In such a case, should one of the two branches happen to be an anastomosing branch, it may follow that, after the performance of Hunter's operation, pulsation will be observed to recur

in the tumor, if another ligature is not applied on the second branch.

After-Treatment.—The after-treatment of the wound made in these operations, is that of all operations; one end of the ligature being cut off, whilst the other is left attached to the vessel, so that it will hang out at one angle of the wound. This angle should also be kept open by a strip of lint, so as to favor the free escape of pus, whilst the rest of the wound should be healed as much as possible by the first intention.

Prognosis of the Operations for Aneurism.—The dangers incidental to these operations are, 1st, the danger of mortification. In order to combat this, it is necessary for the surgeon to prevent, as far as possible, that loss of temperature in the parts supplied by the artery, which has been already alluded to as among the first consequences of the application of a ligature. Heat, therefore, is demanded, but it should be very cautiously applied, lest, when the anastomosing branches have enlarged, violent reaction ensue, and this reaction itself become a cause of mortification. The limb, therefore, should be placed in a convenient position and surrounded with wadding or raw cotton, or with cloths wrung out of warm water; or bottles, filled with warm water, may cautiously be applied, the surgeon removing all these appliances so soon as pulsation below the tumor shows that the collateral circulation is fairly established. If the reaction runs high, the cold water dressing, or other means for the application of cold, may be demanded.

2d. Having escaped the danger of mortification, the next danger incurred after the ligature of an artery, is that of secondary hemorrhage. The success of this operation depends not merely on its cutting off of the circulation by means of the ligature, but in the establishment of such inflammatory action as will result in the formation of a clot, and the complete closure of the ligated artery as high as the first anastomosing branch. Now it may happen that the ligature shall cut through the arterial coats too soon, before such a clot is properly formed, or circumstances may delay the formation of the clot till some time after the ordinary date, or the artery may be tied so near a large anastomosing branch that the clot will be too short to resist the force of the arterial current; in either of these cases, secondary hemorrhage will be established when the ligature comes away, and the patient die before aid can be extended to him. It therefore becomes a matter of some im-

portance to watch him carefully, with a view of arresting this secondary hemorrhage should it occur; and it is well to watch him closely from the moment at which the ligature is applied until the wound has nearly healed; but particular vigilance should be exercised from the fifth to the ninth, or even the fifteenth day.

With these general observations, which are applicable to all the arteries, a brief examination may now be made of particular aneurisms, mentioning only such points as are peculiar in the symptoms, pathology, or treatment of each.

As a general rule, it will be found that the large arteries of the body, particularly those near joints, and at their curvatures, are most liable to aneurisms. Thus, the aorta is most frequently affected; and, of this vessel, the portion generally dilated is its arch. According to the statements of reliable authors, aneurisms of the aorta are as common as aneurisms of all the other vessels of the body taken collectively.

SECTION I.

ANEURISM OF THE AORTA.

Aneurism of the aorta will create symptoms that will vary according to the part of the vessel affected; but, as a general rule, it may be said that they will be those due to pressure upon the surrounding viscera.

§ 1.—THORACIC ANEURISM.

Symptoms.—In *thoracic aneurism* the symptoms will be those of irritation of the bronchia and thoracic viscera. As the tumor increases in size, there are, therefore, usually seen changes in the voice and obstruction in the respiration from pressure upon the trachea. There is also some modification of the pulse, as dissimilarity in that of the two wrists, with the other symptoms of derangement of the circulation due to pressure upon the great vessels near the heart. After a time a tumor gradually makes its appearance, and this may show itself at various points, but generally anteriorly, sometimes rising up behind the sternum, at others appearing anteriorly and pushing directly

through the walls of the chest, the ribs being absorbed by the pressure exercised upon them. Or there may be evidences given of disease of the spine, the vertebræ being absorbed or becoming carious, also in consequence of the pressure, whilst the spinal marrow itself may be so encroached on as to produce paralysis and other symptoms equally characteristic of spinal disease. The causes of death in thoracic aneurism are not unfrequently rupture of the sac or pressure upon the heart or the thoracic duct; this latter cause of death being too much overlooked, as death undoubtedly sometimes occurs, in this case, from the interruption of nutrition.

Treatment.—The treatment of thoracic aneurisms will be stated under the next head.

§ 2.—ABDOMINAL ANEURISM.

Symptoms.—The symptoms of *abdominal aneurism* are connected with its pressure upon the abdominal viscera, creating various derangements of the bowels, œdema of the lower extremities, and dyspnoea on account of the interference of the tumor with the action of the diaphragm; whilst finally we may note the appearance of a tumor, which, as the patient becomes emaciated, will show itself more distinctly globular, and pulsate strongly through the abdominal parietes.

Treatment.—The treatment in both thoracic and abdominal aneurisms can only be expectant, no operative measures being of any avail. The plan of treatment known as Valsalva's or Albertini's may be adopted, and consists, as has been already mentioned, in the reduction of the force of the circulation by means of bleeding, digitalis, aconite, and similar measures.

But it must ever be borne in mind that an aneurism of the aorta will sooner or later prove fatal, and that death will very probably be instantaneous, being due to rupture of the sac and the consequent hemorrhage; these cases terminating in this manner quite as frequently as by pressure upon the surrounding parts. When, therefore, satisfied of the diagnosis, it becomes the duty of every surgeon, in a case of this sort, to inform the friends of the patient of his true condition, in order that he may make those worldly arrangements which it may be desirable for him to complete before his death.

SECTION II.

POPLITEAL ANEURISM.

Popliteal aneurism, as its name indicates, is one of the external aneurisms, which is situated in the popliteal artery, just behind the knee-joint.

Symptoms.—Popliteal aneurism, as a general rule, first attracts the attention of the patient by causing a numbing sensation, or sometimes a sharp cutting pain, in the limb, at the same time that the patient is conscious of a peculiar feeling in the part, as if something had snapped or given way. Soon after, a very violent pain is felt, running down along the leg, which is sometimes accompanied with cramp and spasms in the calf of the leg as well as the muscles supplied by the posterior femoral nerves. Then a tumor gradually makes its appearance, and enlarges with more or less rapidity, presenting pulsation and all the various characters of the aneurismal tumor before described. As this tumor enlarges, a disposition on the part of the patient to flex the limb becomes apparent, because, when the limb is extended, the pressure of the tendons of the part produces a pain which is relieved when these tendons are relaxed. As a general rule, the tumor shows a disposition to extend rather to the outer than to the inner side of the limb; and it does this because the greater prominence of the head of the tibia on the inner side of the limb interferes with its development in that direction. This fact should be borne in mind, lest the surgeon, seeing the tumor protruding rather to the outer side than in the median line, should suppose the aneurism to exist rather in one of the branches of the popliteal artery—such as the peroneal—than in the popliteal itself, which is much more generally the seat of the disease. The tumor thus formed and situated may attain the size of a hen's-egg, or even larger, and pursue, if left to itself, the same course as aneurisms elsewhere.

Treatment.—The most judicious treatment in the case of popliteal aneurism is compression; the ligation of the femoral artery in popliteal aneurism being a justifiable operation only when compression has been fairly tried. The mode of making this compression, particularly the mode which has been recommended by Bellingham, of Dublin, is as follows: Prepare two clamps like that shown in Fig.

