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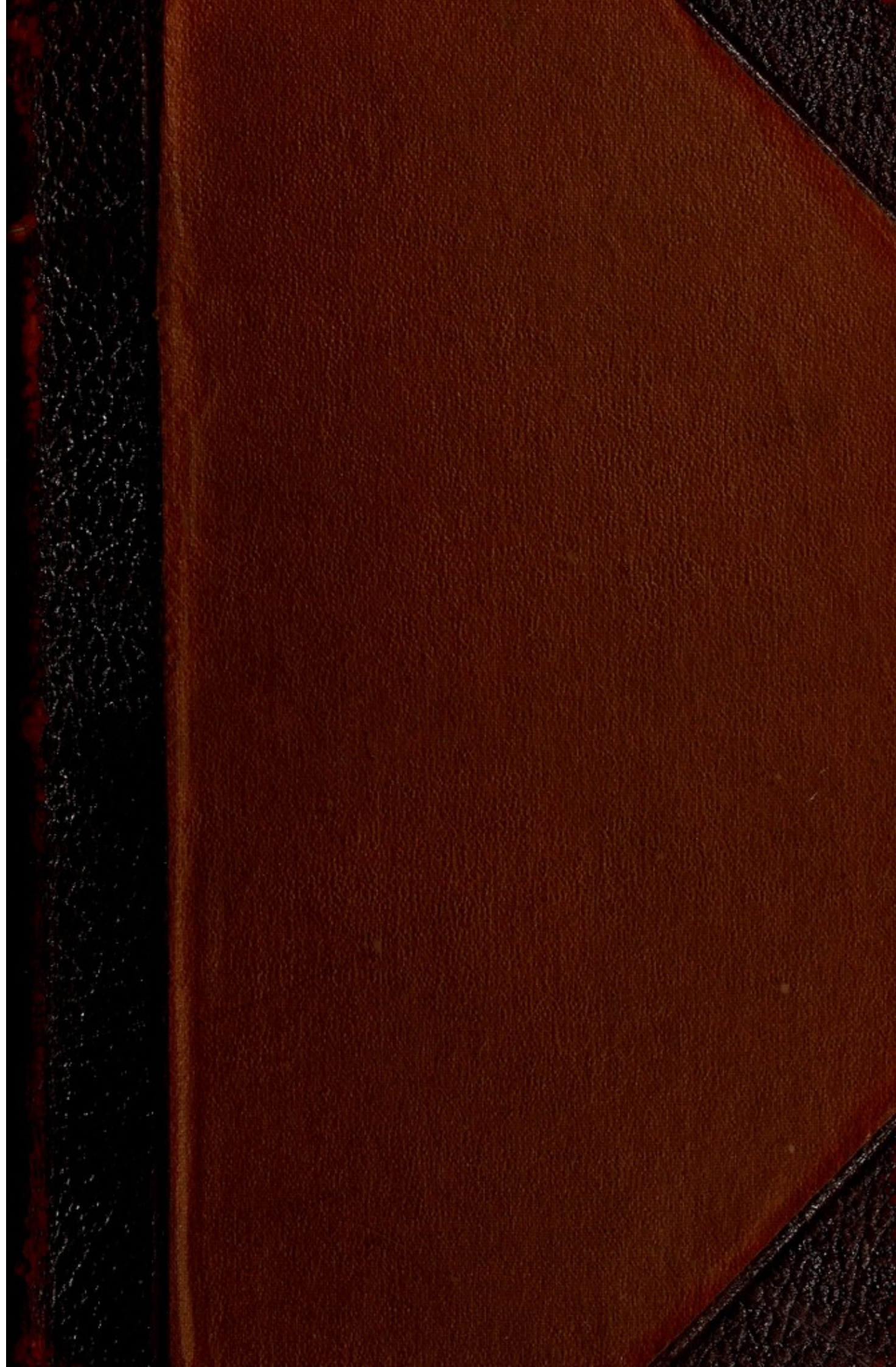
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OUTLINES OF SURGERY

AND

SURGICAL PATHOLOGY

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INCLUDING

THE DIAGNOSIS AND TREATMENT

OF

OBSCURE AND URGENT CASES

AND

THE SURGICAL ANATOMY

OF

SOME IMPORTANT STRUCTURES AND REGIONS,

BY

F. LE GROS CLARK, F.R.S.,

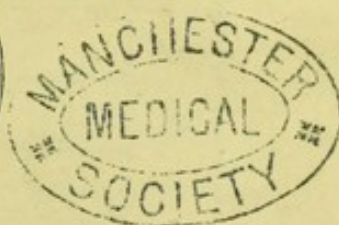SENIOR SURGEON TO ST. THOMAS'S HOSPITAL.

SECOND EDITION,

Revised and Expanded by the Author,

ASSISTED BY

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PREFACE.
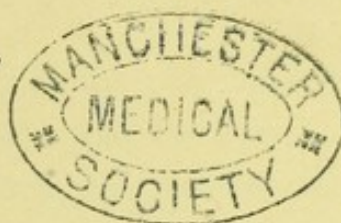
THE present edition of these " Outlines " has been carefully revised, and many additions have been made, especially in Surgical Pathology, so as to include the most recent investigations in this and allied subjects.

Some papers have been added to the Section on " Emergencies and doubtful cases ;" and a short Section has been devoted to the Surgical Anatomy of some important structures and regions ; whereby it is hoped that the volume will prove more acceptable to the Practitioner as well as useful to the Student.

The Author desires to acknowledge the valuable assistance afforded to him by his friend and former pupil, Mr. Wagstaffe, in the preparation of this Edition ; and may especially refer to the papers on the " Method of Observation," the " Diagnosis of Joint Disease," the " Use of the Thermometer in Surgery," and " Hints on Minor Surgery,"—as contributions from his pen.

For further information in relation to " Visceral Lesions," occasional reference is made to the recently published Lectures of the Author on this subject, which were delivered when he had the honour of holding the appointment of Hunterian Professor of Surgery and Pathology in the College of Surgeons.

September, 1872.

PREFACE

TO THE FIRST EDITION.

THE present "Outlines" comprise, for the most part, little more than the notes from which the Author's Lectures have been delivered, somewhat amplified; and they are offered to the Student, in the hope that he may be encouraged to fill in the details from actual observation, and thereby cultivate a habit of self-reliance, instead of depending too much on book-teaching in his early studies. Illustrative notes and cases, thus collected by himself, can scarcely fail to be of lasting value to him in his future practice. Beyond this legitimate aim, the present volume can, of course, have no pretensions in common with more comprehensive "Systems" of Surgery.

Progress in scientific knowledge leads to generalisation; and, happily, Surgery affords no exception to this rule. Facts usually admit of a rational explanation, by referring them to the few and simple principles with which they are naturally allied. The author trusts that this association has been rendered apparent in the present epitome; and that the abruptness of diction, in which the information is conveyed, will be excused as inseparable from compressed descriptive writing.

The concluding Section is designed to compensate, in some measure, for the brevity with which subjects of great practical

importance have been treated in the preceding Sections : and it is the wish and intention of the Author, at a convenient opportunity, to supplement these brief " Outlines," by the publication, in a collected form, of illustrative Clinical Lectures.

As this volume is intended especially for the Student of Surgery, a few words of general advice may be added. He must bring an earnest spirit to his work, for it demands the cultivation of many qualities of both heart and intellect. His early and close observation of Nature should teach him to appreciate and trust in her resources, and not to over-estimate his own ; the sooner this necessary lesson is learned the better. He will perceive that the Art of Surgery is applied chiefly in removing mechanical obstacles to Nature's healing efforts, or in assisting those efforts in accordance with her indications and under her guidance ; as, in the treatment of fracture, the relief of stricture, the removal of a sequestrum, or the excision of a joint. The Science of Surgery comprehends the principles which are designed to teach him how and when to exercise his Art, and the equally important, though not less difficult, lesson of judicious forbearance. In pursuing his studies, he must keep this distinction in view, and strive to maintain a healthy balance, as regards the time and value to be allotted to the guiding principles and the practical detail of his art : for, sound Principles, if unaccompanied by an acquaintance with their application, will be of little avail in actual Practice : and, on the other hand, the mere treasuring up of precedents for future guidance cannot fail to prove disappointing. It is true that a remedy may be correctly applied, because its success has been witnessed when it was employed by others. But this is not scientific knowledge ; it is not satisfactory practice : for the apparently similar is often essentially different ; and the Practitioner who is satisfied to act on precedent alone will continually find himself at fault, and also be deprived of the pleasure of practising his Profession philosophically, instead of

following it as little better than a trade. Armed with sound principles, and with such familiarity with their practical appli-cation as the period of probation permits him to acquire, the student may commence the practice of his Profession with self-reliance, though still a learner, and never relaxing in his desire to enlarge his stock of knowledge. But the foundation will have been laid; and every stone which subsequently comes to hand will find its appropriate place in the superstructure. His pile will thus assume, from the beginning, an architectural character, instead of becoming, as it may be feared is too often the case, a mere heap of fragments, unwieldy and comparatively useless, if not positively perplexing to the accumulator and possessor.

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SECTION I.

HEALTH—DISEASE—TEMPERAMENT.

A **state** of **health** implies the performance of all the functions of the body without disturbance. When this harmonious activity is interrupted, the existence of either functional derangement or of organic change is indicated. Functional derangement may lead to organic or structural change; or the latter may be the consequence of some sudden or accidental lesion. As organization signifies the presence of blood-vessels and nerves, so disease implies their functional disturbance.

Structural and *functional* **disease** both vary greatly in their intensity. Though the latter is usually less important than the former, yet it may be fatal to life; whereas the former may exist with comparative freedom from risk. Functional disturbance may be secondary or sympathetic, as witnessed in almost every disease or injury to which the frame is liable.

The *sources* of disease are numerous. It may be conveyed to us from without, or may exist in a latent or inherited form within the body; its seeds are sown by excess, or it may result from accidental violence. What is disease? The aggregate symptoms which we usually treat as such are to be regarded as a curative effort of nature. Thus, the elements of one form of consumption exist, in a latent form, as tubercle; the phenomena attending its softening and discharge constitute the disease; and in scarlet fever, the symptoms which we call the

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disease are the phenomena attending the elimination of a blood poison ; whereas, the presence of tubercle in the one instance, and of the blood poison in the other, really constitute the disease ; and their elimination is a reparative effort. So, in surgery, profuse suppuration, and other destructive consequences of severe injury, are strictly reparative in their nature, though fatal in their excess. To take this view of the phenomena of disease *generally* will curb our impatience in their treatment, and induce us rather to watch, guide, help, and support Nature in her operations, than to attempt to oppose and control her, by ignoring her indications, and substituting our own theories respecting the cure of disease.

Any one organ or set of organs may be primarily the seat of disease, or may be involved secondarily either by sympathy or by their functions being inordinately taxed for vicarious elimination or otherwise.

The *phenomena* of diseased action have their seat especially in the vascular and nervous systems, and in each this morbid condition is evinced by either excessive or defective action. In some instances this excess or deficiency is in direct proportion in each ; whilst in others it is developed in an inverse ratio, extreme nervous excitability being accompanied by feeble vascular energy.

In the study of pathology and the treatment of disease, it is to be remembered that the chemical affinities of inorganic matter are modified by vitality ; and that, therefore, diseased products are not to be viewed as mere chemical compounds, nor is the action of medicines to be calculated on, as if the living body were a chemical laboratory.

The **temperaments** which most concern the surgeon are, the sanguine, the choleric, the phlegmatic, and the nervous. The activity of the circulation, the excitability of the nervous system, the tranquillity of the temper, have great influence in modifying disease, and in determining the effects of injury or operation. So likewise the reciprocal influence of body and mind, and the predisposition or hereditary tendency to certain forms of diseased action, must be studied ; and the habits, whether temperate or self-indulgent, require to be taken

into account in operations or in the treatment of surgical injuries.

GENERAL EFFECTS OF DISEASE OR INJURY.

Every organ in a healthy state is susceptible of being excited to action by the presence of an appropriate stimulus ; as the heart by the presence of blood, the stomach by the presence of food, the organs of sense by the appeal made, severally, to them. Thus, the function of an organ may be said to depend, for its activity, on the agency of an appropriate stimulus. Admitting this physiological basis, it follows that derangement of function has its source in either the excess or deficiency of excitability in an organ, or the presence of an exciting cause, which is morbid in quality, or rendered so by quantity ; both of these conditions may be in operation simultaneously.

Irritation, in its pathological sense, is the consequence of an irritant acting on a morbidly excitable organ, or of a morbid excess in its healthy excitability. This is distinct from inflammation, and has its seat in the nervous system, as the phenomena of the latter are especially localized in the vascular. Irritation may be local, *i. e.* affecting some particular organ or limited spot ; or it may be general, *i. e.* extending over many organs, or involving the frame generally.

Local irritation may be either direct or sympathetic. Thus, a healthy stomach may be nauseated by disgusting food, and an irritable stomach by wholesome food ; or such irritation may be the consequence of an appeal to another organ, as when a blow on the head produces vomiting, or a strong light sneezing.

Sympathetic irritation may be more or less direct ; as where the lungs and stomach (receiving their nervous supply from the same source) are affected sympathetically ; or when the skin and mucous membrane are similarly influenced.

General nervous irritation may be idiopathic or *apparently* spontaneous, as in chorea and other nervous affections ; or the

cause of irritation may be palpable though distant, as where a wound is succeeded by tetanus, or a broken leg by delirium.

A local injury may be followed (1) by **healthy reaction** which is temporary; this requires no treatment. Or (2) it may be followed by **excessive reaction**, endangering or destroying life; this demands control according to circumstances, such as purgatives, cold to the head, local bloodletting, sometimes opium, rarely general bloodletting. Or (3) there may be entire absence of reaction, death occurring sooner or later from **shock**; this condition is to be met by the employment of warmth to the surface, friction, and the cautious use of stimulants. Or (4) **protracted irritation** may follow at a later period, constituting sympathetic or IRRITATIVE FEVER, and demanding treatment according to the special requirements of each case, as by support, stimulants, and sedatives.

General irritation, the consequence of injury or operation, is sometimes reflected on the seat of lesion, inducing a morbid instead of a reparative action, and thus giving rise to phlegmon, or otherwise endangering the vitality of the part affected. This condition occurs chiefly in unhealthy constitutions, deteriorated by dissipated habits, therefore of feeble power, but great susceptibility.

It may be assumed as an axiom, that irritation is augmented in intensity, usually, in proportion to deficiency in power. This constitutes a marked distinction between irritation, which has its seat in the nervous system and excited vascular action or inflammation. The method of affording relief is correspondingly distinct. In the one it is often necessary to relieve vascular repletion; in the other, soothing and tranquillising remedies are required.

Nervous delirium may be the consequence of a local irritation—any injury—acting on the cerebro-spinal centre: this occurs most frequently, but not necessarily, in drunkards. It is ushered in by an unnatural cheerfulness, with affected courage and indifference; bright eye; quick, involuntary movements; then occasional incoherence and sleeplessness, followed by insensibility to pain and wild delirium. There is usually profuse perspiration, but absence of fever, marked by a

clean tongue and quiet pulse. When this condition occurs in drunkards **(delirium tremens)**, there is general muscular tremor, anxiety, lack of appetite, nausea ; tongue usually coated, creamy and tremulous ; the pulse full and soft. In nervous delirium, the mind seems to be abstracted from surrounding objects of sense, and to hold intercourse with imaginary persons, and to be acting a part amid imaginary scenes.

This condition is rarely fatal, and is to be TREATED BY repeated doses of *opium*, either by the mouth or rectum, or by its subcutaneous injection, until sleep be procured ; from which, if profound, the patient usually awakes in a sane state. *Stimulants* must be used discretionally. *Digitalis*, in large doses, has been given with success ; and *hydrates of chloral* and *bromide of ammonium* have also been advantageously employed.

Tetanus is another form of nervous irritation, dependent frequently on a local injury, which, acting on the cerebro-spinal centre, produces, by reflection, more or less general muscular spasm. These are essentially excito-motor phenomena. If limited to the muscles of mastication, which are usually first affected, the disease is called trismus. Emprosthotonos, opisthotonos, pleurothotonos, are terms employed severally to denote spasm of the back, front, or side of the trunk. The traumatic causes of tetanus may be any form of wounds—most usually contused or lacerated wounds—sometimes of very trivial magnitude or importance, such as even a bruise ; it occurs not infrequently after gunshot wounds, and may follow burn. Tetanus has been known to succeed various operations, as amputation, castration, deligation of an artery, hydrocele ; but such cases are very rare. The interval between the receipt of injury and development of the disease varies from a few hours to many days. Trivial causes excite a paroxysm ; the aspect of the patient is then very distressing. Death occurs from exhaustion, asphyxia, or possibly spasm of the heart. The intellect is unaffected, except just at the last in some protracted cases. Post-mortem examination shows congestion of spinal cord and of lungs ; and the investigations of Lockhart Clarke have shown the presence of extensive areas of disinteg-

ration in the grey substance of the cord, especially around the central canal, with softening and exudation of a finely granular fluid, and the *débris* of blood-vessels and nerves in the same locality.

TREATMENT.—Relieve constipation; draw off the water if retained. Perfect quiet should be enjoined. Soothe the seat of injury. The following *medicines* have been given in this disease:—Opium in repeated doses. Extract of belladonna, two or three grains every three hours. Same dose of Indian hemp at short intervals, till its narcotic effect is produced. Tobacco, in infusion, as an injection. The above are powerfully sedative. Aconite and strychnia have been recommended on an opposite principle. Chloroform and chloral given at intervals, and repeatedly for a lengthened period, are valuable remedies. Sesquichloride of iron is valuable as a tonic. Division of nerve may be practised, by transverse incision above a wound. Amputation has been proposed, but rarely practised. Tetanus may become chronic, and then requires purgatives and tonics.

Constitutional irritation from absorption of morbid poison, as in hydrophobia and dissecting wounds (to be noticed presently), is very closely allied to that in tetanus and nervous delirium.

Fever may occur in connection with injury, operation, or surgical disease: it is then said to be irritative or inflammatory fever. The type and degree of intensity of such fever are dependent on the character of the injury, the period of its endurance, and the importance of the tissues involved; also, intrinsically, on the previous health and habits of the patient, and on his age and temperament. It is ushered in usually by shivering, followed by heat of skin, quickened pulse, thirst, foul tongue, disturbed secretions; pain in the head, and irritable stomach. This may be *continued* fever for a protracted period; or may assume the typhoid type, when there is feeble power and the source of irritation is unrelieved.

Irritative fever is usually asthenic in its type, and requires corresponding treatment.

Hectic is commonly present where suppuration is profuse and emaciation considerable. The periods of exacerbation are usually noon and evening. Appetite and digestion are good.

The attack is ushered in by chill, then heated hands, flushed cheek, hurried breathing and cough, perspiration abundant towards morning. Tongue clean, thirst, eye bright, mouth aphthous at the last.

TREATMENT. — Nutritious diet, fresh air, cooling drinks, soothing medicines.