257, and apply one on the femoral artery, near the groin, and the other on the same vessel, in the middle third of the thigh, applying the pressure of one whilst the other is slack, and loosening the first, but tightening the second, when the first pressure causes the patient to complain. In applying this pressure, too much caution cannot be used, to prevent its becoming intolerable; and it should always be recollected—as essential to success—that it should be very gently made, so as to diminish, and yet not interrupt the circulation through the artery. Unless compression is made very lightly and gradually, it will cause such pain that the patient will not be able to sustain it. The time required will vary from eight days to several weeks, the secret of success being found in the slowness of the compression, which it is again stated cannot be too gradually or lightly applied.

SECTION III.

FEMORAL ANEURISM.

Femoral aneurism may be seen at all points in the femoral artery, but occurs most frequently high up in the groin, because, as the artery is more superficial in this situation, it is more liable to injuries from wounds, &c. &c. The wounds that give rise to femoral aneurism not unfrequently result from the practice of carrying in the pocket such a weapon as a pistol, which, exploding accidentally, creates a wound the after consequences of which are femoral aneurism. In some cases, this weapon has been made to explode by leaning over the table in playing billiards.

Symptoms.—The symptoms of femoral aneurism are those of aneurism generally; thus, a tumor forms; its pulsations are felt; and the patient complains, as the tumor enlarges, of neuralgic pain due to the pressure upon the nerves.

Treatment.—The treatment is most judiciously carried out by means of pressure where pressure can be effected; this being made upon the external iliac artery within Poupart's ligament, by means of Signorini's tourniquet.¹ But on account of the difficulty of making pressure properly, this treatment has not been so successful in

¹ See Operative Surgery, vol. i. p. 218, 2d edit.

femoral aneurisms, particularly those high up in the groin, as it has been in popliteal tumors. It should, however, be tried, and if it fails, resort can then be had to the ligature of the external or even of the primitive iliac, although success is to be hoped from the former operation much more than from the latter.

SECTION IV.

ANEURISM OF THE CAROTID ARTERY.

Aneurisms are also found in connection with the upper extremities as well as in the neck. In the neck the most common form is *carotid aneurism*, which is generally seated near the bifurcation of the carotid artery.

Symptoms.—The symptoms are first the formation of a tumor, this tumor being situated in the parotid region and unaffected by the efforts of the patient to swallow, whilst it does not rise when the larynx rises. The aneurismal tumor cannot, therefore, be confounded with goitre, as the pulsation is distinct, and the seat of it different in reference to the median line of the neck. There are various symptoms found in carotid aneurisms which are due to the pressure upon the surrounding parts, as more or less alteration of the voice from pressure upon the larynx; or more or less alteration in the sense of hearing from pressure upon the nerves connected with these parts; whilst, as the tumor enlarges, it may press upon the trachea, so as to interfere with respiration, or by deranging the circulation in the brain, interfere with the functions of that organ.

Diagnosis.—It is possible to confound this disease with certain other affections of a very simple character, such, for example, as enlargement of the lymphatic glands of the part, these being tied down by the fascia and made to press upon the artery, so that they will receive a certain amount of pulsatile character. In diagnosing such tumors it will, however, be observed that pressure upon the vessel does not diminish the size of the tumor as in aneurism, and if one of these simple tumors be pushed off from the artery to one side, or raised up from it between the fingers, the pulsation in it will cease, which would not be the case in aneurism.

Treatment.—The treatment of carotid aneurism is by means of

the ligature,¹ compression being uncomfortable, uncertain, and likely to do mischief by compressing the jugular vein or other important organs.

Aneurisms of the superior extremities sometimes occur, and are to be treated first by pressure, and if that fails, by the ligature.²

SECTION V.

ANEURISMAL VARIX.

Aneurismal varix is produced by a wound of an artery through the vein which establishes a direct communication between the two vessels. The injury is very frequently a result of careless venesection in the bend of the arm. As a consequence of this wound the vein is observed to be filled with arterial blood, distended, tortuous, and varicose.

Diagnosis.—The history of the case will be very valuable in forming a diagnosis. If the tumor has occurred after bleeding, such an affection might be suspected.

Treatment.—The treatment most likely to afford relief is compression both above and below, as well as over the tumor.

SECTION VI.

VARICOSE ANEURISM.

Another form of aneurism of the extremities is that which is designated as *varicose aneurism*, which is a false aneurism that is

Fig. 260.



A VARICOSE ANEURISM, SHOWING THE ANEURISMAL SAC BETWEEN THE ARTERY AND THE VEIN.—*a.* The artery. *b.* The vein. *c.* The aneurismal sac. (After Sir Chas. Bell.)

¹ See Operative Surgery, vol. i. p. 544, 2d edit. ² Ibid., vol. ii. p. 355, 2d edit.

formed between the artery and the vein, and opens into both, the sac being formed by the cellular tissue between the artery and the vein. Both these forms of aneurism are to be treated upon the same general principles, and are chiefly liable to occur in the same position, especially in the bend of the arm.

SECTION VII.

ANEURISM OF BONES.

There is another form of aneurism, the importance of which demands a more extended notice than can be given to the subject in this place, and that is *aneurism in the bones*, the nutritious artery becoming the seat of an aneurism which produces absorption of the cancellated structure of the bone, and finally a tumor, which has, to a certain extent, the characters of aneurism elsewhere.

Treatment.—The treatment is that of aneurism elsewhere, as compression, or the ligation of the vessel concerned.

SECTION VIII.

ANEURISM BY ANASTOMOSIS.

One other variety requires mention in order to complete the enumeration, and that is the form known as *nævus maternus*, aneurism by anastomosis, or by the jaw-breaking designation of *Telangiectasis*.

This affection is due to an enlargement of the capillary vessels of the skin, and forms a tumor in which the arterial or venous element—though generally the arterial—predominates. It is the same affection as was designated as “aneurism by anastomosis” by Mr. John Bell. This tumor is usually supplied by one or more principal vessels, and the best treatment will be found to be extirpation, provided its size is not very great, and there is sufficient sound skin adjacent to the tumor to permit of its being dissected out, without incising the vascular structure.¹

¹ See Operative Surgery, vol. i. p. 236, 2d edit.

PART XVII.

AFFECTIONS OF THE EXTREMITIES.

CHAPTER I.

INFLAMMATION OF THE THECA AND BURSA.

SECTION I.

PARONYCHIA.

PARONYCHIA (*παρα*, by, and *ονξ*, the nail), or the whitlow of common language, is the term applied to certain inflammations of the fingers and toes, and especially of the first phalanges.

Varieties.—Four varieties of the disease are usually made by authors for the purposes of methodical study. But as the affection presents itself to the surgeon, these forms not unfrequently complicate each other to a considerable extent:—

1. In the first variety, we have a very superficial inflammation upon the dorsal face of the finger; pus forming around the matrix of the nail, and resulting generally in the destruction of the connection between the nail and the soft parts, whilst the nail falls out. This variety, strictly speaking, should pass under the designation of *onychitis*, which was the term uniformly applied to it by the old writers, and is the complaint which in common language is designated as a *felon*, while to paronychia the popular term *whitlow* is applied.

2. In the second variety, pus is found in the cellular tissue, which constitutes the pulp of the extremity of the finger.

3. In the third, the inflammation travels still deeper, and is found to involve the theca or sheath of the flexor tendons (seldom of the

extensor tendons), a circumstance which is due probably to the fact that the palmar face of the finger is more exposed than the dorsal to violence from accidents and other causes likely to produce inflammation.

4. In the fourth variety still deeper parts are invaded, the pus being now found beneath the periosteum of the phalanx involved.

When these varieties of the complaint are examined, it is easy to perceive that they differ from each other only in extent. In all the disease consists essentially in inflammatory action, resulting in the formation of pus, the position of the seat of the inflammation being all that constitutes the varieties of the complaint. The symptoms, therefore, under all circumstances, may be described as those of inflammation, and differ only in degree.

Symptoms.—The symptoms of the first variety, which is a simple inflammation that is circumscribed in extent and superficial in position, are first, a burning pain and slight circumscribed swelling around the matrix of the nail. The disease, therefore, is found chiefly on the dorsal face of the fingers and toes, and the inflammation and swelling seldom extend beyond the limits of the first phalanx. The skin covering the part goes through all the changes of color which would reasonably be anticipated in a superficial inflammation, becoming dark red from capillary congestion, then violet, and by and by, more or less bluish, according to the chronic character of the complaint. Owing to the thinness of the skin of the part, so soon as the pus is formed, it shows itself as a yellowish band, surrounding the root of the nail. At last, the distension causes the skin to burst; the pus is evacuated, and the loosened nail comes off, being elevated *first from the matrix*.

The new nail is generally found beneath the old, as the latter is thrown off, or is soon afterwards formed. But it is often vitiated in character, being sometimes harder and more horny than the natural nail, or if not vitiated in character, often takes an unnatural direction, becoming incurved, this incurving in the toe being not unfrequently a cause of what has been designated as "ingrowing of the toe-nail." Among the laboring classes, the symptoms of the complaint are more severe; and as the skin is thicker, the pus finds greater difficulties in the way of its escape. The pain is therefore more violent, and the suffering and constitutional disturbance more marked.

In the second variety, there is an increase of all the inflammatory

symptoms, and especially of the pain, because there is here a dense cellular tissue, containing the delicate nervous filaments connected with the tactile papillæ, and it is easy to perceive that when pus is effused in such a structure, violent pain must be the result. The swelling is, therefore, more dense and hard, the fluctuation more indistinct, and the pus frequently not perceptible until it has accumulated to some amount; consequently, in this variety, the matter has a greater opportunity to travel than in the last, and it may go to such an extent as to result in the formation of the third and fourth varieties, which will readily happen should it involve the theca of the tendon, or the periosteum of the bone.

In the third variety, in which the theca of the tendon is involved, the pain is more severe, often quite excruciating and lancinating, going up as high as the axilla, and in this respect resembling the pain in the fourth variety. The swelling also is more marked, extending often to the second and third phalanges (Fig. 261), and even upon the palm of the hand, while the congestion and obstruction in the capillary circulation may be such as to give rise to erysipelas.

Fig. 261.



Paronychia of the Thumb, showing the Swelling and Disorganization of Tissue. (After Miller.)

In the fourth variety the symptoms are the same, though, if possible, in a still higher degree, there being more marked constitutional disturbance, the patient sometimes remaining for days unable to sleep, and in a high state of nervous excitement.

In any of these varieties, as soon as the distension of the skin has gone beyond the point which its elasticity can bear, it cracks, or ulceration is established, and the pus is evacuated. With the pus comes away more or less of a slough, or "core," as it is called in common language, involving often the theca of the tendon or the

tendon itself, portions of which may also come away, after which the bone may become carious, or, necrosed, and the whole phalanx, or even the finger (Fig. 262), be destroyed. From the ulcer,

Fig. 262.



Caries of the Phalanges, as the result of badly treated Paronychia. (After Miller.)

fungous granulations begin by and by to sprout, and the condition which results is not unlike in appearance certain forms of malignant disease. In this general survey of the symptoms of the more severe forms of paronychia, those of the constitutional irritation ought not to be neglected, being those of irritative or traumatic fever generally, to which allusion has already been made in connection with the subject of inflammation.

Etiology.—The causes of paronychia are often not very apparent; the disease being sometimes undoubtedly due to epidemic influence. Within the last few years such an epidemic has spread through the United States, sweeping not only along the Atlantic coast but down the valley of the Mississippi, and affecting persons of all classes. Sometimes the origin of the disease can be traced to a blow; sometimes to the little loose piece of cuticle near the root of the nail, familiarly spoken of as “widows” or “old women.” It may also be due to the sudden warming of the hands after exposure to cold, and hence coachmen who drive in cold weather are apt to suffer. Sometimes it is created by puncture, as by a sharp-pointed instrument, the third and fourth variety being especially due to such causes. Waiters and cooks, from punctures by forks, &c., therefore frequently suffer from the complaint.

Prognosis.—The prognosis will depend upon the variety of the disorder, and upon the time which has elapsed before it was seen by the surgeon. Thus, the inconveniences resulting from the first and second variety are comparatively slight compared with those which may ensue on the third and fourth. If the pus is allowed to travel it will do mischief, and the prognosis will become much more serious; and hence it is that the disease generally eventuates much more seriously if left to itself than if submitted to appropriate treatment. Under all circumstances, the prognosis, so far as a per-

fect cure is concerned, should be guarded, the disease being very apt to result, especially in the last variety, in the loss of the joint.

Treatment.—The indications in the treatment are very simple, and may all be summed up under one head, and that is the early evacuation of the pus, and the free division of the tissues so as to prevent the inflammation from spreading and involving the neighboring parts. By the words "early evacuation of the pus," I mean its evacuation within forty-eight hours after the symptoms have become well marked; and this is not only the safest, but also the most efficient plan, being the only one likely to save the finger. In the milder form of the complaint, that, for example, which is connected with the root of the nail, or that which involves only the pulp of the extremity of the finger, if the patient is timid and dreads the knife, or the physician is unwilling to make an incision, the pus may be evacuated by creating an ulcer which shall perforate the integument, through the application of caustics, as suggested about the year 1800, by Dr. Perkins, who effected his object by means of a caustic consisting of white vitriol, corrosive sublimate, &c. &c. The same thing, however, may be accomplished by the caustic potash and the integuments perforated in precisely the same way that we would form an issue, a piece of kid with a hole in it of the size of the intended eschar being first bound upon the finger and the caustic applied. When the slough comes away, the pus will be evacuated; but this mode of operating is both more tedious and more painful than the operation by the knife.

Should the surgeon fortunately see the case before forty-eight hours have elapsed, which is rarely done, he might attempt to check the inflammatory action by antiphlogistic measures, as leeches freely applied, cold lotions, &c. But it must be admitted that these means present but little chance of success. Stimulating applications are sometimes popularly employed by patients and their friends in the treatment of these cases, and it is easy to perceive how such applications act, as there is a dense unyielding tissue, seized by inflammation, which is increased and hastened to an issue by the formation of a slough, the pus being evacuated, and the patient relieved when it comes away. The common applications to whitlows, such as brown soap and sugar; shoemakers'-wax; soaking the finger in strong lye—a lye poultice, &c., act upon the same principle. Another application which is stimulating from the ammonia which it contains, is one which is common in the country

among the lower classes, to wit, the cowdung poultice; human urine (chamber-lye) also probably derives its real or supposed efficacy from the presence of ammonia.