Temperature.—In fever it would appear that the temperature of the blood is raised ; and the intensity of the fever is probably proportioned to the rise in temperature, the rigor marking the commencement of this change. The fall of temperature in simple shock appears to average $1°$ or $2°$, while the subsequent rise reaches in healthy reaction from $2°$ to $4°$ above the normal temperature of the body ($98 \cdot 4$). The maximum is usually reached in about thirty-six or forty-eight hours ; and if the temperature continues to rise after this, or remains at the same height for any length of time, the prospects of recovery become more and more unfavorable. In the typhoid forms of fever following surgical injuries the temperature may reach $110°$; and the same temperature may occasionally be found in some of the acuter forms of disease coming under the surgeon's notice, as tetanus. During convalescence the daily variations are great : the temperature falls often below the standard.

FUNCTIONAL DISTURBANCES IN THE VASCULAR SYSTEM, AND THEIR SEQUENCES.

The phenomena of inflammation have their proximate *seat* in the vascular system. The blood is compounded of various elements, endowed with chemical affinities, possessed of vital properties, and subjected in its circulation to mechanical influences. The direct mechanical agents in the propulsion of the blood are muscular contraction and elasticity. The phenomena of nutrition, growth, and repair, or of disorganization and destruction, are more directly in association with the capillary or intermediate system of vessels ; whilst the augmented activity or increased energy of the propelling agents is

entirely secondary, and dependent on the antecedent loss of
balance in the capillary network, the arteries and veins holding
the relation of intermediate conduits between them and the
heart.

In health, the due balance of waste and supply is preserved ;
yet the operation of efficient causes may, without constituting
disease, induce an extraordinary or diminished supply of blood
to a part, and the corresponding consequence of excess in
growth or the reverse ; as in muscle when much taxed or
disused.   But there are other ways in which the balance may
be suspended or lost ; in which a large quantity of blood may
be accumulated at any given point : this is "**Hyperæmia.**"
Such hyperæmia may depend on two distinct mechanical causes
—one in which the accumulation is the consequence of some
obstruction to the return of the blood through the veins towards
the heart ; the other in which it is conveyed to a part in in-
creased quantity through the arteries.   These two conditions
are severally denominated *passive* and *active hyperæmia.*

Passive Hyperæmia, or **Congestion**, is the effect of
mechanical obstruction, as where a vein is compressed or
plugged.   The consequence of such venous obstruction is
distension of the capillaries, and, if continued, infiltration of
tissues from excessive exudation of liquor sanguinis.   Thus
œdema or local dropsy, ascites or abdominal dropsy, and
anasarca or general dropsy, are produced.   In this filtering
process through the porous vessels the nutritive quality of the
liquor sanguinis is modified by changes in the proportion of
albumen and salts ; so that, although the quantity of blood
actually present in a part so affected is unnaturally large, it is
blood despoiled of its nutritive and stimulating properties, and
therefore valueless for growth.   Thus, congestion is an atrophic
condition ; and its effect is the same as where there is simply
a deficient supply of nutrient blood, without detention ; as
proved by the feebleness of muscular tissue, which is the seat
of such congestion, the occurrence of ulcers in varicose
limbs, &c.

As, in passive hyperæmia, there is retention of deteriorated
blood, so, in **Active Hyperæmia**, there is an increased supply

of fresh and nutrient blood. Such augmented supply may, however, be attended by obstruction, primarily and principally, in the capillaries. It is this last characteristic which distinguishes inflammation from **Hypertrophy**; in the latter there is excessive nutrition, but unattended by obstruction. Thus, the quantity of blood is augmented in a part which is the seat of congestion, or inflammation, or hypertrophy. In the first there is obstruction in the venous circulation, and the blood is impoverished; in the second, there is obstruction in the capillaries, and the blood is nutritive; in the third, there is no obstruction.

Atrophy, or deficient nutrition, may be local or general, and may be the consequence of disuse of the part affected, of congestion, of obstructed arterial circulation, of mal-assimilation, or of defective innervation.

Anæmia is used in a more restricted sense, to denote a general bloodless condition, resulting either from large or repeated loss of blood, or from some defect in the production of its constituent elements.

Inflammation.—The capillaries, which take a most important part in the phenomena of *inflammation*, occupy an intermediate position between the extreme arteries and veins, and are constructed of a simple membrane of extreme delicacy, through which the liquor sanguinis is permitted to transude for purposes of growth and reproduction : beyond this passive office, the removal of effete matter, and the power they are endowed with, of extending themselves by offshoots into new tissues, they take no active part in growth; such tissues growing by their own intrinsic power of development in their own germs.

Arteries are both muscular and elastic, the former property increasing and the latter diminishing as they recede from the heart; they are, therefore, capable of contraction and dilatation; veins possess the same properties in a very minor degree.

In health, the blood moves through the capillary network in an even uniform stream. Local irritation produces a disturbance in this uniformity, and subsequent arrest of the blood corpuscles; such stagnation resulting probably from an altered condition in the vital relations between the vessels and their

contents, and the suspended influence of the vaso-motor nerves. Thus, the first observable sign of inflammation is capillary stagnation, immediately succeeded by transudation of the liquor sanguinis. The direct consequence of this exudation, but essentially secondary, is an increased supply of blood to the part :—degeneration of texture and active textural productiveness coexisting as essential conditions of inflammation. Increased supply of blood is accompanied by corresponding augmentation in the calibre of both arteries and veins, which the relaxed condition of the capillaries would more readily permit ; there is diminished resistance to the ingress of blood, and the arteries propel it with increased activity. As reparation and reproduction proceed, the capillaries extend themselves into the new tissues, and, finally, the supplying and returning vessels resume their normal calibre, when the local requirements for augmented supply cease, *i. e.*, when the inflammation subsides.

When an irritant is applied to a tissue capable of being submitted to observation, there follow (1) disorder of the circulation, with changes in the blood-vessels; (2) exudation of liquor sanguinis, with migration of white corpuscles ; and (3) altered mode of growth in the elements of the tissue around.

1. The *disorder of the circulation*, as seen in the mesentery of the frog, consists in a dilatation of the vessels ; and it is doubtful whether this is preceded by any contraction. At the same time that the dilatation commences the rate of flow is accelerated, and this acceleration soon attains its maximum, while the dilatation is gradual, and does not reach its maximum until about twelve hours after exposure of the mesentery.

The vessels continue to dilate until they reach about double their normal size, the arteries increasing in size more rapidly than the veins. Before the vessels have reached their maximum of dilatation the flow of blood in them becomes retarded, and the amount of blood brought to the part under observation becomes diminished. Lastly, circulation becomes irregular, the blood-stream appears undecided in its course ; its flow then ceases, and the condition called stasis is produced.

The contents of the vessels now become altered in appearance ; the red corpuscles appear to run into one another, and form a red, jelly-looking mass in which no individual corpuscles are visible.

2. *Exudation of liquor sanguinis, with migration of white corpuscles*, occurs during that stage of inflammation in which the circulation is retarded in its rapidity, and while the vessels are dilated. The evidence of the exudation is to be found in the juiciness of inflamed tissues, and the evidence of migration in the presence of pus, which has its origin in the early stages of inflammation chiefly in the migration of the white corpuscles from the blood. These corpuscles are first noticed to be adhering in gradually increasing numbers to the walls of the vessels, especially the veins. Later on, accumulations of similar corpuscles are found upon the exterior of these vessels, while free corpuscles are seen floating in the fluid around, or passing into the tissues. If a small vessel be carefully examined for a length of time, white corpuscles may be seen at first adhering to the wall by one end, and being beaten about by the stream of blood passing over them. If one of these corpuscles be observed attentively, it will be seen that in the course of a short time it becomes more firmly implanted in the wall, and may sometimes be seen projecting one half outside the vessel and one half in. Later on the corpuscles are seen lying altogether outside.

The corpuscles have received the general name of leucocytes in common with lymph corpuscles, pus corpuscles, and similar bodies which cannot be distinguished from them, and they possess a power of movement exactly resembling that of amœbæ—some of the lower forms of living bodies. When they have escaped from the walls of the vessels, they appear to consist of a mass of protoplasm, which has the power of projecting from its surface processes and retracting them, and thus of exhibiting what are termed amœboid movements. They travel in the tissues for some distance from the vessels. They possess, also, another peculiarity,—the power of absorbing materials into their substance, as, for instance, vermillion, milk, carmine, &c.

The locomotive power of these corpuscles is well shown by one of Recklinghausen's experiments. A piece of cornea, several hours dead, is placed in one of the lymph sacs of a frog. After a few days leucocytes were found in the piece of cornea, of the same size and character as those in the frog's blood, and coloured with vermillion, which had been injected previously into the frog's circulation. Similarly Lortet showed that the leucocytes pass through the walls of a fish's air-bladder which has been placed in an inflamed area.

Under certain circumstances the red corpuscles of the blood can be seen to pass through the capillary walls in inflammation, without rupture of the vessel; and these corpuscles also possess the power of amœboid movements. The migration of red corpuscles takes place more readily after the injection of certain saline solutions into the blood; and this power of locomotion is important in the explanation of internal and other hæmorrhages in purpura, hæmatemesis, scurvy, and similar diseases where no vascular lesion can be discovered.

The walls of the blood-vessels play an important part in the process of inflammation. They are not merely passive tubes, but living membranes of soft, plastic matter, through which fluids and, at times, solids can pass without leaving a rupture as the consequence. In inflammation there is an altered relation between them and the blood, the blood containing certain elements which are morbid in quantity (leucocytes) or kind (chemical peculiarities), and the capillary walls permitting the transudation of these materials more readily than in health. The influence of the vascular walls in the production of stasis is shown by Dr. Ryneck's experiment. A frog is injected with milk until only that fluid is circulating; mechanical irritation of the web or mesentery will produce stasis of the circulation; but if the vitality of the capillary walls be injured by previous treatment with solution of chromic acid, no such stasis is producible by the irritation.

3. *Altered mode of growth in the elements of the tissues around.* Although in the earlier stages of inflammation the source of the leucocytes which constitute pus is, in all probability, alone from the migration of the white corpuscles of

the blood, in the later stages the elements of the tissues of the inflamed area undoubtedly assist in producing these corpuscles. There is an increased activity in the nutritive functions of these elements. Cells which normally exhibit active movements, as the amœboid corpuscles of connective tissue and cornea, become still more active; irregular nuclei appear, which multiply and produce irregular clusters of amœboids which throw off free leucocytes. Cells which normally exhibit no active movements whatever, as in epithelium and cartilage, become active; they send forth processes, their nuclei divide, proliferation occurs, and in the place of the cells leucocytes, free and in masses, appear. These textural changes are the effects of stimulation by the exuded liquor sanguinis which is morbid in character.

In **Repair after injury** a process goes on which is closely allied to that of inflammation, but differs in the character of the exuded fluid and in the results. The fluid is not morbidly irritating as in inflammation, and consequently there is not the same germination and production of leucocytes from the blood or from the elements of the tissues. The exuded liquid contains the fibrin-bearing elements of the blood, and these are coagulated by being brought into contact with the surface or part which has been injured. In this fibrinous coagulum granulation tissue and new capillaries are developed. The granulation tissue consists entirely of young cells, which differ from leucocytes in being protoplasm with a well-defined central nucleus, nearly allied, in fact, to formed tissue. They possess a great tendency to rapid multiplication by division, but very slight tendency to amœboid movements. New capillaries are formed in this granulation tissue by a process of budding off from the side of a vessel, the buds enlarging and uniting with others to form anastomosing vessels.

The SIGNS of inflammation are *redness*, *swelling*, *heat* and *pain*. *Redness* is due to the accumulation of blood in the relaxed and distended blood-vessels. The intensity of colour and its hue depend on the degree of distension and the preponderance of arterial or venous repletion. It is not confined to the immediate seat of inflammation; it is removable for the time being by pressure, and is thus distinguishable from dis-

coloration by extravasation of red corpuscles. The presence
of new capillaries also adds colour. The brighter the hue,
generally speaking, the more active is the inflammation.

Swelling varies according to the laxity of the tissue
affected. Taken alone it is valueless as a sign of inflamma-
tion. Its presence, in this condition, appears to depend on
accumulation of blood, on infiltration from exudation, or on
excess of new growth. Parts in the neighbourhood of inflam-
mation are involved in this condition.

Heat is a somewhat deceptive sign, being more apparent
than real, as proved by the thermometric test. Morbid ner-
vous sensitiveness exaggerates the feeling to the patient. Yet,
heightened temperature is present in inflammation, and appears
due to the abundance of blood in circulation in the part, and
the more active evolution of heat from the correspondingly
active chemical changes. Experiment has shown that the
focus of inflammation is warmer than the arterial blood in its
progress to such part ; and that the latter has also a lower tem-
perature than the returning venous blood.

Pain may exist in varying intensity and kind, or may be
altogether absent. Natural sensitiveness of a texture, and the
unyielding character of surrounding tissues, modify this symp-
tom. It may be intermitting or continuous ; and may be
excited by pressure or motion. In acute inflammation it is
usually throbbing, plunging, or lancinating. Dense and closely
confined textures are generally the seat of the severest pain.
The character of pain is often a valuable diagnostic sign of the
stage of inflammation ; and various explicatives are employed
by patients to define their suffering, such as pricking, burning,
stabbing, cutting, or gnawing. Tenderness is pain induced by
pressure. Pain may be sympathetic and at a distance from the
seat of inflammation, as that in hip-disease referred to the knee.
Sudden cessation of pain may indicate the suppurative or gan-
grenous termination of inflammation. The pain of inflamma-
tion is due to pressure, or stretching, or actual organic lesion of
the nervous fibrillæ ; and is distinguishable from simple neu-
ralgia by the absence of the other signs of inflammation, and
by the latter being almost invariably intermitting or periodical.

The CAUSES of inflammation may be classed under two heads—exciting and predisposing; or both may be combined. The exciting causes may be mechanical, chemical, extremes of temperature, the circulation of a poison, the proximity of disorganised or dead tissue. The principal predisposing causes are, defective innervation, deteriorated or obstructed circulation, hereditary diseased tendencies, atmospheric and allied external influences.

The CHANGES which occur in the transuded fluids in inflammation must not be confused with those which are consequent on congestion. Both the physical causes of the effusion and its chemical constitution are different. The quantity of inflammatory effusion is influenced by the natural vascularity and the looseness of the affected textures, and therefore it is not to be taken as a measure of the intensity of inflammation. Its physical characters also vary; it may be colourless, limpid, turbid, or mixed with blood. Its specific gravity is high; and, besides the presence of organic forms derived from the dissolving tissues, inflammatory exudation may be further distinguished chemically from dropsical effusion by an excess, even over the blood, of chloride of sodium and the phosphates, as well as by the presence of albumen in sufficient quantity to coagulate with heat. Cells, in various grades of development and in varying quantities, of which the pus-cell is the type, are also present. These products indicate the coexistence, in an inflamed tissue, of rapid decay and death, with abnormally active productiveness and growth.

TREATMENT. — In treating inflammation, remove, if possible, the exciting cause, or mitigate, as far as may be, its effects. An accurate knowledge of the pathological condition will lead to the employment of sound treatment, on rational and intelligible principles. It is to be borne in mind that inflammation is essentially reparative, and therefore that its course and consequences are not to be opposed, so much as controlled, directed and modified.

Rest should be enforced, *e. g.*, in a broken limb, a diseased joint, after operation for hernia. *Posture* should be such as to favour the return of blood towards the heart. *Depletion*

may be local or general; as by leeches, punctures, sudorifics, purgatives, &c. *Counter-irritation* by blister, moxa, &c., to a neighbouring part. *Topical applications*, viz., cold, warm, and anodyne. Heat and cold produce similar results in a different way; the former encourages free exhalation from the skin, the latter acts as an astringent on the vessels, and thus limits transudation from them. The former is generally preferable, as more continuous in its operation. *Surgical operation*, as in phlegmon, abscess, extravasation of urine. Diet to be regulated by circumstances.

The special application of these general principles embraces a large proportion of surgical practice.

CONSEQUENCES OR TERMINATIONS OF INFLAMMATION.

Inflammation may run its course, and subside without leaving any trace of its existence: or it may entail one of two sets of consequences—the deposit of new product, succeeded, perhaps, by organisation; or a loss of substance by a gradual and wasting process, or by actual and rapid death of the part. Such loss may take place, in other words, by interstitial disintegration, by ulceration, or by gangrene.

In **resolution** the capillary obstruction and arterial repletion subside, a healthy equilibrium between the afferent and efferent vessels is restored, and the effused liquor sanguinis is absorbed, leaving no organic change behind. Mild erysipelas, trifling scalds, &c., illustrate this condition. In some instances congestion accompanies or follows inflammation tending to resolution. *Treatment* must be directed to limit such inflammation and induce its resolution, as by evacuants, rest, posture, warmth or cold.

Interstitial disintegration, ulceration, phagedæna, gangrene, are all modifications of the same destructive process by which the living organism becomes effete and is given over to chemical dissolution. Thus, abscess is a closed and shut-in ulcer, and ulcer an

open abscess on the surface. Phagedæna is rapid ulceration ; so rapid that the effete matter is undissolved in the pus, and clings to the surface. Gangrene is more or less sudden death falling on a part, involving various textures simultaneously.

Ulceration is a devitalising process, by which a breach of surface is produced, in consequence of the molecular disintegration and softening down, under chemical decomposition, of the heretofore living textures. New chemical affinities being established, fresh combinations result, and oil especially is found in place of albumen and gelatin. But, as the process is, in a varying degree, inflammatory, the presence of reproductive effort is apparent in the discharge, in the form of unappropriated cells and corpuscles, including those of pus. Ulceration presents every grade, and corresponding variety in its attendant phenomena, between the almost imperceptible extension of a breach and rapid phagedæna bordering on gangrene.

TREATMENT.—By rest, soothing applications, warmth, and moisture, detergents, stimulants, escharotics, &c., according to circumstances. The details will be given, with ulcers.

Pus is found on the surface of ulcers, of mucous and other membranes, and contained in circumscribed cavities. Microscopically, pus consists of a multitude of cells, about $\frac{1}{2000}$th of an inch in diameter. These cells have the same appearance as the white corpuscles of the blood. In pus examined under ordinary circumstances they are spherical bodies of plastic matter, more or less granular, and when acetic acid is added one or more nuclei are visible in their interior. When examined during the process of suppuration, in the cornea or mesentery, they are seen to be amœboid bodies capable of movement and of constant alteration in form. Other globules and cells mingled with pus on a suppurting surface, represent the spoiled material for growth.

Abscess is a disorganising inflammation of texture beneath the surface, presenting the essential phenomena of ulceration, but modified by circumstances of position and texture. Thus, the products are confined within a more or less limited space. The loss of substance is not to be measured by the size of an abscess. The tendency of such purulent accumulation is to

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evacuate itself by the surface, or into some neighbouring cavity.

SYMPTOMS.—Pain, swelling, fluctuation, varying in quality, extent, and period, in accordance with the high or low vitality and the density of the textures affected. Abscess may be acute or chronic, with many intermediate conditions. The purulent contents vary according to attendant circumstances, being thin, thick, bloody, or fetid.

TREATMENT, *local and general.*—Rest, position ; leeches ; cold, or warmth and moisture. The time for opening is earlier where density of texture resists approach to the surface, or where there is risk of penetration in other directions involving important tissues, as in the perineum or neck. Handling should be avoided ; as well as admission of air, by which the contents of an abscess are subjected to decomposition. Large chronic abscess should be treated by repeated openings, and uniform pressure in the intervals. Pus is transferred, apparently, in some instances, from one part to another. Abscess, consequent on poisoned blood, is probably eliminative, and is unattended, or almost so, by loss of texture. Sympathetic abscess may result from simple irritation or from the absorption of poison, as in bubo. Pus may be diffused through the areolar tissue, or amongst muscles ; it should then be evacuated early.

A **sinus,** following abscess, is the consequence of defective action or some mechanical obstacle, preventing a cavity from completely closing. The secretion is usually thin and abundant, often accumulating for want of ready exit.

Fistula is a sinus in connection or communication with some natural excretory duct.

TREATMENT. — By pressure, stimulant injection, caustic probe, or free incision, dressing the wound from the bottom.

Hectic is a frequent concomitant of suppuration in weak and irritable constitutions which are overtaxed by the reparative effort.

Mortification, as a consequence of inflammation, is purely destructive ; thus differing from ulceration and abscess, which, though also essentially destructive with varying rapidity, are attended by an abortive effort at reparation. Gangrene may

be dry or moist, according to the rapidity of the devitalising process, the character of the tissue involved, the scantiness or abundance of the areolar tissue, and the quantity of moisture in a part. The earliest SYMPTOMS indicate intense inflammation ; the colour is dark, the heat burning, the swelling hard. The skin next assumes a yellowish or bruised appearance ; the temperature declines, and vesication occurs with effusion of dark fluid. Then pain diminishes ; the parts shrink and turn to a brown or ashy colour, with fetor ; lastly, they become black, cold and insensible. The general symptoms are, first, in slow but fatal cases, excitement of the circulation and fever ; subsequently, those of shock. Face cold, pale, and moist ; features pinched ; pulse quick but feeble ; tongue brown ; collapse, vomiting, hiccup, muttering delirium, earthy odour from the body ; death.

The constitutional symptoms are much modified according to circumstances of extent and cause of gangrene. In senile gangrene the process is usually unattended by active symptoms, and the character of the gangrene is dry.

General CAUSES. — Feeble power with irritability, either natural, induced by fevers, or by other depressing agents ; poisons inhaled (as in hospital gangrene), or introduced into the circulation (as in bites of venomous serpents) ; also defective assimilation or nutrition ; ergot of rye.

Local CAUSES. — Insufficient circulation or innervation ; pressure, as in bed-sores ; contused and lacerated wounds ; tearing across or ligature of a large artery, or obstructed arteries from coagulation of their contents, commencing peripherally ; arteritis ; or from ossification (senile gangrene) ; isolation of a part, as after plastic operations ; excessive, or deficient heat ; escharotics, as acids, lime, &c.

TREATMENT.—General, according to circumstances, such as cause, condition of system, and stage of disease. Support and tranquillise ; bark, ammonia, opium, wine. Local ; various stimulating poultices, such as stale beer-grounds or carrot ; charcoal ; chloride of lime or nitric acid washes. Remove sloughs as they are loosened. The period for amputation must be determined by the original cause of mortification ;

when purely local, and the effect is limited, it may be resorted to early; where the cause is general or constitutional, the arrest of the destructive process, as indicated by a line of demarcation, must be waited for. Spontaneous separation of a mortified part is accomplished by an ulcerative action, and not by absorption.

Boil and Carbuncle.—**Acne** is the simplest form of boil, being suppuration excited by the accumulation of secretion in a sebaceous follicle of the skin. Friction of the affected surface is the best preventive.

Boil and carbuncle are closely allied, both commencing usually as circumscribed inflammation of the skin, and subsequently extending more or less deeply. They are often combined; and the causes producing them are the same, though modified in degree.

In *furuncle or boil*, the condition is allied to abscess, the cutaneous inflammation terminating in circumscribed suppuration. In *anthrax or carbuncle*, the inflammation terminates in plastic infiltration of the areolar tissue, and rapid disorganisation. Probably, in each the action is eliminative. The predisposing causes are insufficient or excessive nutrition, low power of assimilation, inaction or disordered function of liver, kidney, &c.: diabetes; gouty diathesis. The parts most usually attacked are, the nape of the neck, between the scapulæ, the buttock, or the shoulder: but any part of the body may be the seat of these affections, which are very liable to recur, especially when interfered with surgically at an early period.

TREATMENT. — Careful attention to secretions, nutritious diet, suitable or accustomed stimulants. Pressure, or the application of iodine paint may arrest carbuncle at an early period. Subsequently, use warmth and moisture. Premature incision is to be deprecated. Small but deep incisions where pus begins to exude, to give exit to it and to sloughs, are preferable to large incisions, unless the mechanical tension imperatively demand the latter. Then apply stimulating poultices, such as scraped carrot, and linseed meal with stale beer-grounds; and support with adhesive plaister as soon as the sloughs have separated.

Erysipelas is diffused inflammation of the skin alone, or involving the areolar tissue, accompanied by fever. It is probably due to an atmospheric poison and infectious; its duration varies. It occurs most frequently in constitutions naturally feeble, or broken down by previous disease or excess; and is more common in youth and middle age, often indicating an inherent predisposition on the part of the patient. It may recur repeatedly and coexist with other diseases. The exciting CAUSES are sometimes trifling, such as a slight wound of the scalp or scrotum, a leech bite, &c.; also any surgical operation. The general SYMPTOMS which usher in the attack are those of fever, viz. rigor, flushed face, foul tongue, quick pulse. A scarlet blush then appears, accompanied by some tumefaction, and spreads with more or less rapidity, and the peculiarity which may commonly be noticed, and which will usually distinguish it from inflammatory redness, is its well-defined irregular outline. The TERMINATIONS are, as in ordinary inflammation, according to the type of the attack, which may be that of simple, œdematous, or phlegmonous erysipelas. In the first form the inflammation is limited to the skin (**erythema**); in the second the areolar tissue is involved, and there is always more or less infiltration of it from exudation; these forms usually terminate by subsidence or resolution. The third or phlegmonous form frequently runs a destructive course, terminating in diffuse suppuration and sloughing, and often entailing a fatal issue. In the milder forms of erysipelas vesication is usual, and occasionally circumscribed abscesses form where the areolar tissue is lax and abundant, especially in the eyelids. The scalp rarely sloughs after erysipelas, probably because of its high organisation; and the scrotum and lower extremity do so most frequently.

TREATMENT.—*General*, as in ordinary inflammation, according to the cause, constitution, and existing condition; but remembering that the disease is generally indicative of an asthenic state. Light nutriment, wine, bark; opium if necessary, but with caution. Attend to the secretions.

The *local* treatment in the mild forms should be very simple, such as light poultice, water dressing, or evaporating lotion. In

erratic or spreading erythema, a free use of nitrate of silver to the skin, beyond the seat of attack so as to isolate it, will often arrest its progress ; but it is of little value where the areolar tissue is involved.   Leeches or punctures are rarely of any use, but often mischievous.   When the phlegmonous form is accompanied by great tension, or there is evidence of diffused or circumscribed suppuration, then incision should be resorted to. Such incisions should rarely exceed two inches in length, but they must be deep enough to divide freely the areolar tissue down to the subjacent fascia in a limb ; superficial incisions do no good.   Regard should be had to the neighbourhood of large vessels ; and hæmorrhage should be controlled by a compress of lint in the wound.   Separation of sloughs of areolar tissue and fascia should afterwards be encouraged by warm applications. The skin rarely perishes in this form of inflammation.

Hospital Gangrene, or gangrenous phagedæna, is essentially constitutional in its origin, dependent on an atmospheric poison absorbed into the system, and occurring principally in crowded, ill-ventilated hospitals or camps ; it belongs to the same category as traumatic erysipelas.

It is ushered in by rigor, foul tongue, excited circulation, hot skin, &c., and accompanied by great prostration and irritability. The ulcer or wound which it attacks becomes covered with viscid, ash-coloured slough, and surrounded by a vivid red blush.   The circumference vesicates and ulcerates rapidly, and the chasm deepens.   The neighbouring absorbents become inflamed.   An allied condition is occasionally met with in patients, mostly females, suffering from syphilitic ulcer or bubo.

TREATMENT.—Generous diet, stimulants, bark, and ammonia : strong nitric acid applied to the carefully dried surface, and repeated if necessary : stimulating poultices, as stale beer-grounds.   Above all, plenty of pure air and cleanliness.

Ulcers.— Ulcer is the condition consequent on ulceration as the action : thus, every patch of ulceration is an ulcer, and whatever its duration, is the consequence of the same proximate cause, and is to be treated on the same general principles. These general principles are based on a proper understanding of the various conditions of the circulation in congestion and in-

flammation, and their resulting tendencies. The most usual seat of ulcers is the leg below the knee, and this is the consequence of low vitality, dependent on varicosity and congestion.

CAUSES.—The exciting cause of ulcer is often so trivial as to escape notice, when acting on a limb or a part predisposed to ulcerate. This predisposition, locally, consists in chronic congestion or venous obstruction in the smaller vessels, often, but not necessarily, associated with varicosity of the larger veins : and this condition is favoured by the erect posture constantly maintained ; by heat, as in cooks ; by obstruction of venous circulation, arising from habitual constipation or from pregnancy. The skin is sometimes thick and mottled, at others white, shining and œdematous, or showing patches of injection on the surface. In this lowered state of vitality, a slight lesion of surface, instead of healing, ulcerates ; or a little spot of superficial ecchymosis precedes this result ; or the first step may be quite spontaneous by vesication. The circumference of such spot becomes angry and inflamed, and ulceration spreads. Apart from specific causes, as scrofula, syphilis, &c., the constitutional or predisposing causes of ulcers are, as in other destructive forms of inflammation, an overloaded state of circulation, combined with disordered functions of assimilation primarily and of circulation secondarily ; or debility from overtaxed powers and deficient or defective food : an enfeebled system after disease, such as fever, predisposes to ulcers, which then result from even trifling exciting causes. Ulcers are sometimes vicarious of suppressed catamenia, or other habitual discharges.

The simplest division of ulcers is into *acute* and *chronic*. Either may be converted into the other ; the former by time, the latter by sudden and active extension.

Acute ulcer is characterised by a tendency to spread, being usually recent ; and it may thus become phagedænic or gangrenous : it may spread superficially or deeply, and is accompanied by great pain, unhealthy discharge, and inflamed circumference with œdema.

TREATMENT.—According to circumstances ; soothe, support,

attend to secretions, &c. Rest, favorable position, soothing or detergent application, as the case may demand, water-dressing, poultice.

Chronic ulcers are usually irregular in form, more or less excavated ; and, when indolent, of a dull red or pale colour and glazed appearance, with white, elevated and irregular callous edges, and pouring out a scanty and thin discharge. A common position for them is over the ankles, or on the front or side of the leg. Chronic ulcers may be indolent or active, and this activity may be shown by a disposition to spread or to heal. When spreading, the surface is foul or even sloughy ; when healing, healthy florid granulations cover the surface, and yield a creamy discharge. The treatment of chronic ulcer must be determined by its condition. Horizontal position and rest are important elements. Strips of wet linen, and over them a bandage carefully applied from the foot to the knee, when the leg is the seat of ulcer, serve to afford uniform support to the circulation. But first of all, the foul surface must be cleansed by stimulating lotions beneath poultice or water-dressing, such as black-wash, chloride of lime, &c., or a single application of strong nitric acid ; poultices of yeast, charcoal, or carrot. Red mercurial ointment, under a roller, suits some ulcers. Callous edges should be pared, or destroyed by caustic. Where a sore is large its healing may be very materially assisted by **grafting** small pieces of skin from some other part of the body. For this purpose a portion of skin, about the size of a split pea or larger, may be removed from the arm or thigh, and cut up into a dozen or more pieces. These are to be inserted into incisions or punctures in the sore, care being taken to allow all bleeding to cease before inserting the grafts. The wound may be dressed simply with wet linen. No special means for retaining the grafts are required. The wound should be in a healthy condition to ensure success.

Besides the above simple division of ulcers, the following modifications may be mentioned :—The *irritable* ulcer, which is usually small, circular, irregular, not deep, with inflamed circumference and thin discharge. The pain accompanying this form of ulcer is sometimes very severe, and quite dispro-

portioned to the magnitude of the wound. It is usually of long standing and difficult to treat. Black-wash, with mucilage and opium, may be applied under poultice. Support, and even firm pressure, often relieve.

The *catamenial* ulcer is usually circular and superficial, and yields a vicarious menstrual discharge.

Varicose ulcers sometimes commence by the bursting of a vein, or they subsequently are prone to bleed. Rest and support are then imperative. Obliteration of the vein by caustic or by acupressure is sometimes necessary before the ulcer will heal.

Much caution should be exercised in healing old ulcers rapidly, if they be so disposed, as head symptoms or internal hæmorrhage may supervene.

THE HEALING PROCESS.

The nature of the healing process depends upon the condition of the wound or lesion to be healed ; and it is only in those injuries of textures, which are unattended with loss of substance, that the reparation can be effected without reproduction of material. Further, the healing process varies materially according to the tissues which are lost, or injured, or divided, such as skin, muscle, bone. These details will be noticed in association with the " Injuries of various textures." The present remarks will be limited to the healing of divided tissues by adhesion, and breach of texture by granulation. The union of a simple fracture of bone requires the production of new material to cement the broken ends together, even when there has been no loss of structure ; and probably this is the only instance, unless tendon be included, in which such new material is strictly identical in texture with the original.

The vascular activity and its attendant symptoms, in a healing part, are essentially the same as in inflammation, but the difference is in degree and results ; the process in healing is purely reparative. The true elements of growth, and therefore

of reparation, are, as already stated, a solution of the salts of the blood, containing albumen mixed with fibrin in varying proportions ; and various textures possess the remarkable property of selecting the requisite materials for their own reproduction or repair.

The basis on which adhesion depends is fibrin, poured out in solution, and subsequently converted by coagulation into a colourless, homogeneous mass ; by this the adjoining surfaces of a wound, unattended by loss of texture, are mechanically agglutinated together, whilst the serous menstruum escapes from the breach. Probably this fibrin is not organised, as fibrin *per se* exhibits no especial tendency to organisation ; but it forms the bed through which capillary offshoots pass between adjoining surfaces. When the vascular union is complete the fibrin is removed by absorption. Where there is loss of texture the process is similar, but modified by the mechanical difference in the circumstances of the wound. After bleeding has ceased serous exudation continues, accompanied by increased vascular action. The fibrin is deposited, and gradually coagulates until the surface of the wound assumes an uniform glazed appearance. Into this, in the course of time, vessels shoot ; pus is secreted (the superfluous material of reparative growth), and the vessels form the tufted cones in the fibrin called granulations. Then the condition of the wound is identical with that of a healing ulcer or the interior of an abscess, and the further steps are the same in all. As the production of new material by cell-growth goes on and becomes organised, so, *pari passu*, the old fibrin is removed, and fresh is thrown out to form the bed of new tufts of vessels, the pus meanwhile protecting the surface. The surrounding level is thus gradually gained, and then roofed over with skin. The cavity of an abscess from which pus has been discharged is, in like manner, filled in until the sides coalesce by vascular intercommunication. The so-called pyogenic membrane would seem to be this granulating surface modified by circumstances. The contraction and loss of elasticity following the healing of an abscess or breach of texture are dependent on the non-reproduction of destroyed tissue, especially the elastic and areolar.

In the case of a *sinus* the difficulty in healing depends on its approximation, in its mechanical relations, to an unopened abscess, and the distance between its extremity and the skinning edge. The constantly accumulating secretion prevents the organic coalition of its opposed surfaces, especially where there is any movement, as in fistulæ. Therefore, rest and pressure are useful, and the stimulation of the surface provokes more activity and the exudation of fibrin; or incision puts the *edges* of a sinus, as well as its mouth, in free communication with the contiguous skin, and thus converts it into an ulcer, and allows the healing to take place as in an ulcer.

The skinning over of a granulating surface is effected from the circumference of a breach, and this circumference should be healthy. A recent cicatrix possesses low vitality, and is thus obnoxious to fresh ulceration from exciting causes, which act less readily on original texture; as in scurvy, hospital gangrene, &c.

SECTION II.

OF WOUNDS IN GENERAL.

ALL *injuries* may be classed under three heads—mechanical, chemical, including heat and cold, and from poison. Hæmorrhage is so common a consequence of the first that its causes and treatment should be first considered.

Hæmorrhage may be *external* or *internal;* the former comes within the province of the surgeon. The effects of the loss of blood depend on the rapidity of its abstraction, and whether it is arterial or venous. Faintness is consequent on the diminished supply of blood to the brain when the heart's action is enfeebled, and thereby the force of the circulation is further reduced; this is nature's styptic, allowing time for coagulation and the plugging of vessels.

Internal hæmorrhage results from the bursting of capillaries under excess of pressure, or from feeble resistance, or from transudation. It may be idiopathic, *i. e.* without apparent cause, as in epistaxis, or symptomatic, as from organic disease or congestion. Further, it may be active, as in the robust; or passive, as in the feeble; it may be also vicarious of menstrual discharge. These considerations must guide the treatment.

Hæmorrhagic tendency is noticed in some persons and families; thus, bleeding from the nose, the loss of a tooth, or a trifling wound has proved fatal: probably deficiency in fibrin or defective coagulability of the blood is the explanation. Internal hæmorrhage affects different organs at various ages; as the lungs in youth, the urinary and genital passages in middle age, and the brain in old age.

In active *external* hæmorrhage an uniform stream and purple colour betoken venous bleeding; a rushing stream, especially

when in jets, and a scarlet hue are characteristic of arterial bleeding. The two may be mingled. Arterial hæmorrhage more rapidly depresses the heart's action than venous by its mechanical influence, as well as by the abstraction of nutritious blood.

Hæmorrhage is *primary*, as from wound ; *reactionary*, after suspension from faintness, or other cause ; and *secondary*, as from ulceration, or separation of slough or ligature. Venous hæmorrhage usually ceases spontaneously without recurring ; arterial hæmorrhage may do so likewise, in the following way :—The open mouth of the severed artery contracts and retracts ; coagulum forms around and within it ; its sides are subsequently glued together by effused fibrin, and vascular union ensues. Hence, a partly-divided artery bleeds more than one entirely severed. A torn artery bleeds less because its outer or cellular coat, being tough and inelastic, gives way last, and is thus elongated beyond the other retracted coats, forming a conical projection beyond them. When a large artery is wounded it should be tied above and below the wound, as the distal extremity will bleed when the collateral circulation carries blood enough into it. (For more details, see " Injuries to blood-vessels.")

Transfusion of blood into the veins is eligible as a last resource when there has been a large drain, and there is reasonable prospect of its not recurring.

TREATMENT.—Surgical hæmorrhage should be treated by rest, a position to favour the return of blood, a cool atmosphere, and security from all sources of vascular excitement ; nutritious but unstimulating diet. Locally, astringent solutions ; perchloride of iron ; a stream of cold water, or ice. Compression of the supplying artery, or a sponge compress, wrapped in gauze, fixed firmly in a wound ; uniform support of a bleeding limb ; actual cautery. Vessels may be twisted until the middle coat is ruptured, or a ligature may be applied on an isolated larger vessel. Of medicines, iron, gallic acid, lead, and turpentine, are the most usual and valuable. The hypodermic injection of ergotine has been recently introduced for checking internal hæmorrhages.