But although these popular applications may at times, and when nothing better can be done, possess a certain amount of efficacy, the educated surgeon will never hesitate about the course which he ought to pursue, but will proceed at once to lay open the diseased tissues and evacuate the pus if any have formed. And this must be done boldly and without fear or hesitation. A very slight reference to the structures concerned will show that such an incision is really a very simple operation, and one which does not involve the slightest danger, the course of the flexor tendon being directly along the centre of the finger, whilst the artery and nerve are on each side. If, then, the incision be made lengthwise and along the centre of the finger, there is no danger of wounding the latter organs. The incision should be made boldly down through the theca and tendon to the bone itself, and should extend the whole length of the phalanx affected. If more than one phalanx is diseased, several incisions should be made, the number of incisions corresponding with the number of phalanges involved; but one incision should not be allowed to extend the length of two or three phalanges, because as this would cross the joint, the capsular ligament might be opened and an inflammation created which might terminate seriously. The incision should be made with a scalpel or bistoury, the scalpel being preferable, and the importance of cutting through the periosteum, if the pus is forming between that membrane and the bone, cannot be over-estimated, for, as the phalanx derives its nourishment from the periosteum, and the pus separates the two, an accumulation of pus in this locality must terminate in caries or necrosis of the bone. If the patient dreads the pain of the operation, anæsthetics may be administered.

The relief experienced after the operation is generally great and speedy. Indeed, the first night's rest the patient has experienced for some time is often that following the operation. Should, however, this not be the case, some anodyne may be prescribed. The after-treatment requires attention; as the exuberant granulation must be guarded against. At first, warmth and moisture are the means to be employed, the finger being surrounded in a sheath of spongio-piline, made like a finger-stall, but if this cannot be obtained, a flaxseed poultice may be substituted, and the whole covered

with oiled silk. Then, after a few days, when the suppuration has ceased, the granulations which begin to form from the bottom of the wound should be regulated in their progress by touching them with the nitrate of silver.

The subject of Paronychia is one which demands careful attention from the surgeon, as the loss of the joint which it very frequently involves is a serious matter, and can generally be avoided by proper treatment. Sometimes, however, notwithstanding the best treatment, more or less deformity, contraction of the finger, etc., will result from the complaint, and the surgeon should always advise the patient of this fact when undertaking the treatment of the case.

SECTION II.

ENLARGED BURSÆ.

A reference to the anatomy of the different parts of the muscular system shows that certain points where the muscles pass over bones, as well as the sheaths of certain tendons, are lined by synovial membrane and *bursæ* or little sacs which contain synovia. These are found in connection with the tendons of the wrist-joint; with the tendon of the patella; with the muscles inserted into the trochanter major of the os femoris; with the ankle, etc. Now, at any of these points there may be such a modification of the action of the bursal synovial membrane as will lead to an accumulation of the fluid within the sac and the formation of a tumor. This complaint generally ensues upon over-exertion, upon pressure, or upon any such causes as would develop chronic inflammation in a synovial tissue, and like chronic inflammation sometimes results only in an increased secretion of the parts; but sometimes it goes still farther and creates an effusion of lymph into the cavity of the sac, the partial organization of this lymph leading either to the formation of a solid tumor or to those peculiar cartilaginous rice-shaped bodies which are sometimes found in enlarged bursæ, and of which there are several specimens in the Wistar and Horner Museum of the University of Pennsylvania.

Symptoms.—The symptoms of enlarged Bursæ are generally easily recognizable. Thus there is a tumor formed by the accumulation of matter within the sac, whether of synovia or of lymph, this tumor

being more or less globular in its shape, and generally presenting more or less fluctuation in it. Sometimes, however, the contents of the sac so distend it that fluctuation can hardly be perceived, and then it might be mistaken for a fibrous or other solid tumor. When the tumor exists about the wrist-joint, it is called a *ganglion*, and as it often possesses these solid characteristics, it has been mistaken for dislocation of the small bones of the wrist, particularly when the tumor ensued on some injury to the joint.

Pathology.—The pathology of enlarged bursæ may be comprehended at a glance, as they consist essentially in the chronic irritation or inflammation of a synovial membrane, with increased secretion or effusion of serum and lymph, and the consequent modifications of the action of a serous tissue.

Varieties.—Different names are given to these effusions in the bursæ, according to the different localities in which they are found, as will now be explained.

§ 1.—GANGLION.

A *ganglion* has all the characteristics and presents all the symptoms which belong to the complaint elsewhere.

Treatment.—The treatment of ganglion consists in getting rid of the contents of the sac, and this may be accomplished in two ways. 1. By such means as are calculated to check the irritation and promote absorption, as friction of iodine ointment, or the parts may be painted with the tincture of iodine. Pressure has also been recommended, though individual experience has led me to the opinion that all such means are but temporary, and that pressure, by causing inflammation, rather leads to the increase of the disease. The best mode of treatment is 2. To promote the evacuation of the contents of the sac by rupturing it with a blow, or by a subcutaneous puncture; when the sac having been ruptured, the fluid will escape into the surrounding cellular tissue and be afterwards absorbed. But a less painful and more surgeon-like mode of producing the same result is by means of a subcutaneous puncture with some suitable narrow sharp-pointed instrument, such as a tenotome, or a cataract needle.

§ 2.—HOUSEMAID'S KNEE.

Housemaid's knee is the name given to the disorder when the enlarged bursa is that of the tendon of the patella. This is a disease quite common in England, but much rarer in this country, our servant-girls using the scrubbing-brush with a long handle instead of going upon the knee to use the hand-scrub; hence the disease is rarely seen in the United States, and when it is, is generally found among the natives of the British islands. When the disease occurs, it shows itself at first in the shape of a slight thickening or enlargement on the knee, but this soon becomes a tumor, which is sometimes flattened, though generally more or less spherical, and is seated just below the knee-joint, corresponding in situation with the position of the bursa. (Fig. 263.) It is not only a deformity from its appearance, but creates inconvenience by interfering with the action of the tendon, and preventing the proper flexion and extension of the leg. It has been known, moreover, to create such inflammation as to involve the knee-joint secondarily.

Fig. 263.



Enlarged Bursa over the Patella—Housemaid's Knee. (After Miller.)

Treatment.—The treatment is to be conducted upon the same principle as that of ganglion, bearing in mind, however, the difference in the size of the tumors, this tumor requiring to be evacuated by a small trocar and canula, so as to draw off the fluid, when pressure may be made with a view of bringing into contact the sides of the sac and causing them to adhere. Should, however, this plan fail, as it will very often do, and the tumor reappear, one of two plans may be resorted to.

1. An incision may be made and the sac entirely dissected out; which should be carefully done, every means being taken to prevent the consequent inflammation from involving the knee-joint; whilst any portion of the sac that is adherent to the patella and left behind should be cauterized by the nitrate of silver, lest the tumor be reproduced.