Mechanical injuries may be inflicted with pointed, sharp-edged, or blunt instruments ; and thus we may have punctured, incised, or contused wounds ; or a wound may be produced by some object tearing the soft parts, and this is called a lacerated wound. These different forms of wound may be combined in one injury.

Simple **contusion** or bruise without breach of surface, may result from a blow or pressure causing limited effusion of blood into the areolar tissue (ecchymosis), or larger extravasation, either diffused or accumulated. It is important to distinguish between such circumscribed extravasation and abscess ; for which purpose the history of the case, the sudden appearance of the former, absence of pain, &c., suffice. Such extravasation may give rise to suppuration. Simple contusion may be treated by evaporating lotions, or warmth and moisture ; subsequently friction and support. Circumscribed extravasation of large extent will be absorbed in time. Do not open such sac unless suppuration threaten ; if converted into an abscess by inflammation it must be treated accordingly.

An **incised wound** should be carefully cleansed, and its edges adapted and retained with plaster, sutures, or pins, as required. It should then be kept cool. Alcoholic lotion favours union ; and the antiseptic treatment by carbolic acid has been extensively employed.

Punctured wounds are inflicted with pointed instruments, with either sharp or blunt edge. Such wounds being deep, and their aperture small, the discharge is confined, and the troublesome consequences attending them are due to this cause, as in a sinus ; probably there may be also contused division of nerve-fibres. Constitutional irritation attending these wounds is often severe. Treat by rest, cool applications ; and if there be much inflammation, by free incision, converting the punctured into an incised wound, to give free exit to the discharge.

Laceration, or contusion, with breach of surface, is a torn bruise. These bleed less than incised wounds. If severe, sloughing may succeed, followed by protracted suppuration. Their healing is always tardy. Cleanse and soothe ; first apply cold ; when inflammation ensues, warmth and moisture, to

favour granulation ; then treat as ulcer. Try to save the skin, and reapply it, using sutures if requisite. The risk of tetanus is greatest in these wounds.

Gunshot wounds are from ball or shot. Small shot may enter or pass through a limb or other part of the body in a mass, if the distance be short ; or the surface may be penetrated at numerous points, if the distance be greater. In either case, as far as practicable, remove the shot, and with them any extraneous matter. Promote suppuration by soothing applications. If the hand be the seat of injury, care should be taken to sacrifice as little as possible, and skin should be preserved to cover the surface exposed by partial amputation. It should be remembered, however, that these are wounds not unlikely to be succeeded by tetanus.

The wound from a ball is contused and penetrating, and prone to bleed freely in proportion to the velocity of the projectile. First, a numbed sensation is experienced, followed by acute pain, and subsequently prostration. The orifice by which a ball enters is smaller than that by which it makes its exit, unless the velocity of the shot be very great. Such double opening favours the subsequent escape of discharge. These wounds are, of course, complicated by the retention of the ball or of clothing. A gunshot wound is said to be *simple* when the skin and muscles alone are implicated ; *compound*, when a large artery is cut, a bone broken, or a visceral cavity entered. Yet, deep textures may be severely injured without breach of surface, as by contusion ; or by the " wind of a ball," *i.e.*, the sudden vacuum caused by its near and rapid transit. A " spent ball " is dangerous, because a rapid axioid motion may, by striking any body, be converted into a projectile motion ; thus a blow from a spent ball in the epigastrium has caused instant death. The general TREATMENT must be conducted on rational principles, modified according to particular circumstances. When there are two openings, treat by rest and soothing, and by encouraging granulation and favoring discharge. When the ball is lodged endeavour to extract it, as in the case of any other foreign body. The position of the patient when the wound was received will serve as a guide to the direction the

ball has taken ; but wounds should not be needlessly dilated. Balls sometimes take a circuitous course, as round the body, beneath the skin, or round the skull ; they may then make their exit at some distant point. If left in, a ball may travel from spot to spot, or become encysted. When cavities are penetrated, it is generally vain and prejudicial to search for the ball ; the treatment must then be as in other penetrating wounds of these cavities. (See " Injuries of regions.") Recent experience has demonstrated that rifle bullets, projected with great velocity, splinter in a remarkable way bones which they strike.

Wounds from *cannon shot* are necessarily severe. With regard to amputation in such cases, as, indeed, in correspondingly severe bullet wounds, instantaneous removal of the limb is regarded as the best practice, where the collapse does not forbid it ; otherwise, wait for reaction. It has been remarked, in military practice, that secondary amputation is rarely successful. The ordinary rules of practice would appear to apply to these cases in most instances. Tetanus, according to military annals, appears to be very prevalent, apparently epidemic, in some circumstances ; and in others, without assignable cause, it is scarcely met with.

Sabre and bayonet wounds are incised and penetrating wounds, and are to be treated severally as such.

Poisons are agents which either destroy structure, as escharotics ; or produce disturbance of function, as many medicinal agents, in the body : and these effects are independent of mechanical violence or extremes of temperature. The subjects to be here considered are—(1) the action of *chemical agents* on the surface of the body ; and (2) *animal poisons*.

Many *chemical* agents are employed to destroy diseased growth, or the foul surface of an ulcer ; such as the strong mineral acids, and some metallic salts, as of mercury, zinc, antimony, potass, silver. Where so used, great caution should be exercised to limit their action, either mechanically or by antidotes. For immediate effect, either nitric acid or potassa fusa are best ; for slower destructive agency, the metallic salts may be mixed with lard. Where injury from these has been

inflicted incidentally, the only remedial means to be employed are diluents or a neutralising application. Treat the part afterwards for local gangrene. The healing of such wounds is tardy, and may require to be supplemented by skin grafting.

Animal poisons taken into the circulation may be either the natural product of an animal, or the result of decomposition.

In our country there are some few insects which sting, of which the hornet is the worst ; and but one reptile whose bite is venomous,—the adder. The puncture of the wasp's or bee's sting is accompanied by the injection of poison, which produces tingling pain, with inflammation in the part. Oil, ammonia, or laudanum, or two of them applied in combination, allay the burning pain. The most troublesome part to receive the poison is the mouth or throat. Should œdema of the glottis or its neighbourhood ensue, threatening suffocation, tracheotomy may be necessary. When there are many stings, there may be considerable constitutional disturbance. The viper's bite is rarely fatal : occasionally the effects of poisoning from tropical serpents is seen in this country ; and the intensity of the symptoms does not appear to depend alone upon the quantity of poison injected. These symptoms are intense local pain, swelling and livid discoloration of the part, sickness and giddiness followed by vomiting, intoxication, and insensibility. Death occurs at varying intervals, from a few minutes to hours, or longer.

TREATMENT.—(1) Oppose the entrance of the poison ; (2) strive to remove it ; (3) support the vital powers. A ligature round the limb may arrest the poison, when limited to the veins and absorbents of the skin. Suction by the mouth or a cupping-glass may withdraw it ; or excision or caustic may be available at any period. Brandy and ammonia in large doses constitute the most approved general treatment, and recently ammonia has been injected into the veins, with, it is said, decided benefit. Natives of tropical climates compound remedies from herbs, which are said to be antidotes to this deadly poison.

Morbid animal poisons may be received into the system through the lungs, or by inoculation. In the former class are numbered many contagious disorders ; and the latter includes cow-pox ; and also syphilis, to be noticed anon.

Hydrophobia probably never occurs sporadically. The source or vehicle of the poison is the saliva. The SYMPTOMS IN THE DOG are—running straight with the head and tail down, and snapping at obstacles, restlessness in confinement, unnatural appetite, altered bark, suffused eye, frothy mouth, swollen tongue, exhaustion, constant snapping till death. Youatt says the shortest period of incubation is fourteen days ; more usually five or six weeks elapse. Most animals may be infected if bitten.

In man the interval from infection varies to many months. The SYMPTOMS IN MAN commence with pain at the original wound ; the cicatrix gives way. There is a sense of depression and dread ; stiffness of the neck and throat ; irritability of manner ; dread of swallowing ; the sight of water, a breath of air, or any bright object, produces a paroxysm. The intellect is affected, sometimes to wild delirium, and death ensues usually in three or four days, or earlier.

TREATMENT.—Youatt deprecates excision, because thereby the poison may be diffused, but has perfect reliance on nitrate of silver, a pointed stick of which should be plunged, as soon as practicable, to the bottom of the wound. This should not be neglected after time has elapsed ; but if the wound be healed, the cicatrix should be excised and the caustic then freely applied. General treatment, where the disease is developed, is probably of little avail. Chloroform may be inhaled, or opium exhibited, to tranquillise and soothe.

Absorption of poison, generated in **decomposing animal matter,** usually occurs in dissection, or to cooks in preparing high game. The consequences of such wounds are divisible into those which expend themselves *locally*, and those which affect the system *generally ;* and these consequences are often, if not most commonly, developed in an inverse proportion. Punctures or scratches more often entail mischief than incised wounds. An inflamed lesion of surface does not so readily

absorb poison as a recent abrasion or wound. The health of the recipient greatly influences the result; but full-blooded, healthy persons are by no means exempt. The LOCAL EFFECTS are tingling and itching, followed by throbbing pain; absorbent inflammation; suppuration at or near the seat of injury, sometimes deep-seated, or in the course of the absorbents, or in the lymphatic glands. Wandering in this way the poison is often eliminated; erythema may spread aronnd the wound, or phlegmonous inflammation may ensue; constitutional disturbance is also present, but varies much in intensity.

If GENERAL SYMPTOMS first appear, and speedily, absorption of poison into the system is denoted, and its circulation is indicated by shivering, headache, vomiting, general nervous irritation, small, quick pulse, hurried respiration, anxious countenance; then, reflected irritation, and inflammation at the seat of injury, perhaps running speedily into mortification. Patients may die delirious and typhoid.

TREATMENT.—It is desirable always to convert a punctured wound of this sort as soon as possible into an incised wound, and to encourage bleeding. Then soothe by employing warmth and moisture. Leeches may be applied along inflamed absorbents, if there be much tenderness. Incise early and deeply where there is local tension or suspicion of the presence of pus. Tranquillise nervous irritation with anodynes, and give a sustaining, and even a stimulating diet. Gentle, alterative aperients should not be neglected. In the severer constitutional form of the disease, opium, ammonia, bark and wine must be used at discretion, as the prostration and nervous excitement are great. Change of air is a valuable aid when the condition of the patient admits of it.

In some instances a train of analogous symptoms, accompanied by severe, and perhaps fatal, *phlegmon*, is the consequence of some trivial accident, such as the scratch of a rusty nail, as the exciting cause. But such results ensue only in persons of vitiated constitution or deteriorated health. Probably the explanation of these phenomena is, that local morbid changes or decomposition generate a poison at the seat of injury; and thus the circulation generally becomes im-

pregnated zymotically, as where foreign animal poison is introduced. Analogy forbids our believing that a metallic, or even vegetable, poison, can directly produce identical contagious results.

Effects of heat and cold.—The extremes of temperature produce similar effects upon the body. Severe burn and frost-bite destroy texture ; and the reaction following reduced temperature is a condition closely allied to the immediate effects of heightened temperature.

Chilblain appears to result from repeated alternations of temperature, producing congestion first, followed by a low form of inflammation. Pain, redness, heat and swelling are accompanied by a tingling and itching sensation, sometimes terminating in superficial, indolent ulceration. The parts affected are usually the toes or fingers. Warmth and stimulating embrocations in the early stage, and suitable applications to an indolent ulcer, if there be such, constitutes the treatment.

Very low temperature suspends vital action ; and if prolonged, this suspension is permanent. The part thus affected is said to be frost-bitten, and is pale, insensible and shrivelled. Reaction should be moderated ; thus friction with snow is employed. After reaction, soothing, warm applications should be employed. If irrecoverable, the part should be treated as in ordinary mortification. Destruction may be immediate, or the consequence of excessive reaction. Cold winds act by the continuous abstraction of caloric from the parts subjected to their influence.

Excess of temperature over the natural standard may be borne, within certain limits and under certain conditions, without injury. Evaporation from the skin protects it when surrounded with air heated to a high temperature ; the hand may be placed over a jet of high-pressure steam ; or a wet hand may be plunged with impunity into molten metal, probably because protected by the vaporized fluid.

Scalds are produced by liquids at high temperature ; those from oil are severe. The cutis is rarely destroyed. Generally the condition is identical with that of slighter burns ; redness,

vesication, &c. ; to be treated in the same way. Scalds of the throat and mouth are dangerous if the glottis be involved.

Burns, when slight, are followed by vesication. Acute suppurative inflammation of the cutis may succeed, without its destruction ; but the more severe action of heat may destroy the cutis, which then has a grey or brown hue, or charred appearance, usually with defined margin, readily distinguishable. The amount of constitutional disturbance varies in proportion to the extent of surface implicated, and is more severe when the trunk is affected. The shock of a large superficial burn or scald is very great, and often fatal, from collapse without reaction.

TREATMENT.—The indication in superficial burns is to supply the lost protection of the cuticle, which may be best effected with a mixture of chalk and vinegar, or with oil or cotton wool. Vesications should not be unnecessarily meddled with ; only to relieve tension. Reaction should be encouraged cautiously, and watched. The state of the chest and abdomen should also be watched, as fatal inflammation may ensue. Opium is valuable to allay pain. In destruction of the cutis the local treatment must be as in mortification : no specific remedies are needed. The general treatment must be the same as in large superficial burns. If the early shock be survived, the patient may afterwards sink under the exhausting suppurative stage, in spite of support. Great caution must be exercised in the healing of such wounds, to obviate the disastrous consequences of contraction, as in the neck, armpit, elbow, &c. This is to be accomplished by position and careful dressing.

Ulceration of the duodenum, which is met with after burns, is either metastatic, or the consequence of vomiting accompanying the attendant shock and nervous irritation. *Tetanus* may supervene during the contraction following a burn, or *convulsions* may carry off a patient in an early stage.

Contraction following the healing after burn may be relieved by operation, although the permanency of the benefit is not always to be relied on. This may be effected either by simple division of the cicatrix and subcutaneous bands, and

the employment of careful and continuous extension afterwards; or by the additional precaution of transplanting a healthy portion of skin from the neighbourhood to occupy the gap; in the latter case all the diseased tissue should, as far as possible, be dissected out, that the borrowed portion may be attached to healthy skin. In retarded healing of a wound following burn, skin-grafting may be employed with great advantage, and the risk of contraction may be thereby materially lessened.

SECTION III.

SPECIFIC DISEASES.

Scrofula affects both external and internal organs, attacks all classes and ages ; and under various phases, prostrates, maims, and destroys vast numbers of our population. The pathological condition which characterises this comprehensive and fatal disease is the presence of **Tubercle**, which is in its early stage a deposit of gray translucent matter, in various forms and in varying quantities, in the different tissues of the body, and in its later stages breaks down into a yellowish cheesy or grumous mass.

The scrofulous or strumous *diathesis* is usually characterised by fair complexion, light hair, blue, watery eyes, with large pupils, white skin with a bright colour, often apparently denoting florid health. The nervous system is excitable. The vessels bleed readily, as of the nose, lungs, &c. ; the mucous membranes are irritable ; the temper is quick, and the passions are warm ; the intellect sometimes precociously keen, at others dull and obtuse. In scrofulous persons of dark complexion, the disease is generally more aggravated and intractable ; in such also the intellect is of lower quality, as in some parts of France and Switzerland. This diathesis is hereditary ; it is also asserted, and with strong grounds for the assertion, that it may be generated by favouring circumstances, as bad air and insufficient food. Domestic animals have not immunity from the disease.

Tubercle, properly so called, is what was formerly known as *grey* or *miliary tubercle*. What was called '*yellow tubercle*' may be merely the degeneration of the grey ; but, as degenerations of pus, blood, or adventitious products present exactly the same appearances, it is often impossible to determine whether

such cheesy masses of ' yellow tubercle' have had any relation whatever to true tubercle. It is, therefore, better to avoid the use of the term *tubercle*, except for miliary tubercle.

STRUCTURALLY tubercle consists of lymphatic cells contained in the meshes of a very delicate reticulum. The *cells* vary in size, are spherical, or nearly so, translucent, and slightly granular; sometimes a nucleus is visible. A few large cells with the nuclei more constant and more numerous, are also found. The *reticulum* is composed of delicate fibres, or of a transparent, almost homogeneous material, often hardly visible on account of the abundance of cells and nuclei.

The process of DEVELOPMENT of tubercle is seen well in the strumous enlargement of glands. In *one form* the cellular elements increase inordinately, and a semifluid mass results, in which the corpuscles are now called pus-corpuscles, though there they are identical in character with the lymph corpuscles of the original gland. In *another form*, where the process of enlargement is slower, the reticulum is chiefly increased, and the result is at first an induration of the gland; subsequently the vessels become obliterated by pressure, the gland substance and the new development become, so to speak, necrosed, fatty degeneration occurs, and the result is caseation. The cheesy contents of the enlarged tuberculous gland may remain quiescent, or may become a source of irritation, and be extruded by suppuration.

These forms of tubercle development are found in other organs, as the spleen, liver, lungs, &c., and in these organs its development has been traced to overgrowth of pre-existing adenoid tissue. Collections of lymph cells with trabeculæ have been found to exist normally in the lungs, spleen, liver, and other organs and tissues in situations where tubercle is developed as the result of the spontaneous or artificially produced disease.

The softening, whether by chemical changes or otherwise, of tubercle, and the consequent irritation and ulceration of surrounding textures, would seem to explain the phenomena which accompany scrofulous ulceration of an organ such as the lung. Thus tubercle or scrofulous deposit is not the product

of inflammation, but is commonly, sooner or later, the source or instigator of inflammation in the locality it may chance to occupy, whether that be lung, liver, lymphatic glands, mucous or serous membranes, nerve tissue, muscle, periosteum, or even bone.

Early life is the period in which the phenomena of scrofula are most actively developed: in childhood many organs are simultaneously affected ; as the adult period approaches, the softening of tubercular deposit in the lungs is most frequent. But this activity may be deferred till later in life, though the origination of external scrofula after puberty is of rare occurrence. This diathesis would seem, from statistics, to be more common in females than in males.

Besides the general influence of this diathesis in modifying many surgical diseases and influencing the sequences of injuries, the surgeon has to treat scrofulous affections of the superficial glands, especially in the neck, and their sequences ; some forms of skin disease ; eye diseases, affecting the conjunctiva in particular ; ulcers of the same type, sometimes obstinate and destructive, as lupus ; chronic abscesses ; hypertrophy of the tonsils, and aphtha of the mouth and tongue ; ozæna, with necrosis of the bones of the nose ; diseases of the genital and urinary organs, such as leucorrhœa, and affecting the testicle and mamma ; and diseases of the bones and joints. These will be noticed in their several proper places as associated with the organs and tissues which are their seat. Some few remarks on the development and general treatment of scrofula will conclude the present brief survey of this widely-spread disease.

Scrofula would seem to be hereditary on both sides, but affecting often only one or two in a family. Those who suffer from early external development of the disease often escape fatal lung disease. Bad air, unwholesome and insufficient food, are, it is said, capable of generating it ; certainly they stimulate its development in the worst form. Any debilitating cause may operate in the same way, as dissipation, excessive study, syphilis, and the eruptive diseases.