2. The sac may be again evacuated, and its cavity injected with tincture of iodine, with a view of producing adhesive inflammation.

§ 3.—FEMORAL BURSA.

Symptoms.—When the bursa which exists in connection with the passage of the tendons of the glutei muscles over the trochanter major of the femur enlarges, the symptoms will be very much the same as those of the complaint elsewhere, but the dense nature of the structures covering this bursa gives to the tumor such a degree of firmness that it is often mistaken for one of those fibrous tumors which are not uncommon in this part.

Diagnosis.—A diagnosis, however, may generally be made from the presence of more or less obscure fluctuation; from the situation of the tumor corresponding with the normal position of the bursa, and, if all other means fail, by the use of the acupuncture needle.

Treatment.—The treatment is to be conducted upon the principles already laid down.

SECTION III.

NEURALGIA.

Neuralgia, or a functional disturbance of the nerves of the extremities, is another complaint, sometimes requiring surgical treatment, as patients not unfrequently present themselves to the surgeon suffering under excruciating pain in these nerves.

Symptoms.—The parts supplied by the nerves affected often become atrophied, and to the violent pain are superadded all the inconveniences resulting from loss of power.

Etiology.—Very often these symptoms are the result of a punctured wound in the nerve itself. This wound may have been made with a needle, with a fork in the hands of waiters, cooks, and others, or with any similar instrument.

Treatment.—The treatment is simple, and may be carried out by means of anodynes, judiciously administered, as frictions with aconite ointment, or the tincture of aconite, or similar remedies. But when these have failed, it will sometimes be found desirable to

cut down upon the main trunk and divide it, or even to remove a small portion of the nerve by incision. The treatment of neuralgia by division of the affected nerve has been required in various portions of the body; thus it has been performed in connection with the supra-orbital nerve, as well as with the facial nerve, &c. &c.; but in all these cases the principles guiding the surgeon are the same, and the only differences in the methods of operating will be those necessitated by the anatomy of the parts.¹

SECTION IV.

VARICOSE VEINS.

Another complaint of the extremities which requires special attention from the surgeon is that designated as *varicose veins*, a disease which, from its frequency, from the inconveniences resulting from it, and from the dangers attending the operations which have been recommended in its treatment, demands careful study.

The term *varices*, or *varicose veins*, derives its origin from the Latin verb *variare*, to turn, and indicates the tortuous and twisted condition into which the enlarged veins are thrown. The veins affected are generally understood to be those of the extremities, the disease, when existing elsewhere, being spoken of under some special designation. Thus, when the veins of the rectum are enlarged, it is known as *hemorrhoids*, or piles; when the veins of the scrotum are affected, it is called *varicocele*; whilst the term *varices* is most generally limited to the form which is found in the external veins of the lower extremities.

Etiology.—Varices are generally due to some obstruction in the course of the veins—such as the pressure exercised upon the iliac vessels by the gravid uterus during pregnancy, or certain other tumors, as enlargement of the liver or spleen; tumors within the abdomen; impacted feces in the rectum, &c. &c.; or that created on the saphena or femoral veins by hernia. It has also been caused in the upper extremities by the pressure of the edge of a desk upon the forearm of a patient, and I have seen a well-marked case of it

¹ See Operative Surgery, vol. i. p. 242, 2d edit.

in the upper extremity which was due to this cause, in the person of the editor of a newspaper.

As the superficial and the deep-seated veins inosculate freely, they both usually participate simultaneously in the complaint, though the external are the most evident; and this should be particularly remembered, as it will serve to show the ultimate inefficiency of certain operations which have been highly recommended for the cure of this disorder.

Symptoms.—After the disease has existed for some time it begins to exert an influence over the whole system, but is first shown in a disturbed local circulation, the veins of the part carrying the blood sluggishly to the heart, owing to the continuance of the obstruction which has produced the disease, whilst as the arteries of the limb continue to supply it as freely as ever, an effusion of the more liquid portions of the blood takes place into the superficial cellular tissue, from which swelling and thickening of the whole limb result. Meantime distension renders the coats of the vein itself, and often the skin immediately covering it, thinner and thinner, until at last it bursts, and a troublesome hemorrhage is the result, or ulceration may be established, and the condition formerly described as varicose ulcer ensue.

With regard to the general symptoms, they are often well marked; thus the patient first experiences a tingling or itching in the skin of the limb, which is followed by an irritation that often shows itself in the form of eczema rubrum, many cases of this latter disorder being due to the irritation of varicose veins, and to the interference of the distended veins with the capillary circulation of the affected limb, he also is often troubled with a sense of weight and fulness. When the limb is examined, a change will be at once noticed by the surgeon in the appearance and course of the veins, and as these vessels have become tortuous and knotted, they can be felt beneath the skin, giving to the fingers very much the sensation of a bundle of worms in a bag; besides which their tortuous and knotted appearance can be readily discerned by the sight (Fig. 264). The limb itself is also swollen and thickened, and gives evidences of effusion beneath the skin.

Prognosis.—The prognosis is favorable as regards the effects of the complaint upon the health and life of the patient, but unfavorable in respect to the permanent cure, for, though the disease may be relieved and rendered supportable, yet I know of no method

likely to effect a radical cure; nor have I found that any of the plans of treatment, or even of the severe and dangerous operations which have been devised for the purpose, have ever succeeded in effecting a cure, without a return of the affection at some subsequent period.

If the complaint is left to itself, the chief inconvenience will be the ultimate formation of the varicose ulcer, the principal danger from which will be the hemorrhage to which it may give rise.

Treatment.—The chief indications in the palliative treatment are, 1. To support the coats of the veins; and, 2. To check the disposition towards hemorrhage.

The palliative treatment consists in the use of cold bathing, with a view of diminishing the activity of the circulation; in frictions of such substances as are likely to modify the effusion of lymph into the cellular tissue; such, for example, as mild mercurial ointment rubbed upon the limb, or advantage may be derived from the use of iodine ointment or of the tincture of iodine painted upon the part, &c. &c.; whilst such lotions may be employed as will harden the skin, and enable it in the end to act the part of a bandage.

Advantage may possibly be derived in certain cases from an imitation of the practice of certain of the veterinary surgeons in the cases of "bog spavin" in the horse, in which a hot iron is applied in several places so as to sear the skin, in order that the contraction of the cicatrices consequent upon the operation may so contract the tissue as to cause it to exercise pressure upon the distended veins.

Fig. 264.



A view of the Position and Tortuous Character of Varicose Veins on the inner side of the Left Leg. (After Liston.)

But perhaps the safest and most efficient way of treating varicose veins, and a method which does quite as much permanent good as the many painful and dangerous operations recommended in this complaint, is the application of equal and judicious pressure by means of bandages, laced stockings, gaiters, and similar appliances. Of these, the best contrivance is the elastic stocking, which consists of a stocking properly shaped, and formed by the interweaving of silk with the fibres of caoutchouc. This stocking should be rather tight than otherwise at first, as, after it has been worn for some time, it is apt gradually to become too loose to answer a good purpose. If, however, the expense or difficulty of obtaining this article should be an objection, a very excellent substitute may be made of brown holland by any seamstress; but a buckskin tongue should be placed under the lacing to prevent the cord which laces it up from wetting the skin, a very important point in the result, as, in a bad case of varicose veins, the most trifling wetting may lead to ulceration, hemorrhage, &c.