The general TREATMENT must be chiefly hygienic, as pure air, especially sea air and bathing, good clothing, nutritious

food, exercise. The most valuable medicines are iron, iodine, cod-liver oil. In deciding upon operations for the removal of scrofulous disease, as of joints, &c., the surgeon should always bear in mind that its active development in other and more vital organs is a not improbable alternative, especially where a long-continued discharge has been thus suddenly arrested.

THE VENEREAL DISEASE.

The venereal disease assumes numerous phases, and is attended with various consequences, often entailing life-long misery on the first recipient, and descending, as an inheritance, to the offspring. The primary forms of this disease, including gonorrhœa, as at least an allied affection, are a purulent discharge from the genital organs, or a lesion of surface in some part of the same, constituting a sore or ulcer. *Gonorrhœa* is an acute and usually specific inflammation of the urethra. *Simple* or *soft chancre* is a local disease manifested by a sore, the pus from which is specific and capable of producing, on any other part of the body, a sore similar to that from which it was originally taken ; it does not infect the system, but invades neighbouring glands by continuity. *True* or *hard chancre* is also the result of a specific poison which infects the system, and the consequences of which are often most serious. This form of chancre only is capable of producing secondary and hereditary syphilis. The secondary forms of the disease affect chiefly the cutaneous surface, the mucous membranes, and the bones.

Gonorrhœa is a purulent discharge from the urethra in the male, or from the vagina in the female. Such discharge is the product of acute inflammation, consequent on exposure to the contagious inflammation of a like discharge in an individual of the other sex ; yet a similar purulent discharge may be the consequence of acute inflammation resulting from other causes, such as local irritation, cold, &c. The treatment in each is the same. Some individuals are more obnoxious to gonorrhœa than others, and the first attack is generally the severest. Its

appearance is usually between the third and seventh day after subjection to the infection. First SYMPTOMS, itching, irritation, and scalding in making water, soon followed by discharge. The lips of the urethral orifice become inflamed, and the passage is narrowed from swelling and thickening of the mucous membrane and corpus spongiosum, blood being mixed with the discharge. There is *chordee*, or painful priapism ; and the bladder becomes sympathetically irritable. In the severe form, the yellow discharge becomes greenish. The prepuce and glans often partake of the inflammation, and are affected with a discharge (external gonorrhœa) ; superficial sores may succeed, and phimosis, from swelling of the prepuce, may occur, or be converted into paraphimosis by imprudent retraction of the prepuce. Sympathetic irritation produces enlargement of the inguinal glands, which may terminate in suppurating bubo, or inflammation may be propagated along the vas deferens to the testicle, affecting especially the epididymis ; then the urethral discharge generally ceases suddenly.

The early TREATMENT of gonorrhœa should not be specific : enjoin abstinence ; give a saline purge ; mucilaginous and alkaline drinks, with sedatives if necessary. Afterwards give copaiba or cubebs, or both combined, if necessary. At a later period, alum in ten-grain doses, in infusion of roses, or an injection of sulphate of zinc, or of nitrate of silver, varying from one to three or four grains to the ounce, according to circumstances. Permanganate of potash and also carbolic acid have been employed in a diluted form for the same purpose. External gonorrhœa must be treated by cleanliness and some astringent wash : such wash must be thrown up under the prepuce in *phimosis*, and emollient applications applied externally ; it rarely needs division unless there be a sore or wart underneath. But *paraphimosis* must be overcome by pressing back the glans while the prepuce is drawn forwards, using ice, or puncturing the swollen glans if required.

If the prepuce require division, it is better to incise below, by the side of the frænum, or, if there be a redundance of skin, circumcise and then slit up the inner skin. Remove *warts* with scissors or caustic.

As SEQUENCES of gonorrhœa in the male, there may be *ulceration of the urethra*, followed by abscess in its course, to be treated by early incision. *Inflammation of the prostate*, requiring leeches and other antiphlogistic treatment. *Cystitis, rheumatic* affections, for which the iodide of potassium is a suitable remedy. *Ophthalmia*, a destructive purulent affection of the conjunctiva, communicated by actual contact of pus conveyed by the hand to the eye. (See " Diseases of the Eye.") *Gleet*, in which the urethral discharge becomes thin and scanty, is often very troublesome. Treat by injections, or by the introduction of a bougie smeared with copaiba. *Stricture*, as a sequence, is caused by narrowing of the canal from deposit of plastic lymph in the submucous areolar tissue. (See " Diseases of Urethra.")

Gonorrhœa in the female extends to the vulva and vagina, the symptoms being similar to those in the male. The treatment is chiefly local, by astringent injections.

Chancre.—An ulcer or sore on the genital organs, propagated by contamination, is termed a chancre. The character of such ulcer is certainly modified, at least in a measure, by the susceptibility of the recipient. Some of these sores are mere open ulcers without special characteristics, and are then of a comparatively innocuous character and are termed **simple** or **soft chancres**; others are deep and have a hard circumference and base, and are termed **true** or **hard chancres**; this condition betokens a virulent character, one in which the constitutional contamination is reflected. Whether this distinction is to be strictly accepted or not, there is no doubt that the hard chancre is the most intractable, and most usually entails secondary consequences.

If the poison of chancre be applied directly to an abraded surface an ulcer is formed; otherwise a pustule succeeds an itching pimple, and speedily ulcerates. Ten days or a fortnight generally elapse, after subjection to the infection, before the pimple appears. The ulcer deepens and becomes harder round the base. After the lapse of three or four days the glands become affected. The ulcer is usually circular, but varies; sometimes different ulcers coalesce. If a phagedænic character

be speedily assumed, it is usually indicative of feeble power, and the virulent property of the sore is probably modified or lost.

TREATMENT.—During the first few days the surface of the sore may be destroyed with lunar caustic or nitric acid, or both combined. This may extinguish the virulent character, and secure immunity from constitutional contamination. If too late for this, give mercury, or rub it in. Blue pill night and morning, or once a day, according to circumstances, till the mouth is touched. In strumous or feeble patients, iodide of potassium or nitric acid and bark are preferable. Keep up the action of the mercury gently ; apply black-wash, and add opium if there be much pain. If the sore become phagedænic, destroy the surface with strong nitric acid ; then soothe, and support the system, avoiding mercury.

Chancre may destroy the meatus and be followed by constriction of the urethral orifice ; or it may involve the prepuce, frænum, &c. *Bubo*, as a sequence of hard chancre, results from absorption of prepuce and usually attacks only one gland ; this is more sluggish at first than sympathetic bubo, but afterwards quickly opens out into a hard irregular ulcer, almost virulent in its secretion. Bubo should be opened by a vertical incision. Spreading ulcer of the groin requires specific constitutional treatment, and to be dressed with mercurial wash or ointment. When these large ulcers become phagedænic and spread, nitric acid should be freely applied ; subsequently stale beer-ground poultice ; and bark, ammonia, wine, and good nutriment must be given.

Secondary symptoms exhibit themselves in the mucous membrane of the throat, tonsils, mouth, and nose, the skin, the iris, the periosteum, and, apparently, the bones. Some weeks at least elapse, often months. The throat is generally first affected ; erythema, followed by ulceration, sometimes deep and destructive. Eruptions on the skin ; as papular, lichen, psoriasis or lepra, all of a coppery hue. Pustules, rising and drying in the form of a cone, constituting tubercular eruption (rupia). Ulcers of the tongue or fissures, often hard and malignant-looking. Iritis, running a rapid course, and terminating by deposit of lymph and organised adhesions (*see*

Eye). Node, which is inflammation of the periosteum, with thickening or suppuration. Pains in the limbs, ostitis followed by exfoliation, are also enumerated among the secondary effects of syphilitic poison ; these, if not usually the effects of mercurial poison, are certainly aggravated by the long-continued influence of this mineral on the system, especially in strumous patients.

TREATMENT.—In secondary affections the treatment must vary much, according to the intensity of the affection, and the power of the patient. Mercury should be given sparingly in most cases. In sore throat, tonics, with small doses of Plummer's pill at night, and iodide of potassium twice a day ; astringent gargles. In phagedænic ulcer of the throat, support, and apply linimentum æruginis, or strong nitric acid ; detergent gargles ; mercurial fumigation is occasionally useful. In ulceration of the larynx, tracheotomy may be needed. In eruptions, give bark with iodide of potassium or small doses of the bichloride of mercury. Treat ulcer of the tongue in the same way. Iritis requires the same treatment as when not specific ; mercury is essential in both. Nitro-muriatic acid, or the tincture of the perchloride of iron, are valuable tonics. Sarsaparilla may be given in all ; but its value is probably overestimated.

TUMOURS.

The word *tumour* is very comprehensive in its application, being employed to designate various forms of morbid increase in the bulk of a part, whether from hypertrophic growth, from diseased deposit, from the accumulation of natural secretion, or from addition of natural texture. Some tumours may be purely local in their origin, others are constitutional, and evince a tendency to reproduction, if removed. Tumours affect various tissues, as skin, areolar tissue, mucous membrane, bone, &c. They differ in their physical characteristics and anatomical structure, as well as in their activity in growth ; their

diagnosis is, therefore, often obscure, and demands careful inquiry involving many questions as to history, temperament, and other collateral circumstances.

Tumours may be classed according to the tissues which they severally affect. The details of this classification will be noticed under the diseases of different tissues. Or they may be classified under the two heads of tumours of which the structure is natural, though in excess, and those which consist of new structures. Or they may be arranged according to their pathological signification alone. They may also be classified according to their clinical importance. Preference is here given to that arrangement which combines the clinical with the pathological peculiarities.

Tumours may be *simple*, in which case they are usually only local in origin, and there is little or no tendency to recurrence when once the tumour has been completely removed. In these the anatomical structure resembles closely some tissue found in the body in health. Or they may be *malignant*, in which case they may be either at first or eventually constitutional in their character, and when removed have a tendency to recur either in the same or some other part. Their anatomical characters differ from those of normal tissues.

There are many tumours which must be placed on the confines of these two great classes, inasmuch as they resemble some of the lowest types of normal tissue, and have a tendency to recur after removal, and with recurrence to approach in structure nearer and nearer to that of the malignant growths. Such are the sarcomata which histologically resemble embryonic connective tissue, and myxomata which resemble the peculiar gelatinous form of similar tissue found in the umbilical cord.

Simple tumours may be CYSTIC or SOLID, and the distinction between them may usually be made by observation before removal.

CYSTIC tumours may be *simple* or *compound*, the compound including both those which are composed of numerous loculi (multilocular) and those with intra-cystic growths (proliferous cysts).

Cysts may be formed by the accumulation of substances

within the cavities of pre-existing structures.   They may then be either—

(*a*) *Retention cysts*, the result of the normal secretion being retained.   **Sebaceous** cysts are of this kind, and are found in the skin, especially of the scalp, where they sometimes attain a large size, and are removed most readily by excision.   Their contents vary in consistence from a thin fluid to a cheesy or calcareous mass.   They are also found under the mucous membrane of the lips and cheek, and beneath the tarsal cartilages of the eyelids from obstructed meibomian glands.   **Mucous** cysts are formed from the same cause on mucous membranes, and are seen in some forms of polypus.   **Ranula** is the result of obstruction in the salivary ducts (usually submaxillary), the consequence of inflammation or concretion ; it is to be treated by incision.   **Encysted hydrocele** from the occlusion of the tubules of the testis.   The mammary gland may be the seat of these cysts from obstruction of the ducts.

(*b*) *Exudation* cysts from excessive secretion within closed cavities.   The **thyroid body** is the seat of such cysts which sometimes endanger life by pressure.   **Hydrocele** is such an accumulation within the tunica vaginalis.   **Synovial bursæ** are similarly distended, as that over the patella, on the hamstring muscles (where it may be mistaken for popliteal aneurism), on the nates, in the palm of the hand, or on the back of the wrist (**ganglion**).   The usual cause is abnormal pressure or friction.   These sometimes suppurate, or their contents become fibroid from inflammatory deposit.   When uninflamed these tumours may be opened subcutaneously (with certain exceptions to be noticed with the affected tissue), but caution must be used or dangerous inflammation may ensue.

(*c*) *Extravasation* cysts ; pure extravasation of blood into closed cavities.   **Hæmatocele** is from extravasation into the tunica vaginalis.   **Sanguineous** cysts are occasionally the result of hæmorrhage into sebaceous cysts ; they are sometimes allied to nævi in their structure.   The neck is not an uncommon situation for them.

Cysts may also be of independent origin, and may arise—

(*a*) From softening of tissues, as in the interior of an enchondromatous or of an encephaloid tumour.

(ϵ) From expansion and fusion of spaces in connective tissue, as **bursæ**.

(γ) Around foreign bodies, extravasated blood, parasites. **Hydatid** cysts are found in any part of the body, and may expand bone.

(δ) May be congenital, including **dermoid** cysts. These appear often to be the remains of blighted ova, and may contain hair, teeth, bones, &c.

SOLID simple tumours may be single or multiple, and may affect any tissue or organ. They are *new formations*, but each resembles some pre-existing structure. They are in fact *hypertrophic* tumours. Histologically they are excessive developments of connective tissue, fat, cartilage, bone, adenoid tissue, muscle, nerve, vessels, &c. It may be taken as a general rule that the more a tumour resembles in its structure the lower forms of tissue the more nearly is it allied to the malignant tumours, and the more prone is it to rapid development and to recurrence.

Muscular tumours (myomata) are usually composed of unstriped muscular fibres, and are found chiefly in connection with the uterus. They have been commonly called *fibroid* tumours. They may attain an enormous size, and often cause serious uterine hæmorrhage.

Neuromata consist almost entirely of nerve tissue, but the term neuroma has been applied to any tumour connected with nerves. They are most frequently found at the extremities of divided nerves, as after amputation, and are closely connected with the scar of the wound. They are very painful, and may be excised or divided subcutaneously.

Vascular tumours (angeiomata). (See "Diseases of the Vascular System.")

Papillomata resemble ordinary papillæ in their structure. Such are *warts* and *horny growths*, which may attain a very large size. Warts may be removed by caustic applications, and horny growths must be excised. Some forms of warty growth closely resemble in their appearance epithelioma, but their epithelium is found only on the surface of the papillæ, not in

the deeper submucous tissue, and they do not evince the same tendency to ulceration as epithelioma.

Glandular tumours (adenomata) are found in connection with the breast, the parotid, and other glands. They are hypertrophied gland structures and are usually hard in proportion to the amount of fibrous tissue which they contain. On section they are generally firm and often present a lobulated appearance. They may degenerate and colloid cysts form in them, and cancer is sometimes associated with them. (See "Diseases of Regions.")

Mucous polypi are commonly glandular in origin, arising from the adenoid tissue of the mucous membrane of the nose, ear, vagina, &c. They are soft and often gelatinous, and may contain cysts from the dilatation of their tubules. They should be removed by the forceps, and astringent applications, as tannin snuff, will sometimes reduce their bulk. In the nose they occasionally give rise to great deformity.

Bony growths (osteomata) occur in the form of *exostosis* in connection with pre-existing bone, and *osteophytes* growing from connective tissue or from cartilage. They are composed of true bony structure, and differ thus from calcareous degeneration. Exostoses are sometimes symmetrical, and may be troublesome from pressure upon important textures. When growing from the facial or cranial bones they are frequently very dense and ivory-like. When growing rapidly exostoses are commonly covered by a layer of cartilage, in which the bone is being formed. Bony growths are occasionally found in tendons, especially in the adductor magnus; also in the pia mater, dura mater, and pleura. Bone may be produced on the surface, or in the substance of malignant tumours.

Cartilaginous tumours (enchondromata) grow from the surface or interior of bones, sometimes from connective tissue, rarely from cartilage itself. The intercellular substance may be hyaline, fibrous, or mucoid. When fibrous the fibres may be arranged irregularly or form loculi. The cartilage cells are usually large in the hyaline forms of enchondroma, small in the fibrous forms, and stellate in the mucoid. Enchondroma sometimes ossifies; it is sometimes found in encephaloid cancer,

especially in the testicle. The commonest situation of enchondroma is in the fingers and toes; it is sometimes found in the parotid, the testicle, or the breast. It may attain an enormous size, but does not usually return after removal.

Fatty tumours (lipomata) consist of a circumscribed hypertrophied growth of fat, and occur chiefly in situations where fat normally exists in quantity, as on the shoulders, nates, &c. They are lobulated, and are usually surrounded by a fibrous capsule, which separates them from adjacent structures. They give a peculiar doughy sensation to the fingers on manipulation. They are sometimes pedunculated. They should be excised before they attain an inordinate size.

Lymphatic tumours (lymphomata) consist of adenoid or lymphatic tissue—a delicate reticulum, within the meshes of which lymph corpuscles are packed. They are, in fact, hypertrophied glands, and their commonest situations are in the neck, axilla, groin, and abdomen. They sometimes attain a very large size, and are generally multiple. They are frequently associated with constitutional disease—scrofula—and should not be removed. The visceral deposits found in leukæmia and tuberculosis are of the same nature.

Fibrous tumours (fibromata) consist of normal fibrous tissue, are uniform or lobulated, and may occur wherever fibrous tissue previously existed. They may soften or calcify. The fibres in them may be arranged irregularly or in bundles, sometimes concentrically, and the cell-elements are usually scanty and small, but are more numerous in the rapidly-growing forms. The tumours should be excised.

Sarcomata consist of embryonic connective tissue. This group includes those growths known by the names of fibro-cellular, fibroplastic, fibronucleated, *recurring fibroid*, and *myeloid* tumours. They are composed almost entirely of cells which are masses of nucleated protoplasm, but which are pretty uniform in size and shape in the different forms of sarcoma. The inter-cellular substance is scanty, and may be homogeneous, granular, or fibrillated. Blood-vessels are very abundant, and the growth is very definitely related to their walls. The *spindle-celled sarcoma* (fibroplastic tumour) is composed of spindle-shaped and

fusiform cells with very little intercellular substance, and is found growing from the periosteum, fasciæ, and connective tissue. When it recurs after removal it is called recurring fibroid. The *round-celled sarcoma* is softer, of brain-like consistence, and of a grayish, semi-translucent appearance. It is closely related to encephaloid cancer, and has been called medullary sarcoma; but it differs from cancer in the greater regularity of its cells, and in the absence of a fibrous stroma. It does not invade surrounding structures, but follows the course of the connective tissue. It is, however, impossible sometimes to determine whether a tumour should be placed in this or in the cancerous group. *Glioma* is a variety growing from the neuroglia or delicate connective tissue of nerve. A *myeloid* tumour contains large multi-nucleated cells together with spindle cells. It occurs almost invariably in connection with bone, usually from the epiphyses of long bones, or from the junction of epiphyses with shaft. Growing usually from the medulla the tumour expands the bone, and a thin shell sometimes remains which communicates the sensation of crackling on pressure. Myeloid tumours are usually firm, elastic, fleshy-looking on section, or mottled. They are generally very vascular. It is advisable to remove the whole of the bone, which is the seat of this disease. *Epulis* is usually a myeloid tumour growing from the jaw.