With this simple plan as much may be accomplished as by any other method yet devised, though it will not effect a cure, the patient being obliged to continue the use of his elastic or laced stocking for years, perhaps for life. On account of the length of time which the disease as thus treated lasts, and on account of the expense of the apparatus necessary to carry on the treatment, surgeons at different periods have recommended various operations, these operations being stated at length in the *Operative Surgery*,¹ but I must enter my protest against the performance of any of those which incise the veins, and can conceive of no case so severe as to justify the risk of such operations, and my objection to them is still further increased by the fact that they can rarely or ever accomplish more than a temporary relief, owing to the free anastomosis between the deep and the superficial veins. Such an anastomosis may be readily proved by injecting the veins after death, and any one who wishes to test the value of the so-called radical cures of varicose veins can easily do so on the dead body by tying the saphena major both at the knee and in the middle of the calf, and then injecting a vein in the foot with a fine injection, when he will find the superficies of the limb finely mapped out with the injecting material that has run in all directions around the ligated veins.

¹ *Operative Surgery*, vol. ii. p. 351, 2d edit.

CHAPTER II.

CLUB-FOOT.

TALIPES, or *Club-foot*, is a very common complaint, and one which, as it generally makes its appearance at birth, or in young children, causes great anxiety to parents. This deformity presents certain details applicable to the whole class not only of club-feet, but of deformities in general; and a very slight examination of the subject will demonstrate, that club-foot has many points in common with strabismus; with spinal curvature (muscular); with certain forms of torticollis, with club-hand, and all other similar deformities. Before, then, we proceed to study the symptoms and treatment of the disease in question, it is right that allusion should be made to some of the points connected with the action of the muscles, which are common to all deformities.

As deformities from muscular action are due to the general law that the two sides of the body are equal, and that the muscles of each side have an equal amount of power, due allowance being made for the slight predominance of those of the right side over those of the left, on account of their being more exercised, there are certain general principles applicable to their treatment which should be here alluded to. For instance, it is well known that where the muscles of one side are contracted, those of the opposite portion are usually lengthened; and that where those of one side are overacting, those which oppose them must be acting with diminished power. In all these cases, therefore, it will become the duty of the surgeon not only to overcome this excessive action and weaken the power of the contracted muscles, but also to stimulate and favor the contractile power of the elongated muscle, whilst he hardens the skin on those points where pressure is to be made, in order that it may be better borne. These principles apply to all deformities as well as to those which are included under the head of club-foot.

Symptoms.—Club-foot is a deformity in which there is more or

less deviation in the axis of the foot in one of several directions: thus the toes may be depressed, and the heel elevated; or, the toes may be turned inwards or outwards, or various modifications and combinations of these conditions may be present.

Etiology.—The causes of club-foot are varied, and by no means thoroughly understood. By the older writers, this affection was ascribed to various causes, all more or less absurd; thus, it was supposed to be due to the fact that, during pregnancy, the mother had seen something disagreeable, or suffered so as to induce a contraction in the toes of the foetus, and this absurdity is still popularly believed in, as I was once told by a lady of high education, that a club-foot in her child, to which she called my attention, was caused by her having stumped her toe when about her third month of pregnancy. By some it has been ascribed to unnatural or irregular contractions of the uterus upon the foetus, and by others to the umbilical cord having accidentally been wound around the limb; and this latter may sometimes have really been the active agent in producing the deformity, though the general cause applicable to nearly every case of congenital club-foot, is want of proper innervation, and the student who would truly understand the pathology of this disease, must start with this idea.

The fact that so many infants with club-foot also show more or less deviation in the spinal column, laterally, and even sometimes suffer from spina bifida, or harelip, would point out the fact that, in the majority of these cases, there is more than a mere local disorder.

My own impression is, that the position in utero, so much spoken of in connection with this subject, has little to do with the complaint, and that the cause of the deformity is generally to be sought in the spasm of the muscles created by disorder of the nervous system.

Varieties.—Five varieties of the complaint have been made by authors:—

1. The first and simplest is designated as *pes equinus*, because the individual laboring under the complaint when he comes to walk, walks as a horse does, upon the end of the phalanges, the heel being elevated and the toes depressed. This variety, though sometimes existing alone, is very generally more or less combined with those which will next be brought into consideration.

2. The second variety is the reverse of *pes equinus*; as here we have a depression of the heel and an elevation of the toes, so that

the patient stumps along upon his heel, this being the variety known as *pes calcaneus*.

3. The third variety is one of the most common, and is that in which there is a turning inwards of the metatarsal bones and of the toes, as well as an elevation of the heel; and this form has received from writers the designation of *varus*.

4. The fourth variety is called *valgus*; and here the toes and the supporting metatarsal bones are turned outwards; this condition being, therefore, directly the reverse of *varus*; but, like it, generally combined with more or less elevation of the heel.

5. The last variety is *pes plantaris*, a deformity in which there is a doubling under of the toes beneath the sole of the foot, so that the individual walks upon his instep, or upon some part of the upper portion of his foot.

That much may be done towards remedying these various conditions by mechanical means, will readily be understood by any one who will reflect upon the great changes produced by pressure and bandaging upon the foot of the Chinese lady, and it is therefore but reasonable to suppose that means so potent in the production of deformity in the sound limb cannot but be useful, if judiciously applied to the case of one that is diseased.

SECTION I.

PES EQUINUS.

In taking up the special consideration of these different varieties of club-foot, attention may first be given to *pes equinus*, as the contraction of the gastrocnemius and soleus muscles, or a certain amount of *pes equinus*, not unfrequently complicates *varus* and *valgus*. In order that the student may understand readily this or any other variety of club-foot, a brief allusion to the structure of the healthy foot will be useful.

Anatomical Relations.—In the foot we have the articulation of the bones of the leg with the astragalus, which bone articulates below with the os calcis, and forwards with the scaphoides; whilst the os calcis, which projects posteriorly and inferiorly, forms the heel, and gives an insertion to the tendo-Achillis. This bone articulates anteriorly with the cuboid, which supports the fourth and fifth meta-

tarsal bones; whilst the scaphoid articulates anteriorly with the three cuneiform bones which support the first, second, and third metatarsal bones.

Any of the varieties of club-foot alluded to, after it has existed for a short time, will cause displacements of these bones of the tarsus, so that the articulating surfaces shall be much modified, or it may even go to such an extent that the appropriate articulating facets of the bones shall no longer present to each other. Besides these changes in the bones, the modifications in the action of the muscles themselves require special study. Thus, in *pes equinus*, we have an over-action in the gastrocnemius and soleus, which induces a shortening in these muscles, which draws up the heel by means of the insertion of the tendo-Achillis into the os calcis (Fig. 265). The antagonistic muscles, on the other hand, are lengthened. As a result, changes must necessarily be experienced in the limb, the tibia no longer resting upon the articulating surface of the astragalus, owing to the violent extension of the foot, but being seated upon this bone posteriorly to its usual articulating face, or forming a new articulating surface upon the os calcis itself. Like displacements also

Fig. 265.