Myxomata are rare. They are translucent and succulent, and are composed of a soft, gelatinous matrix yielding mucin, and in this matrix are found multipolar cells, with long branching processes, isolated fusiform cells, and a few elastic fibres. Myxomata are developed from connective tissue, and are found in fat, and in the brain, breast, and other organs. They are sometimes associated with cancerous growths, and can only be treated by excision.

CANCER.—Tumours which have a constitutional origin, and are not due to locally augmented action alone, are prone to return, if removed, and are for the most part designated *malignant*, from their fatal influence on health and life. Yet all constitutional tumours are not malignant, nor are all local tumours without danger. Thus, scrofulous tumours do not

necessarily threaten life ; whereas large fibrous or cystic tumours connected with internal organs, as those of the uterus and hydatid cysts, are often fatal even from mechanical causes, and consequent interference with function.

Cancer differs from all other growths in many features besides its microscopic characters : it is an eliminative action established in some selected locality, and is exhaustive alike of the elements of life and of nervous energy. The product which forms the tumour is no conversion of texture, no hypertrophic growth, nor accumulation of natural secretion, but essentially new. It is uncontrollable by any known agent, and is often hereditary.

Cancer presents itself in four different *varieties*, viz. *epithelioma*, *colloid*, *scirrhus*, and *encephaloid*, and in each there are certain common and special peculiarities of structure. **In all** are found cells more or less perfectly developed, arranged irregularly within the alveoli of a fibrous stroma ; but the microscopic characters are by no means always sure evidences of the cancerous nature of a growth. The cells may be large or small, but they are peculiar in their irregularity of form and size ; their nuclei are generally large, are frequently multiple, and vary much in size in the same specimen ; they are often free, *i. e.* not enclosed in plastic cell material. The nucleoli are single or numerous. This want of regularity precludes the possibility of there being anything like a specific cancer-cell. The stroma is dense and fibrous in slowly growing cancers, but is soft and contains numerous spindle-cells in rapidly growing ones ; these spindle-cells are the evidences of incomplete development of the stroma.

Epithelioma is usually the result of local irritation, and is found on the lip, tongue, scrotum (chimney-sweep's cancer), uterus, &c. The most distressing form is that of the tongue. Epithelioma starts as a wart-like prominence, or indurated fissure or ulcer, which gradually extends and ulcerates, and exhibits a very indurated base. The glands become affected, and the disease becomes a constitutional instead of a local one. The growth is composed of epithelial scales, which differ only in the rapidly growing forms of tumour from ordinary squamous epithelium, but they are here and there arranged peculiarly in concentric groups around

somewhat spherical, unequal cells ; this arrangement constitutes the appearance known as birds' nests. In other parts of the growth similar spherical cells are seen probably in earlier stages of development. In other cases the epithelium is arranged rather in cylindrical masses among a fibrous stroma. Epithelial cancer should be removed early from the tongue by excision or ligature, or by means of the galvanic or other cautery.

Colloid cancer is gelatinous in consistence and is rarely met with in surgery. The gelatinous or colloid material is em-bedded in spheroidal alveoli, and a few epithelial cells are found in it. The serous membranes are the commonest seat of this disease. Other kinds of cancer and of innocent growth fre-quently undergo a mucilaginous form of degeneration, which has frequently been confounded with colloid cancer.

Scirrhous cancer is of stony hardness, grows slowly at first, and causes acute lancinating pains from contraction upon the nerve fibres of the involved tissue. The contraction of scirrhus causes puckering and retraction of the skin over it. It invades all tissues and does not displace them. It appears as a single tumour at first, never multiple, and subsequently affects the neighbouring glands and lymphatic vessels. It may attain a large size, and then interferes with circulation so that the neighbouring veins are congested. It has a tendency to ulcerate through the skin, and fungate : the fungating portion is very vascular and closely allied to encephaloid cancer in its structure ; frequently it becomes identical with it. Scirrhus is composed chiefly of dense fibrous stroma, and has been called fibrous cancer. In the section of an organ affected with scirrhus strongly marked fibrous bands extend into the tissue beyond the main tumour ; the cut surface of the tumour is cupped and glistening, and yields, on scraping, a juice in which the cell elements abound. The cells are irregular, unequal in size, and contain one or more comparatively large nuclei ; free nuclei also abound in the juice. Scirrhus is most common in the female breast, rectum, œsophagus, and genital organs. The secondary deposits are usually of a more rapidly developing type than the primary, and are therefore less fibrous and more allied to encephaloid, but a strong resemblance generally exists

between the primary and secondary growths. Fatty and colloid degeneration may occur in the interior of the masses.

Encephaloid or **medullary** cancer differs in degree only from scirrhus, and there are intermediate forms which connect the two. Encephaloid is soft and brain-like, bulges on section, is very vascular, and hæmorrhage frequently takes place into and from it. It grows rapidly, invading all tissues, is less painful than scirrhus, has a great tendency to ulcerate and fungate, and the ulcer does not heal. It exhausts the patient rapidly as a rule. Secondary deposits occur in the neighbouring glands and in internal organs. In structure encephaloid consists of cells in every stage of development, excessive in quantity, excessive and unequal in size, and of every variety in shape. Their nuclei are generally very large, frequently multiple, and the nucleoli usually prominent. There is a large abundance of free nuclei in the juice. The stroma is succulent, and is proportionately much less abundant than the cell-growth. It occurs most frequently as a secondary growth, but is found as a primary tumour in bone, the eye, testicle, &c. Degeneration readily takes place in it, and cysts are thus sometimes formed. Encephaloid is occasionally found associated with simple forms of tumour in the same or different parts ; and new growths, originally simple, may, if left to develop gradually, assume characters closely resembling, if not identical with encephaloid.

Peculiarities in the appearance and structure of these cancers have given rise to special names :—*Melanotic* cancer is where pigment exists in abundance, and the form of cancer with which it is commonly associated is the encephaloid, and its seat the pigmented tissues, as the choroid ; the secondary deposits are also usually pigmented ; *osteoid* is where bone exists in abundance ; *villous* where the surface of an encephaloid shows a quantity of free processes, as occasionally in the bladder ; *cystic* where cysts have been formed by degeneration or special development in the interior of the tumour. In all of these forms, as in the typical kinds of cancer, the secondary growths show a remarkable resemblance in structure to the primary, but the secondary is usually the more rapidly developed, and has, therefore, more of the encephaloid type.

The so-called cancerous *cachexia* is only the evidence of interference with normal secretions and nutrition. Cancer often exists without it, and a similar aspect is seen in patients suffering from other visceral diseases.

What peculiarity in the constitution may determine the form in which cancer is developed is unexplained. The encephaloid form of the disease is not only the most rapid in its development, but also the most hopeless in the surgeon's hands. Scirrhus, being slower in growth and not ulcerating so readily, extends rather by contamination of neighbouring lymphatic glands.

The appearance of these tumours is often ascribed to some source of local irritation or injury : such exciting cause may, no doubt, determine the development of the disease in organs or parts of naturally high organisation, where the predisposition to cancer exists. Vascular organs, the active functions of which have ceased, are specially obnoxious to cancer.

When cancer ulcerates, the discharge is generally abundant and fetid. The surface may fungate or become excavated ; the pain is severe, and exhaustion is proportioned to the discharge and suffering.

The question of *operation* is one surrounded with difficulties. Removal of cancerous growth rarely effects more than affording relief for a time, and deferring a fatal issue. The suffering and distress consequent on the presence of a large and foul ulcerated surface are also thereby materially lessened. Operation may, on the contrary, curtail life, by transferring the morbid action to some more vital part. Where scirrhus is indolent, it is probably wiser to leave it alone. Such indolence or arrested growth in an external tumour is sometimes coincident with its internal development. If removal be determined on, the knife is the best instrument ; the entire diseased growth should be abstracted, and the wound be closed if practicable.
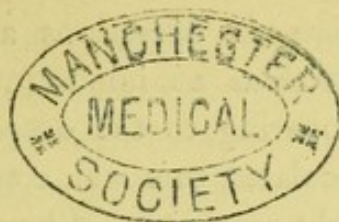
SECTION IV.

ABNORMITIES, DISEASES, AND INJURIES OF TISSUES.

SKIN.—Congenital *deficiency* of the skin is rare, except in connection with median defects from arrested development, such as harelip. *Excessive growth* occurs in subcutaneous tumours, or in pendulous folds after distension. Abnormal thickness is usually the consequence of congestion and inflammation : and the skin is abnormally thin when excessively distended, as in dropsy. *Discoloration*, either partial or universal, may result from disease, or the action of medicine, or external influences. Such are the blue appearance in cyanosis, from the circulation of ill-oxygenated blood ; the pallor of chlorosis ; the bronze hue in supra-renal disease ; and the leaden hue from nitrate of silver. Claret and bronze spots or patches are congenital. Freckles or tanning from the sun's influence are due to deposit of pigment in the epidermis. Petechiæ, in typhus or scurvy, are circumscribed spots of extravasated blood in the skin.

Inflammation of the skin and its sequences have been already noticed (see " Erysipelas, Phlegmon," &c.). *Cancer*, as a primary disease, attacks the skin as epithelioma, and in its scirrhus and medullary forms. Chimney-sweeper's cancer is the first ; it begins on the scrotum as a warty excrescence, which subsequently ulcerates and fungates : the testicle may become involved. This disease should be early extirpated with the knife. *Parasitic* insects and vegetables infect the skin, as in scabies and porrigo favosa.

The *loss* of skin, by injury or sloughing, is serious in proportion to its extent. Constitutional disturbance is severe where the loss is large, and even fatal collapse, or death after reaction

may occur. Therefore, in operations and after injuries the skin should be dealt with as an important and delicate organ, and not as a mere covering to the deeper textures. *Redundancies*, such as pedunculated tumours, condylomata, and warty growths, may be safely removed. The knife is usually the best instrument, or scissors may be more convenient, or it may be safer and more expedient to employ the ligature or caustic. Common wart, which is hypertrophy of papillæ beneath a thick layer of cuticle, is best treated with nitric acid and nitrate of silver, or with caustic potash.

The texture of a **cicatrix** is dense, inelastic, and, where there has been a large breach of surface, white, hard, and stretched over the deeper textures. This is not skin, but a substitute for it, as it is without papillæ, sebaceous, or sudoriparous glands, or hair-follicles. Its physical defects are, in great measure, due to the absence of normal subcutaneous areolar tissue. The contraction after extensive loss, as from burn, often seriously impairs motion, and requires operation for its relief. Simple section of the firm fibroid bands with the cicatrix may liberate the bound parts ; but for permanent relief, the most efficient method is to transplant a portion of healthy integument into the gap from a neighbouring part which can best spare it : for this purpose the cicatrix should be first excised ; or the wound may be left to granulate after excision of the scar, and small grafts of skin may be inserted, as in the treatment of large ulcers.

CUTICLE may be *thickened* into laminated callosities, which are the consequence of pressure or friction, and sometimes press painfully on the cutis. A **corn** is a conical projection of cuticle pressing vertically on the cutis. Soften this by poulticing, and then carefully excise it, subsequently protecting the part from pressure. **Bunion**, which, when inflamed, is sometimes confounded with corn, is a bursa, usually over the deformed articulation of the great toe, between the metatarsus and first phalanx. It should be protected from pressure, and, if suppurating, cautiously opened. Horny growths are essentially cuticular or follicular in their origin.

The NAILS have their growth curtailed or arrested in para-

lysed limbs, and during union of fracture, and also during the progress of any disease accompanied by much impairment of nutrition. A marked transverse line may be seen upon the nails during convalescence from fevers, starvation, &c. They often become *excessively thickened* or painfully *deformed* from pressure and neglect. The nails have a peculiarly curved form in consumptive patients. The *loss* of a nail in whitlow or from wound is usually, though sometimes imperfectly, repaired. In-growing nail is the consequence of pressure, the inner border of the nail being usually driven into the skin. It should be softened and carefully cut away. *Inflammation* and ulceration may extend round to the root of the nail, and necessitate its entire removal. Sometimes the application of nitric acid will loosen it, or it may be desirable to excise it. A fetid ulcer occasionally attacks the roots of the nails, for which nitric acid, in full strength, is the best application.

The HAIR may be congenitally defective in part or entirely. Its growth is sometimes *excessive;* and, in some instances, precocious on the face and pubes. Sudden *loss* of colour has occurred from the influence of depressing passions. Hair is occasionally found in cysts. In **plica polonica** the central loose structure of the hair is distended with moisture, which exudes and mats the hair together. In **porrigo decalvans** the scalp is white, shining, and bald in patches. Free rubbing with strong acetic acid is the best remedy. In **tinea tonsurans,** and in **tinea favosa,** where yellowish crusts collect upon the surface of the scalp, mycelium and spores may be detected by a microscopical examination ; strong acetic acid may be used, or with caution an ointment of bichloride of mercury, five grains to the ounce.

The SEROUS and SYNOVIAL MEMBRANES are not infrequently the seat of injury or operation, and may be placed, surgically, in the same category. Serous membranes, as the pleura and pericardium, sometimes communicate. Persistence of communication between the peritoneum and tunica vaginalis determines the congenital form of hernia, in which the latter forms the sac. Bursæ may, in like manner, communicate with joints. *Excessive development* is exemplified in hydrocephalus and spina

bifida. Tapping, to withdraw the accumulated secretion, followed by pressure, may afford relief. Obliteration, or degeneration into areolar tissue, may result from inflammation, as in the pleura, pericardium, and peritoneum. Such is often the consequence of operation for the radical cure of hydrocele. **Bursæ** are developed over club-foot, &c.; and a similar development takes place in new joints after unreduced dislocation. General distension is the consequence of accumulated secretion, as in **ascites, hydrocele, hydrops articuli:** all may require tapping; and distended joints have been treated, like hydrocele, by injection of iodine.

Congestion of serous membrane may be caused by disease or mechanical obstruction, as in strangulated hernia. In operating the appearance of the intestine is a guide in the prognosis. The consequences of long-continued congestion are increased secretion, opacity, thickening, or transudation of blood.

Inflammation may be primary or consecutive. It may result from cold or injury, as in joints. Inflamed serous or synovial membranes are injected, and subsequently may become opaque or thickened, or pour out an increased secretion, or plastic lymph or pus. When the exudation is coagulable, adhesions follow; or pus may require evacuation, as from the peritoneum, pleura, or joints. Hæmorrhagic effusion into the large cavities is often fatal. *Gangrene* occurs, as in hernia, from continued obstruction, or excessive inflammation. The subserous areolar tissue is often seriously involved in these changes.

The *treatment* of the above conditions must be conducted in accordance with the general principles already laid down.

Serous membranes are the seat of *tubercle*, and of the medullary and colloid forms of *cancer*, and rarely of scirrhus. Gas may be found in serous membranes, the result of decomposition, or by escape, as from the lung into the pleura (where paracentesis may be required), or from perforated intestine into the peritoneum, and occasionally beneath the peritoneal coat, separating it from the muscular. Accumulation of pus in these membranes may also require evacuation. Loose *fibroid bodies* are sometimes met with in serous membranes, but more often in synovial sacs; these are probably deposits in the areolar

tissue, and, subsequently, become free by the separation of their pedicle : they may be coagulated secretion.   In the knee they sometimes require removal.

In *wounds* of joints, endeavour to close the lesion entirely ; and treat the consequent inflammation on general principles, not forgetting perfect rest.   The risk of opening an already inflamed or diseased serous or synovial membrane is infinitely less than of exposing them in health.   (For further detals, see "Injuries, &c., of Joints and Regions.")

MUCOUS MEMBRANE.—Congenital *deficiency* occurs in arrested development, as in open bladder, fissures of the mouth, &c.   The cicatrix following *loss* of mucous membrane differs, like that of skin, from original texture.   Pseudo-mucous membrane is produced in sinuses, and requires destruction by caustic or incision.   *Inflammation* and its consequences have been noticed. Adhesions are rare ; but plastic lymph is sometimes deposited on the surface of a mucous membrane.   *Ulcers* are not infrequent, especially at the outlets, and these are sometimes of syphilitic origin.   Deposit from inflammation in the sub-mucous areolar tissue is a frequent source of stricture.   Œdema affecting the glottis may be fatal.   Mucous membrane may mortify, as in hernia.

Exposed mucous membrane becomes dry and cuticular, as in prolapsed anus or uterus.   It is the seat of *nævus*, as on the lip, tongue, vagina ; also of *tubercle*, and of *cancer* in the epithelial, fibrous, and medullary forms.

AREOLAR AND ADIPOSE TISSUES.—Areolar tissue forms the bulk of some tumours.   It may be *hypertrophied* or thickened ; or *atrophied* when subjected to pressure.   These tissues are often involved in destructive ulceration or sloughing.   They sometimes lodge foreign bodies, and are the seat of bloody effusion. Dropsy of the areolar tissue has been already noticed.

When *inflamed*, both areolar and adipose tissue are red from injection.   Plastic exudation blocks the areolar spaces ; and this may soften down, and suppuration ensue : hence the diffusion of pus under such circumstances, as in phlegmon, wherever this tissue abounds.   In adipose tissue the fat may be displaced by plastic exudation.   Chronic inflammation in these

tissues tends to induration, as around varicose ulcers. This condition may be general, as in varicose limbs; such is *elephantiasis*. In poisoned blood, pus is sometimes deposited at spots in the areolar tissue; such abscesses should be immediately opened; they heal readily. *Gas* is found occasionally in the areolar tissue, as in emphysema or from decomposition. It is the seat of cystic and fibrous *tumours*, also of *tubercle* and *cancer*. When lost by sloughing, or otherwise, the reproduced texture wants elasticity. Adipose tissue is scanty or absent where it would interfere with movements; but occasionally it is the seat of excessive deposit, as on the abdomen.

MUSCLES.—Muscular abnormities are frequent; arrested development is rare. Congenital *defects* in length, development or power, entail deformities, such as club-foot, &c.; these will receive separate attention. The muscles become pale, weak, and flabby, from disease, as in paralysis; this is often accompanied by *fatty degeneration*. *Hypertrophy* results from excessive use; in the involuntary muscles this becomes a disease, as in the heart. Muscle may be ruptured from spasm; but this is rare. It has occurred in the heart and in the uterus. Divided muscle is reunited by fibro-cellular tissue.

Muscles become *inflamed*, as from cold or injury; they may be the seat of serous or bloody exudation. The contraction following such inflammation may require tenotomy. The division of muscular tissue is rarely needed in operations, except amputations. Muscle is occasionally the seat of *nævus*, also of *cancer*. Foreign bodies may become encysted in muscles; and this tissue is occasionally infested with the cysticercus cellulosæ.

TENDONS may require division to remedy deformities, or to facilitate the adjustment of fracture, or reduction of dislocation. They are occasionally cut or *ruptured*. The most common example of the latter injury is that of the plantaris; and the consequent pain and disablement are disproportionate to the lesion. If *inflamed*, as in thecal abscess, they sometimes slough to a considerable distance from the original disease, pus extending along their sheaths. In dividing a tendon, try to preserve its tubular sheath. The fibrous reunion of a divided

tendon very closely resembles, on section, the original texture. (For operations, see last Section.)

FIBROUS AND ELASTIC TISSUES include ligaments, aponeuroses, annular, plantar and palmar fasciæ, the pericardium, dura mater, and theca vertebralis, the periosteum, middle coat of arteries, &c. Suppuration or ulceration may occur as consequences of *inflammation* of fibrous tissue; but more commonly induration or thickening. *Contraction* of the plantar or palmar fascia results from chronic inflammation dependent usually on pressure or some other form of local irritation. The only efficacious treatment is subcutaneous section of the contracted bands, and subsequent extension : this is often mistaken for contraction of tendon. Sloughing of fibrous tissue may occur as in other tissues; the dura mater commonly sloughs after trephining. Inflamed periosteum often leads to destruction of the subjacent bone; but the loss of the fibrous tissue does not necessarily entail necrosis. Fibrous tissues are readily *calcified*, as seen in the pericardium, dura mater, and arteries; also in abnormal growths. When *cancer* attacks the periosteum, it is usually the medullary form, and soon involves the bone. (For ligaments, see " Joints.") The areolar and fibrous tissues are peculiarly liable to certain of the lower types of new growths to which histologically they are closely related. The **sarcomata** and **myxomata** are found in connection with fibrous tissues and are likely to return after removal. Sometimes in internal organs, as the liver, spleen, brain, &c., new growths **(tubercle, lymphomata, cancer)** follow the course of the tissue surrounding the vessels. *Tumours* of a more organized character are also found in areolar tissue, and of these the fibrous is the most common. Cystic tumours may be the result of accidental, serous, or other effusion into the interspaces of the texture or to new growths—true epitheliated cysts.

CARTILAGE, though rarely *defective*, is often found in abnormal growths, generally mixed with fibrous element. Cartilage may be torn or broken, and repaired. *Inflammation* affecting the synovial membrane or the cancellous texture of a bone involves the cartilage, which perishes first on its surface

contiguous to the seat of disease. Inflammation of fibro-cartilages, as between the vertebræ, terminates in suppuration, and entails caries of the vertebræ, and even inflammation, from contiguity, of the spinal membranes. Cartilage is subject to *ossification* and *calcification*, especially as age advances, as in the ribs, larynx, trachea, &c. (See also "Diseases of Joints.")

BONE.—Bone consists of an animal base and of earthy matter deposited therein: it is invested by a vascular fibrous membrane, the periosteum; this is continuous with the endosteum or medullary membrane, which lines the canals of cylindrical bones and the cancelli of their extremities and of irregular bones.

Partial *deficiency* of bone may result from arrested development, as in the sternum; from arrested ossification, as in congenital rickets; also, in the skull and spine, from hydrocephalus and spina bifida. This condition may be reversed in premature closure of the fontanelles and sutures. *Hypertrophy* in length or circumference of long bones, and in density or expansion of the diploe of flat bones, results from hyperæmia, perhaps chronic inflammation of a specific type. The varying density of the skull should be remembered in the use of the trephine. **Exostosis** is a bony growth springing from the periosteum or the bone itself; it may be spongy or cancellous, but is usually firm and compact, sometimes of ivory density, or capped with a thick layer of cartilage. There are sometimes many such in one patient; and they occur principally near the ends of long bones, on the ungual phalanx of the great toe, and on the pelvis; they also spring from the interior of the skull. They usually grow spontaneously, but may result from injury. They do not grow indefinitely, but their removal is often required, when practicable, on account of their inconvenience. This is most readily effected in most cases by exposing the tumour, and cutting it through with bone forceps; a small saw may be used if required. Care must be taken not to interfere with joints when these bony growths spring, as is usual, near to them. *Atrophy* is the consequence of arrested development; of carious disease, or similar sources of exhaustion. Length as well as thickness may be diminished; the bones thus become brittle, as in old age from similar attenuation, and from fatty

degeneration. Pressure produces atrophy by absorption, as in aneurismal and other tumours.

Periosteitis may be acute or chronic, and may result from injury or constitutional disease, as syphilis and scrofula. It is indicated by local pain, tenderness, and swelling, and should be treated locally, constitutionally, or both. Nodes are the consequences of periosteitis.

Osteitis, or *inflammation* of bone, may originate in the osseous texture itself, or be propagated from neighbouring textures, especially the periosteum or medullary membrane. It may be either acute or chronic, and may affect either the surface or substance of bone. Deterioration of the vital powers from the poison of syphilis, mercury, gout, or fevers, often constitutes the predisposing CAUSE of osteitis ; mechanical injury, or cold, are the usual exciting causes. The SYMPTOMS vary according to the acuteness of the attack : the pain is local, deep-seated and aching, sometimes intermittent, and usually worse at night : the same in periosteitis. In acute osteitis, the pain is usually very severe. Severe constitutional disturbance ushers in the attack, whence the frequent mistake that necrosis is the sequence of acute rheumatism or fever. The superjacent integuments become swollen, red and tender. The local TREATMENT of this stage is by leeches and warm applications ; and free incision if pus be perceptible : the general treatment is by anodynes and attention to the secretions. Acute inflammation of the surface of bone may TERMINATE by exudation, which becomes organized without destruction of texture, induration succeeding. When the substance of a bone is involved, pus is formed in the cancellous structure, and permeates the fibrous texture : necrosis is then inevitable. The sympathetic fever accompanying this condition is severe ; and pyæmia, from absorption of the pent-up pus by the veins, is a not infrequent sequel. Such inflammation and its consequences rarely extends from the shaft to the epiphyses of long bones. Chronic inflammation in periosteum or bone may terminate in node, or in tedious suppuration, entailing exfoliation. In the early stage, blister or apply iodine, giving the iodide of potassium internally. In **abscess**, from limited suppuration, as in the tibia, the

trephine should be applied : the symptoms of this condition are often obscure ; the pain is continuous and deep-seated. **Paronychia** may commence in the periosteum, or attack the bone itself, the inflammation of the digital phalanx being acute. Incise freely, deeply, and early : the bone often perishes.

Caries, or ulceration of bone, rarely affects the compact fibrous texture of the shafts, but usually attacks the cancellous structure of the extremities of the long bones, or the irregular bones, as the tarsus or vertebræ. It is often a SEQUENCE OF syphilis, but occurs most commonly in scrofulous subjects. Caries may arise spontaneously, or as the result of injury, or by propagation from contiguous textures, as in joint-disease. When cancellous structure is attacked, it assumes a red, softened, infiltrated APPEARANCE, and yields under the finger. The surrounding parts, which are also swollen and infiltrated, suppurate and ulcerate. Sometimes the shell of carious bone expands and forms a large cavity (*spina ventosa*), containing loose portions of spongy texture and pus. Such caries and abscess may heal readily after opening, or be very tedious ; the former when the disease is the consequence of external injury ; the latter when spontaneous, and occurring in a deteriorated or scrofulous constitution. With regard to the SYMPTOMS, the attendant pain at an early period is often severe, and of a gnawing character ; subsequently it is much mitigated. The discharge varies in quantity and quality, and escapes by a small external opening, either callous or surrounded by soft, infiltrated granulations. New bone is thrown out at a later period. Sometimes a sequestrum coexists with caries.

TREATMENT.—Counter-irritation at an early period may limit the diseased action. Excision by gouging often creates new mischief by violence to surrounding parts ; but a free external incision is often serviceable, as in the treatment of a sinus. Trust most to rest, acetic acid lotion, free vent for the discharge, and constitutional support. Reproduction of bone after caries is limited. In the tarsus, the continuity of the synovial membrane favours the extension of the disease. Caries in the spine, involving the cancellous texture of the bodies of the vertebræ and interarticular fibro-cartilage, entails

angular curvature as a consequence of loss of structure. If the patient survives the lesion and subsequent repair, the deformity is permanent.

Necrosis, or mortification of bone, is CONSEQUENT ON acute inflammation resulting usually from violence or cold. The constitutional tendencies are much the same as in caries. Inflammation may attack the bone primarily, or it may be secondary on inflammation of the periosteum or medullary membrane. Necrosis commonly affects the parts least liable to caries, viz. the compact texture of the shafts of bones, and may affect only an external plate ; or the entire structure of a cylindrical bone may perish. Separation of periosteum is not necessarily followed by death of bone. The most superficial bones, as the tibia, are most liable to necrosis. In internal necrosis the dead fragment is called " sequestrum ;" and its presence is a permanent source of irritation, whereby new bone is thrown out in the shaft and around its exterior, and pus finds its way through openings called " cloacæ." The external apertures of these cloacæ are CHARACTERISED BY prominent and vascular granulations, surrounding a central aperture, and a creamy discharge. The sequestrum may escape spontaneously if small ; if large and loose, the existing openings in the new bone must be sufficiently enlarged with a trephine, forceps, saw, or chisel, to remove it entire or in fragments. When the whole shaft perishes, there may be reproduction, or a new case formed around the old bone : partial necrosis at various points is more frequent. The discharge is sometimes so copious as to exhaust the patient, and thus necessitate amputation ; and it must be borne in mind that long-standing suppuration, particularly in connection with bone, is peculiarly liable to induce visceral disease—especially of the amyloid character.

The *process of separation* is analogous to that of a mortified soft part, *i. e.* a softening down or solution of the healthy texture adjoining the dead. This is accompanied by abundant secretion of pus, containing the earthy constituents of bone in solution and minute subdivision ; hence the inequalities and perforations of a sequestrum.

Reparation keeps pace with separation. Where the necrosis

is superficial, new bone is deposited beneath the periosteum ; as destruction extends deeper, a similar process takes place in the substance and medullary canal of the bone, and thus a sequestrum is enclosed ; and suppuration and exudation do not cease till it is removed. Muscles gradually loose their attachments, and become connected to the new bone without. After removal of the sequestrum, new bone occupies its position ; and, after a time, this solid cylinder becomes cellular from enlargement of the Haversian canals. When the sequestrum is thrown off, and reparation perfected, the remnant of the original bone is enclosed between an external layer of new bone and an internal deposit which occupies the medullary canal. When the entire thickness of a cylindrical bone perishes, reparation takes place in the same way, viz. by deposit around the dead cylinder, and the subsequent occupation of the site of the sequestrum by new bone.

The process in flat bones is similar, but the deficiency is rarely closed by bone ; fibrous tissue takes its place. Not only the periosteum and living bone, but even the surrounding soft parts, aid in the reparative effort following necrosis. Disease of the internal ear and death of the neighbouring bone may involve, by contiguity, the membranes of the brain, and the brain itself, in inflammation.

Osteoporosis is an expansion of the Haversian canals of otherwise healthy bone, and may affect parts of a bone or a whole bone. It is most common in the bones of the skull, and is usually attended by attenuation of the compact tissue.

Rickets is a disease of childhood, usually commencing about the third year, and first in the lower extremities. It is accompanied by low vital power, a tumid abdomen, sickly countenance, and spare muscular development. Though the glands are often enlarged, it seems to be rarely accompanied by tubercle. The bones appear swollen, especially at their articular ends and wherever cancellated structure abounds. This state depends on one of two conditions ; either the walls and cells are thinned, expanded and vascular, or the earthy constituents are deficient ; in the former state the bones are fragile, in the latter they yield to pressure.

The general TREATMENT consists in invigorating the system by pure air, good diet, bathing, friction, and the exhibition of steel and cod-liver oil. Rickety children should not be encouraged to walk early, but artificial support should be dispensed with unless essential : rickety limbs grow straighter as strength increases. Lateral curvature of the spine, as a consequence of insufficient strength in the column to support the superincumbent weight, must be treated by rest in the recumbent or prone posture. Deformity of the chest, carrying the scapula with it, is secondary to lateral curvature of the spine.

Mollities ossium resembles rickets in its mechanical consequences, but differs essentially in other particulars. The bones are thinned and atrophied and the seat of abundance of fat, and readily yield under pressure or break. This disease occurs in adults and towards old age, especially in females ; and more in the trunk than the extremities, the chest and pelvis becoming distorted and flattened. It is a painful and rare disease, and quite intractable ; and is not infrequently associated with cancer in other organs.

Nævus, or an analogous condition in which the enlarged capillary vessels distend the bony canals and cells, is sometimes met with ; blood is extravasated and the bone absorbed.

Cysts are most common in the lower jaw : they are developed in the interior of the bone, distending especially its inner wall, which is sufficiently thinned to yield, with a crackling sensation, under the finger. They contain synovial, gelatinous, or cheesy matter. Being painful from distension, they are sometimes difficult to distinguish from cancerous swellings. They should be laid freely open from within, and suppuration should be encouraged. When complicated with solid intracystic growth, the jaw may require partial or entire removal.

Fibroid, fibro-plastic, and **myeloid tumours** grow in the cancellous structure of bones, chiefly at their articular extremities.

Enchondroma, or cartilaginous growth, springs from the surface of bone, chiefly of the fingers, toes, ribs, or sternum ; these tumours sometimes ossify.

Tubercle, as already remarked, leads to caries, abscess, and

loss of structure in bone ; and is thus the source of great and frequent deformity.

Cancer may attack either the interior or surface of a bone, distending and thinning its walls, or forming a tumour which springs from and adheres to its exterior. Its treatment must be conducted on the general principles already noticed. (See Cancer.) The Haversian canals, and the tissues lining the cells and medullary cavity, are the seat of this internal deposit.

In *tumours* of bone there may be a shell encasing the growth, or there may be osseous spicules radiating through the structure. In the former case the growth has had its origin in the interior of the bone, and distended it. In the latter it has started primarily in the periosteum. This rule applies to both simple and malignant growths.

Foreign bodies may be permanently lodged in and surrounded by indurated bone ; but they more commonly excite inflammation, terminating in necrosis. The same result may be the consequence of laceration of the periosteum by violence.

FRACTURE.

Fracture, or the breaking of a bone, may occur at all ages, though the old are more obnoxious to this injury than the young. Nearly all the bones are liable to fracture, but some much more so than others ; those which are employed as levers are, for obvious reasons, most frequently broken. Fracture may occur in three ways ; as the CONSEQUENCE OF direct violence, of indirect violence, or of muscular action : thus, a blow upon the humerus may produce fracture ; the radius may be broken by a fall upon the hand ; fracture of the patella is caused chiefly by muscular action. The direction of a fracture may be either transverse, oblique, or longitudinal ; and the amount and character of displacement are thereby in great measure determined. Fractures may be *simple*, *i. e.*, without external lesion ; or *compound*, *i. e.*, with a wound communicating with the fracture : such lesion may be the consequence of violence

from without, or from penetration of the bone from within.
Further, fractures may be *single;* multiplied or *comminuted, i. e.,*
broken into three or more fragments ; or they may be compli-
cated with vascular lesion, or accompanied by dislocation ; and,
lastly, they may extend into, and thus involve, joints.

The SYMPTOMS more or less constantly present are distortion,
abnormal mobility, crepitus, loss of power, pain, swelling and
spasm. These vary much according to circumstances.

In the TREATMENT of fracture the two desiderata to be kept
in view are rest and position. These objects can be jointly
attained in two ways, by forced extension, or by relaxation of
the muscles. There are advantages in each plan, as will be
illustrated in detail. Division of tendons, to negative muscular
spasm, may occasionally be serviceable, but should not be
lightly resorted to.

In *simple* fracture, the limb should be placed in an easy posi-
tion, with or without apparatus, as necessity may dictate, until
the subsidence of the early swelling : under any circumstances
compression must be scrupulously avoided, by either bandage
or apparatus, in this early stage. The period for keeping
fractured bone at rest varies according to the weight it has to
support, the age, health of the patient, &c. A fracture should
be frequently inspected ; and that apparatus is best which,
fulfilling other requisites, most ready facilitates such inspection.

In double or *comminuted* fracture, the same treatment is
required, but more care and longer time are demanded : the
possibility of exfoliation of isolated fragments, in such cases,
must not be lost sight of.

In *compound* fracture, the increased risk depends very much
on the amount of contusion of soft parts. Thus, a bone
forcing its way through the skin generally involves more of such
injury than the penetration of a foreign body from without.
Such external wound may heal readily, and this result should
be encouraged ; or suppuration, local or diffused, or even
sloughing, may ensue. Close the wound, then, if possible ; if
not, soothe and facilitate the escape of pus and blood.

The **question of amputation** in compound fracture
includes many considerations besides the character and extent

of the injury, such as the age, health, temperament and habits of the patient. The same amount of injury may thus demand amputation in one instance, whereas a limb may be saved in another. Where doubt exists, the patient should have the benefit of that doubt, as the alternative of secondary amputation is still offered ; and such secondary operations are, on the whole, more generally successful than primary, if discretion be exercised in selecting a favorable opportunity. But many cases admit of no doubt ; and amputation should not be deferred, unless shock or loss of blood demand a temporary delay. The most favorable time for secondary amputation is indicated by the general condition of the patient, as regards pulse, tongue, &c. ; and a local condition indicating a reparative effort, though abortive. Where a joint is involved, or an artery lacerated, amputation is more generally rendered imperative. If a protruding bone cannot be readily reduced, it is best to saw off its extremity. In cases of wounded artery complicating fracture of the leg, the femoral artery has been tied successfully. The possibility of severe and even fatal secondary arterial hæmorrhage, from extension of ulceration in compound fracture, should not be lost sight of ; in such cases immediate amputation is often the only chance of saving life.

Reparation.—The first effect of fracture is extravasation of blood into al. the surrounding tissues, proportioned usually to the degree of laceration of the soft parts : thus, the areolar tissue, sheaths of muscles, and fasciæ, become more or less distended. Serous infiltration succeeds ; and, as this subsides, the broken ends of the bone are left surrounded by a bed of inflammatory exudation, more distinct in deep than in superficial bones. This deposit is derived from the medullary membrane, as well as the periosteum and surrounding textures. If there be an interval between the broken ends, each has its own capsule : and where there is much displacement, the bulk of this deposit is proportionately increased ; but where there is no displacement, as in simple transverse fracture of the tibia alone, the broken ends are cemented together with scarcely any perceptible increase in bulk. This plastic exudation gradually becomes cartilaginous as the surrounding absorption proceeds,

and the medullary cavity is thus occupied and blocked. The cartilage becomes, in turn, the seat of ossific deposit, and is termed *callus*. The surface of the fractured bone and the surrounding textures then take a more active part in the deposit of new bone, until a compact mass unites them, replacing the previous spongy deposit. At a later period, long after consolidation, the superabundant deposit is absorbed ; and still later—after twelve months or longer—the internal deposit is removed, and the medullary cavity and cancelli are gradually restored. Where bones are kept in position accurately there is little or no callus thrown out.

Union of fracture is often *retarded* and even prevented by constitutional or local causes, or by neglect and careless or ignorant treatment. The wide separation of two broken ends, or the interposition of a loose fragment of bone or other tissue may thus act ; but in some cases no cause can be assigned. The local treatment of such cases is by absolute and prolonged rest ; or by rubbing the broken ends together, or sawing off the ends, or introducing a seton. Absolute rest, with a seton, constitutes the most desirable local treatment, combined with attention to the health and habits of the patient, giving the wonted stimulus, &c. Where a syphilitic taint is suspected, mercury may be given. *Deformed union* rarely admits of being remedied except in young and recently united bones. Young bones will sometimes yield without breaking ; this is especially remarkable in the very young skull.

FRACTURES OF PARTICULAR BONES.

Ossa nasi.—Broken by direct violence. Treat by restoring them to their normal position, if displaced, introducing a probe or forceps into the nostril for the purpose. These injuries may be followed by abscess or necrosis ; and usually entail deformity.