Position of the Foot in *Pes Equinus* in the adult. (After Miller.)

occur in the relations to each other of all the tarsal bones, as can very readily be understood. We have then in a case of *pes equinus* first, a deviation in the normal contractility of the muscles concerned; then a deviation in the articular faces of the bones, which are no longer presented properly to each other; next various deviations in the ligaments of this part, these becoming irregularly stretched, in order to accommodate the bones in their new position. When all these facts are taken into consideration, it will be understood that mechanical means for the treatment of such a deformity can only overcome it if used patiently, and for a long time, it being absolutely essential to a cure, that some treatment should be persevered in until the extended and relaxed ligaments, and

the new faces of the bones have resumed their normal relations, a fact which should not be lost sight of, in all cases of club-foot.

Post-mortem Appearances.—A dissection of a case of pes equinus shows that, among the muscles, the gastrocnemius and soleus, with the plantaris and the plantar fascia, the tibialis posticus, and the peronei muscles, and especially the peroneus longus, are all more or less contracted, their antagonistic muscles being weakened, relaxed, and extended.

Treatment.—A judicious surgeon, in carrying out the treatment of pes equinus, will therefore continue to use for some time such mechanical means as tend to restore the equilibrium of the over-balanced muscles of the foot, and overcome the deformity, and either trust entirely to them or combine it with such operative measures as shall have for their object the division of the contracted tendon and the subsequent elongation of the effused and organized lymph that unites its divided extremities.

The mechanical means adapted to the treatment of simple pes equinus may be resolved into such measures as will elevate the toes and bring down the heel, and are usually designated as the club-foot shoe, or as the club-foot apparatus. Of these, there are a great variety, most of which are modifications of the old shoe of Scarpa, though the progress of the mechanic arts has now furnished several specimens of a very neat mechanism, and efficient action. That made by Kolbè will be again alluded to (Figs. 273, 274).

In preparing the patient for wearing any of these, the surgeon should harden the skin by bathing it in strong oak-bark tea, in order that the pressure necessary to effect his object, and which must necessarily be kept up for some time, may not cause a troublesome ulceration in the foot. Then, with a view of increasing the efficacy of the mechanical measures, and saving much valuable time—valuable because while the deformity exists the bones are becoming more and more difficult to shift from their abnormal position—it may be advisable to practise the division of the tendo-Achillis as the most powerful of those concerned in the production of this deformity. The division of this tendon may be accomplished¹ by a little knife, which is designated as a *tenotome*, and which is introduced flatly beneath the skin between it and the tendo-Achillis, and then turned so as to cause its edge to present towards the tendon, when the foot being put upon the stretch, the tendon will be brought up against the knife and divided, by forcibly

¹ See Operative Surgery, vol. ii. p. 354, 2d edition.

extending the foot, the division of the tendon being recognized by an audible snap. The limb being now left at rest, the ordinary changes of subcutaneous wounds ensue, such as the effusion of blood, the liquid portions of which are by and by absorbed, after which there is an effusion of lymph, which becoming organized, unites the two cut extremities of the tendon. This new tissue, when first formed, is elastic and extensible, and if at this period mechanical measures are applied, the heel may gradually be brought down, and the deformity overcome in a few days. But the *rationale* of this plan of treatment should never be lost sight of; for, if the surgeon ignorantly brings the heel down, by mechanical means, immediately after the division of the tendon, non-union may be the result, or so much new structure may be formed, that the increased length of the tendon will be greater than is desirable to restore the equipoise of the limb, and the patient be lamed for life, being thus rendered unable to contract his gastrocnemius muscle sufficiently to raise the heel from the ground.

Fig. 266.



View of a Foot after the Heel is brought down in Pes Equinus. (After Miller.)

The surgeon should, therefore, delay about five days after the operation of tenotomy before mechanical means are employed, and only apply them very gradually at first. If the heel be brought down one line a day, in less than two weeks it will have descended

an inch. *Gradual* extension, therefore, is amply sufficient, and it is only by such pressure and patient perseverance that the cure can be accomplished.

After the heel is thus brought to the ground, the patient, though well able to walk, will generally present some deviation of the foot, if it is closely examined (Fig. 266).

§ 1.—PHALANGEAL VARIETY OF PES EQUINUS.

In connection with pes equinus, it is necessary to allude to what is called the phalangeal variety of that complaint. This is simply the variety of the disease seen in children who have never walked; children, for example, under twelve months of age: and in connection with this subject I would allude to one cause which sometimes produces pes equinus in children who had originally perfectly healthy feet, and that is the practice, now fortunately going somewhat out of fashion, but recently very popular, of amusing children by suspending them in the apparatuses popularly called "baby jumpers." In this the child was suspended from a hook in the ceiling, by a little contrivance which surrounded the body, and was so arranged that it could barely touch the floor with its toes. Then the suspending cords being elastic, the least motion of the child produced a dancing up and down, which seems to have delighted equally the infant and the mother or nurse who had it in charge. But in consequence of the foot being kept constantly extended, and the heel elevated, more than one instance has occurred, within my own knowledge, in which a spasmodic contraction of the muscles in the back of the leg took place, and a temporary pes equinus was produced.

SECTION II.

PES CALCANEUS.

The second form of the complaint to which attention may next be given is precisely the reverse of pes equinus. Here the toes go up and the heel comes down, so that the patient walks exclusively

upon his heel, producing the deformity described as pes calcaneus,

Fig. 267.



A side view of the Right Foot in Pes Calcaneus. (After Nature.)

or that which is popularly called hooked-foot. It is a comparatively rare form of deformity. The os calcis here sustains the weight of the body, and the muscles on the back of the leg are preternaturally elongated, while those upon its front are preternaturally contracted; the muscles whose contractions have most effect in producing the deformity being the extensor communis, the extensor proprius pollicis, and the tibialis anticus. This form of the complaint is very marked

in some instances, and is sometimes carried to such an extent that the anterior face of the os calcis looks upwards instead of forwards. In these cases there are, of course, modifications of the articulating surfaces of the os calcis and of the bones connected with it, as the os calcis no longer articulates in the normal manner with the cuboid, whilst the bones of the tarsus are generally displaced. Of course, there are also changes in the ligaments of the part, caused by the changes in the position of the bones; thus, the ligaments upon the bottom of the foot will be found to be elongated, while those on the dorsal surface will be shortened.

Treatment.—More may be done in the treatment of this complaint by prompt mechanical means than in most of the other varieties, as the form of the foot enables the pressure adapted to the treatment of pes calcaneus to be so readily borne that this form presents few difficulties if treated at an early period of life. In order to bring the foot down, such measures as were directed for the relief of fracture of the os calcis, may be resorted to.

SECTION III.

VARUS.

In *Varus*, the toes and metatarsal bones are turned inward (Fig. 268), and the heel is almost always elevated, showing that the complaint is combined with a certain amount of pes equinus. The

changes in the bones and ligaments, in this form of the complaint, are very marked, and due often to an arrest of development in the bones of the tarsus, this being conjoined not unfrequently with a deficiency of calcareous matter in the bones concerned, so that they readily bend, a condition well illustrated by a specimen in the Wis-

Fig. 268.



Fig. 269.



Fig. 268.—Outside view of Varus in the adult, the deformity not very marked. (After Miller.)

Fig. 269.—View of the Imperfect Development and Displacement of the Bones in Varus. (After Miller.)

tar and Horner museum, of the University of Pennsylvania, a fact which should be borne in mind in connection with the treatment. The principal muscles contracted in this form of the complaint are the gastrocnemius and soleus, tibialis anticus, and the plantaris and plantar fascia, the latter presenting strong lines, which can be discerned through the skin, and may be felt distinctly in the sole of the foot, the latter being turned inward instead of downwards. The tibialis posticus and adductor pollicis are moreover contracted, while the peronei and other muscles antagonistic to those just named are generally lengthened.

As the disease continues and the child begins to walk, certain changes will be noticed in the external tissues, consequent upon pressure. Thus, there is thickening of the skin, and a true hypertrophy at the point at which it comes in contact with the

ground. Sometimes a bursa (Fig. 270) forms between the thickened skin and the deeper-seated parts.

Fig. 270.



Fig. 271.



Fig. 270.—Outside view of Varus, showing the Bursal Pad or Tumor upon which the patient walks, this pad presenting a full, rounded, cushion-like point of support. (After Nature.)

Fig. 271.—View of the Sole of the Foot in a marked case of Varus, showing the contraction of the plantar fascia, &c. (After Nature.)

SECTION IV.

VALGUS.

Valgus is a very rare form of club-foot. The disposition here is to turn the toes and metatarsal bones outwards; and it is, therefore, just the reverse of *varus*. The changes produced by this deformity are readily understood: thus there is a perfect flattening down of the tarsus (Fig. 272), the sole of the foot becoming as flat as that of a negro, whilst there is the total loss of that fulness of the instep which

Fig. 272.



A front view of *Valgus*, showing the eversion of the toes, and the inversion of the Heel, with the flattening of the Instep. (After Nature.)

exists in the white man. *Valgus* is also more common in the negro than in the white man, and among the several negroes known to me who labor under this complaint, almost every case is combined with a marked degree of weakness of intellect, the patient being moreover knock-kneed, in connection with the inclination of the foot outwards. The muscles contracted in this variety are those antagonistic to the muscles contracted in *varus*. They are generally the peronei muscles, especially the peroneus longus and the

muscles of the same group, whilst there is an elongation of the plantar fascia and of most of the muscles contracted in varus. The changes affect here principally the astragalus and the cuboides among the bones of the tarsus.

SECTION V.

PES TALUS OR PLANTARIS.

This last variety of club-foot is a very rare one, and is called *pes talus* or *plantaris*, the foot being so deformed that the patient walks upon the dorsal surface of the toes, of the metatarsal bones, or of the tarsus; in other words, walks upon the top of the foot instead of the sole. Sometimes it is combined with varus, and then the joint of the little toe, with its metatarsal bone, becomes the point of support when the patient walks.

SECTION VI.

TREATMENT OF ALL THE VARIETIES OF CLUB-FOOT.

In the treatment of any of these varieties of club-foot, much may be done, while the infant is yet in the arms, and too tender to be treated by mechanical contrivances or by operative means, if the nurse, by proper manipulations with her hand, will draw the toes up carefully from time to time if the form of the affection be *pes equinus*, or bend the instep outwards, if it is a case of *varus*. As the child approaches the age at which mechanical contrivances can judiciously be applied, say from six to twelve months old, the skin should be hardened by soaking it in oak-bark tea, as above directed, in order that it may be better enabled to bear the pressure of any of the forms of apparatus which may be deemed best in the treatment of the complaint. In any of these varieties, where the heel is elevated, operative measures—as the division of the tendo-Achillis, before alluded to—may be demanded. After which, or from the first, if operative means are not used, some mechanical apparatus will be required, these being persevered in for many months, and a firm support, in the shape of a stiff boot, worn for years subsequently.

One of the best forms of apparatus for the purpose of extension, and which is perfectly adapted to pes equinus, if uncomplicated with varus, is a modification of Scarpa's shoe, which can be made to adjust itself, by means of a screw, to any angle of inclination required. (Fig. 273.) When this contrivance has been fastened to the foot, by means of properly adjusted and padded straps, the motion of

Fig. 273.



Fig. 274.



Fig. 273.—A VIEW OF KOLBE'S CLUB-FOOT APPARATUS.—This ingenious instrument is applicable to *all* the forms of Club-Foot, but especially to Pes Equinus, the position of the foot being changed by means of the key attached to the figure, thus presenting one advantage over some other forms of apparatus, that, when the key is removed, the friends cannot displace the angle of the apparatus, although they can remove it entirely from the foot. It also can be worn whilst the patient walks about, which is not the case with some other forms of the adjusting-shoe. (After Nature.)

Fig. 274.—THREE-QUARTER VIEW OF KOLBE'S ADJUSTING SHOE FOR VARUS.—This apparatus is especially applicable to Varus, and may be adjusted to any angle of the foot, and deviation of the heel, by means of a universal joint, though it will not permit the patient to walk.—1. Pivot for key to move the joint. 2. Joint which revolves three-quarters of a circle laterally and antero-posteriorly. (After Nature.)

These forms are made at No. 45 South Eighth Street, Philadelphia.

the screw, changing the position of the sole to which the foot is strapped, can be made to bring the foot gradually into any position

which may be required, whilst the child will yet be able to walk about, as the apparatus is so jointed as to permit it.

For varus, and especially for a case in which no effort has been made to bring the metatarsal bones into the proper line, a special apparatus will prove useful, and sufficient to accomplish the cure, without tenotomy, or any incision of the plantar fascia. As in this form of club-foot it is desirable that the patient should not walk, lest one of the pads, formed by the bursa, be created, and subsequently make a deformity, an apparatus similar to that shown in Fig. 274, may be required, and Mr. Kolbè has so arranged this shoe, that it may be adapted to almost any length of leg, or any inclination of the foot.

If a finished apparatus cannot be obtained, a ruder article, upon the same principle, might be fashioned, under the surgeon's direction, at any blacksmith-shop in the country; and a very little mechanical ingenuity will often produce one that will prove quite as useful as that furnished in the cutler's shop.

Much good may be accomplished, in the simple cases of *pes equinus*, by surrounding the foot by a handkerchief, binding another around the calf, and then connecting the two together by a third, or by a bandage or string, which from day to day might be tightened; or strips of adhesive plaster or bandages might be employed, in the same way, instead of handkerchiefs, so as to draw the toes towards the tibia.

After from six to nine months' careful use of such an apparatus, the patient may wear an ordinary shoe, with club-foot, or side irons, if the foot has been brought to its correct position. But generally the apparatus will be required to be worn by a child a full twelve-month, before shoes can be well adapted to it. No greater error, however, can be committed in the treatment of club-foot, than an anxiety to establish a prompt cure. The reduction of the deformity must be very gradually accomplished, and maintained by a continuous perseverance in the use of an appropriate boot for years, whilst the child is growing. It is therefore generally advisable to explain these facts to the parents before commencing the treatment.

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