Superior maxilla.—From direct violence. These fractures usually do well, without interference.

Zygoma.—Very rarely fractured. The movement of the lower jaw is impeded by compression of the temporal muscle. No special treatment is required.

Inferior maxilla.—From direct violence or force applied to another part of the bone. It may be broken in the horizontal or vertical ramus, at the symphysis, angle or processes. Sometimes a double fracture occurs. Some of these fractures are best felt from within, being accompanied by wound of the gums, and sometimes troublesome bleeding. Displacement, from muscular action, is often considerable. Treat by enclosing the jaw in a mould of gutta percha or leather, fixed with a bandage. If requisite, adjoining teeth may be held together with wire : for feeding, the mouth should be fixed open with a wedge. Forbid mastication.

Skull.—*Mechanism of fracture.* Separation of sutures rare, except accompanied by fracture. The skull may be fractured by violence directly applied to the seat of injury, or to some neighbouring or distant part of the cranium. These fractures may be thus *classified :*—Simple fissure of one or both tables ; compound, or comminuted fracture, with or without depression of bone ; fracture through the base of the skull. Fracture of the cranium may be *produced* by a fall on the head, or by the violent contact of some obtuse or penetrating body. Fractures of the base may be the *consequence* of a fall on the vertex, or of some heavy body falling perpendicularly on the top of the head. Such fracture is more likely to occur when the surface with which the vertex is brought into contact is yielding, as in a fall on a wooden pavement. When the surface is unyielding, fracture of the vertex is more likely to occur at the seat of contact. Occasionally, both vertex and base are fractured by the same violence and simultaneously. The more extensive fractures are not necessarily the most dangerous ; circumscribed depression of bone is almost invariably accompanied by compression of the brain ; but not so, when the extent and nature of the displacement admits of the brain yielding in another direction. The *dangers* to be apprehended are—1. Concussion. 2. Extravasation within the skull. 3. Excessive hæmorrhage from the wound. 4. Compression from displacement.

5. Inflammation of the brain or membranes. Extravasation of blood is a common and serious concomitant of fracture, especially of the base. FRACTURE THROUGH THE PETROUS BONE is frequently accompanied by bleeding and serous exudation from the ear, indicating intrusion on the tympanum and laceration of its membrane ; but bleeding from the auditory canal is not necessarily indicative of fracture of the base of the skull. The persistent escape of a limpid fluid, in abundance, from the auditory canal can have but one source,—the sub-arachnoid space ; and is unequivocally diagnostic of fracture through the petrous bone. Ecchymosis in the mastoid region, pharynx, and ocular conjunctiva, sometimes characterises this injury. Severally or conjointly, facial paralysis and permanent deafness not uncommonly attend it, and vomiting of blood may help to indicate a fracture through the anterior or middle fossa of the base of the skull. The *usual course* of such fractures, which are produced by the concentration of momentum around the occipital foramen, is through the basilar process, and across one or both petrous bones. These and other fractures may involve the venous sinuses or great meningeal artery : when exposed, bleeding from these vessels may be readily controlled ; but of course due regard should, if possible, be had to their position in trephining. The outer wall of the frontal sinus may be fractured and driven in, without the inner table suffering. Reparation of fracture either of the vault or base of the skull may be effected by bony union ; but when a chasm is left by exfoliation of an isolated fragment or after the use of the trephine, it is occupied by fibroid tissue, unless the space is very limited.

Contusion, without fracture, may be followed by circumscribed extravasation of blood beneath the periosteum, simulating fracture with depression. A probable consequence of this injury is suppuration and exfoliation of the external table ; or, if the bone become inflamed, both tables may perish, and head symptoms may result from pus being poured out between the bone and dura mater. In this last event the trephine must be used.

(For head symptoms and their treatment, see " Injuries of the Nervous system ;" also Section VII.)

Spine.—The multiplied articulations, elasticity, and curves of the spine protect it from frequent injury ; but it may be broken at any point. Fracture of the spine may be *caused by* direct violence, but more frequently by its being bent forcibly forwards, as when a weight falls on the back of the head and neck, or between the shoulders ; the same effect may be produced by a fall, when the body is doubled up. Usually the body of a vertebra is fractured horizontally, the intervertebral fibro-cartilage torn, and the arch with one or more of the processes broken. Such injury almost invariably occasions lesion of the cord from encroachment on the spinal canal. The most frequent *seat* of fracture is towards the lower dorsal region, where the effect of the leverage is most felt. The bony injury is reparable, if the patient survive the nervous lesion. With complete paraplegia following injury the *dangers* are extension of inflammation along the cord, bedsores, and exhaustion. Perfect rest in the recumbent posture is essential, without interference with the seat of fracture. Operations for elevating depressed bone have been practised, but without encouraging success ; such interference is not to be recommended. Fracture of the odontoid processes may result from injury or disease, entailing instant death from compression of the excito-motor centre of respiration. (For nervous symptoms and their treatment, see " Injuries of the Nervous system.")

Sternum.—This bone forms the front boundary of the chest, and is much protected from injury by the yielding nature of the elastic ribs by which it is supported on either side. Fracture from direct violence is therefore rare ; and, when it occurs, is not unfrequently attended with similar injury to the ribs, and consequently severe or even fatal injury to the contained viscera. Fracture is more frequently consequent on indirect violence, the body being bent forcibly forwards or backwards. Usually there is no displacement, because of the surrounding bony and ligamentous connections ; and the only treatment required is rest, and a flannel bandage firmly applied.

Ribs.—The ribs are usually broken by pressure tending to alter their curve, and most frequently give way a little in front of the angle. As the first rib is strong and protected, and the

lower two are floating and therefore more elastic, fracture of these rarely occurs except from direct violence, and then it is not uncommonly associated with injury to the viscus beneath— the lung in the case of the first rib, the liver or spleen in the last two. The displacement is greater where many ribs are fractured, but the treatment is the same. Besides the *pain* and *dyspnœa*, *crepitus* may usually be elicited by placing the hand on the seat of injury, whilst the patient breathes. As the fracture from pressure almost always takes place outwards, the lung is not often wounded, but in fracture from direct violence, as from a kick or blow, the broken ends of the rib are driven inwards, and the pleura and lung are very likely to be wounded. Attention should be paid to any irritating cough, and a broad flannel bandage must be firmly applied around the chest. If the lung be wounded, air will escape either into the external areolar tissue or into the pleura. In the former case it is unimportant and will subside spontaneously ; in the latter the accumulation of air may so compress the lung as to necessitate tapping the chest for its relief ; but this is very rarely required. Hæmorrhage into the pleura is very rare. Pleurisy or pneumonia may occur, but are generally local. (See " Injuries and Diseases of Viscera of Chest ;" also Section VII).

Pelvis.—As the chest is protected by its elasticity, so the pelvis depends for defence from external injury upon its form, massiveness, and solidity ; conditions which are essential for the support and transmission of the superincumbent weight. Fracture of the pelvis, therefore, occurs only as the *result of* great violence directly applied, such as a heavy fall, or the violent contact of a heavy weight. These fractures may involve the acetabulum, or be limited to the crest of the ilium, the body of the pubes, or the ramus of either ischium or pubes ; and they may exist with or without displacement. The *diagnosis* is by abnormal mobility and crepitus, and information may sometimes be gained by means of the finger in the rectum. *Treatment*, by entire rest, and attention to symptoms as they arise. The *danger* of injury to important organs is great, especially to the urethra in fracture under the arch of the pubes. Therefore at once pass a catheter if this be suspected, and keep

it in the bladder if there be laceration. In fracture of the sacrum, paraplegia may exist from compression of the sacral nerves. (See also " Injuries, &c., of Viscera of Pelvis ;" and Section VII.)

Clavicle.—The more extended movements of the shoulder have the sternal end of the clavicle for their pivot ; therefore this bone is often broken from violence applied indirectly, by falls on the hand, elbow or shoulder, as well as by compression of the shoulders, or by direct violence. Fracture is generally single, sometimes comminuted, scarcely ever compound. Pressure on the axillary vessels or nerves may occur. The amount of displacement varies according to the position of fracture, being greatest when in the centre ; the weight of the arm and the loss of support between the scapula and sternum are the chief causes of displacement ; therefore, the arm should be raised and supported, being carried backwards and outwards from the side. This may be accomplished with a pad in the axilla, and by fixing the flexed arm to the side with a bandage. Special apparatus is required in some instances.

Scapula.—The most exposed parts of this bone are most often fractured : the spine, the acromion and coracoid processes, the inferior angle ; the body and superior angle are also sometimes broken. These fractures are usually *produced* by direct violence, and are rarely compound. The glenoid cavity may be split by force communicated through the humerus. Fractured neck is described. *Diagnosis* from mobility and crepitus ; displacement generally limited. *Treatment*, by rest of the entire limb. The arm to be supported in a sling and fixed to the side.

Humerus.—This bone may be fractured at various parts from direct or indirect violence ; viz., through the shaft, the neck or tubercles, or just above the condyles ; vertically, separating the condyles : or by the isolation of one or other condyloid process. In simple fracture of the shaft, use four splints, placing the hand in a sling and excluding the elbow ; get the patient up. Comminuted fracture requires a dish splint and the recumbent posture for a time. In fracture into the elbow-joint, the joint itself should be enveloped in softened gutta-

percha or leather, and thus fixed at a right angle ; passive motion should be resorted to at a tolerably early period. In fracture of the neck, the deformity is *similar to* that consequent on dislocation into the axilla ; but may be distinguished by its almost invariably following direct violence, by the shortening of the limb, crepitus, the presence of the fractured extremity of the shaft in the axilla, and the greater mobility of the limb. Treat by a shoulder splint of wood, leather, or gutta-percha, with a pad in the axilla, and a sling to support the whole member. In early life, the upper epiphysis may be separated. Fracture through the inner condyle may not implicate the elbow-joint : fracture through the outer condyle must almost necessarily involve the joint.

Forearm.—The relative size and importance of the upper part of the ulna, and of the lower part of the radius, render these extremities of the bones, severally, more liable to fracture. Thus, either or both bones may be broken in the shaft ; but, of the ends, the olecranon or coronoid process of the ulna, and the base of the radius, are most usually fractured. In broken shaft of either or both bones, padded or convex splints must be used to keep the bones asunder, the action of the pronators being thus opposed. In broken olecranon the arm should be kept nearly straight, and fixed in this position with a splint ; union is usually ligamentous. In fracture of the coronoid process the elbow must be flexed. The carpal extremity of the radius is often broken through by a fall on the palm of the hand ; this accident, from the resulting deformity, is frequently mistaken for dislocation at the wrist. The hand should be fixed in an adducted position, or hanging down beyond the extremity of forearm splints, with the thumb upwards. Sometimes the carpal epiphysis of the radius is separated in young persons. The head of this bone, or the carpal end of the ulna, or the styloid process of either, may be likewise broken off.

Carpus.—The carpal bones may be fractured by the fall of a heavy weight on the wrist, the bursting of a powder flask in the hand, &c. Such injury is generally attended by severe laceration, necessitating amputation.

Metacarpus.—One or more of these bones may be broken

by (usually) direct violence. The hand must be kept at rest on a suitable splint.

Phalanges.—Fracture of the phalanges is commonly the result of great violence, and often demands amputation. Care should be taken, however, to sacrifice as little of the hand as possible. When these fractures are simple, they may be treated with pasteboard splints.

Femur.—In the child the neck of the femur is short and less oblique than in the adult, and the acetabulum is shallower; therefore fracture of this part is rare at an early age. The thigh is most usually broken in the middle third of its shaft, and the fracture is more often oblique than transverse : there may be double or comminuted fracture. *Compound* fracture is rare because of the thick pad of muscles, and therefore proportionably dangerous. Direct violence is a more frequent *cause* than indirect. The signs are loss of support, deformity, crepitus. The NECK OF THE FEMUR may be fractured within or external to the capsule, or at its junction to the trochanters. Fracture may also extend through the trochanter major. The signs are shortening with eversion, free mobility with extensibility (which especially distinguishes it from dislocation), and crepitus. If inverted, which is rare, it is the effect of impaction of the fractured end. This accident occurs most commonly in advanced life, and as the *consequence of* a blow, in falling on the great trochanter. The condyles may be separated from the shaft, or split asunder longitudinally. Most fractures of the thigh are *treated* best with a long, outside splint, with a foot-piece, and an extending perinæal bandage. Extension by means of a weight and pulley may always be used with advantage when much shortening occurs. The exceptions are, where the fracture is just below the small trochanter, in which case the thigh must be bent on the pelvis, in consequence of the tendency of the psoas muscle to tilt the upper fragment. When the condyles are broken off, the semiflexed position is often preferable, as the gastrocnemius displaces them backwards. Fracture of the neck, if firmly united, entails more or less shortening. In aged people fibrous union alone can be expected ; and the best treatment in such cases is to place the

patient on a double-inclined bed, and confine the feet and legs for a time.

Patella.—This bone protects the knee-joint, and acts as a sesamoid bone in the extensor tendons. It may be broken in various directions, but almost always transversely, and apparently *by muscular action*, the fall which accompanies the accident being the consequence and not the cause of the injury. The amount of separation of the fragments is proportioned to the degree of laceration of the fibrous expansion over the sides of the knee-joint obtained from the vasti muscles ; and this is naturally great when the sudden action of the extensors has been sufficient to break the patella. External violence may break vertically or star this bone. Fracture from direct violence is accompanied by ecchymosis and other evidence of contusion ; and the succeeding swelling is usually greater. *Compound* fracture is very rare, but very serious. Position is everything in the treatment of these fractures. The whole limb should be raised, so as to extend the knee and flex the thigh on the pelvis. A knee-cap of gutta-percha may be moulded over the front of the sound knee, and the part corresponding to the patella being cut out, the mould may be adapted so as to include the fragments of the broken bone. Union by bone is rare and only to be expected in cases of fracture from direct violence, and not important. It is, however, important to limit the amount of intervening fibrous tissue, therefore great care should be taken to keep the knee extended, even for some time after the patient is permitted to get up, otherwise wide separation may subsequently ensue.

Tibia and Fibula.—One or both bones may be broken ; the tibia less frequently alone, the fibula often. The TIBIA is usually fractured at its weakest part, viz., in or near its lowest third. It may be also broken near its head, or into the knee-joint, or close to its base, or into the ankle-joint, or the malleolus may be knocked off. The usual *direction* of fracture in the shaft is downwards, forwards, and inwards. *Comminuted* and *compound* fractures of the tibia are not infrequent. The FIBULA alone may be broken at any point, but most usually a little above the malleolus from a twist of the foot. When

high, the fracture is obscure, from the thick pad of muscle which surrounds the bone. When BOTH BONES are broken, the fibula is often, perhaps generally, fractured secondarily and at another part. These injuries may *result from* direct violence, but more frequently occur from indirect force, as in a fall. The *symptoms* are those common to all fractures. The *complications* attending these fractures are, that either the knee or ankle-joints may be implicated ; that, when either or both malleoli are broken off, the foot may be dislocated inwards, outwards, or forwards, by muscular action. The outward dislocation, attended by fracture of the lower third of the fibula and sometimes of the inner malleolus, is known by the name of *Pott's fracture.* Dislocation of the foot forwards *with* the lower fragment of the tibia may occur in fracture near the joint, and simulate true dislocation, requiring division of the tendo Achillis to neutralise this effect of its spasm. A fragment of the tibia is sometimes torn off with the lower part of the fibula, and fracture may extend into the joint. Laceration of an artery is a rare complication of simple fracture, but more frequent in compound. In the former case it is manifested by rapid swelling of the limb, and arrested pulsation in the injured artery ; in the latter by external arterial hæmorrhage.

TREATMENT.—In *simple fracture* of one or both bones, if practicable, place the limb, semiflexed, on an outside splint ; if not thus amenable, semiflexed on a back splint with a thigh support ; or straight, with a long outside splint, and one to support the calf. In *compound fracture* with protruding bone, if necessary, enlarge the opening, or saw off the extremity of the fragment, or do both. Remove quite loose fragments. Bleeding from torn saphena vein may be stopped by a pad. The gastrocnemius tendon may require division if its spasm resist adjustment, but this is rarely required, and is best deferred till the early effusion has been absorbed. Steady extension by means of a weight and pulley is often very useful in the treatment of these fractures where shortening exists. Compound fractures into the ankle-joint often do well. (For remarks on amputation in compound fracture of the leg, see *ante*, p. 71.)

Tarsus.—The astragalus may be fractured by being jammed between the tibia and calx. A fragment may be displaced and even require removal. The tuberosity of the os calcis is sometimes broken off by the combined operation of a fall on the heel and muscular action ; it is a rare accident, and must be treated by keeping the knee flexed and the foot extended.

The **Metatarsus** is occasionally fractured by the fall of a heavy weight on it, or the passage of a wheel over it. Entire rest, on a suitable splint, is all that is needed if the fracture is simple.

Phalanges.—The fracture of these bones is generally attended by severe laceration of the soft parts, requiring amputation. As little as possible should be sacrificed, and the great toe should be the chief object of care.

DISEASES OF JOINTS.

All of the textures which enter into the composition of joints, viz., cartilage, synovial membrane, ligaments, and cancellous bones, are liable to disease, which may be either primary or secondary. (For pathology of the several tissues, see *ante*, pp. 63—68.)

SYNOVIAL MEMBRANE.—**Synovitis** may result from injury or exposure to cold, or may be secondary to disease of contiguous tissues, as of ligaments or bone, or may be constitutional. It may be *acute* or *chronic*. In the **acute**, the *symptoms* are pain, swelling from effusion accompanied by fluctuation ; suffering, increased by movement ; heat, and sometimes redness of the skin. This condition may *terminate* by resolution, by effusion of inflammatory products, as lymph, or by suppuration. The *treatment* consists in absolute rest, leeches in the early stage, with warmth and moisture, or, if more agreeable, an evaporating lotion. It is often difficult to determine the presence of pus, and much discretion is requisite in making an opening into a joint ; a grooved needle may sometimes be used with advantage. Pus, if present, should be evacuated. The knee-joint is most obnoxious to synovitis, from its exposure to

violence and cold. Such an attack is to be *distinguished from* inflammation of the bursa over the patella by the position of the swelling, which is lateral in the former, central in the latter. The constitutional symptoms in acute synovitis are often severe.

Chronic synovitis generally entails more or less permanent effusion—hydrops articuli. This may be treated with blister and iodine. Rest is essential : support, pressure, friction, the cold douche, are useful adjuncts. In some cases the fluid has been withdrawn from the knee-joint, and a solution of iodine injected. These affections are often associated with a rheumatic diathesis.

If anchylosis be anticipated as a sequence of synovitis, it is most important to attend to the position of the affected limb.

Appearances on dissection.—Acute inflammation is followed by plastic effusion, which adheres principally to the loose parts of the membrane, the latter becoming swollen and opaque ; the surface then becomes villous and uneven, and after long-continued disease very thick and vascular. All these results may be secondary on subarticular caries or necrosis, as seen in cases of resection of the knee-joint, the whole articulation and contiguous tissues being involved and perishing.

CARTILAGE.—**Erosion** or destruction of cartilage, as a primary affection, is probably rare, if it ever occurs. Such destruction is usually consequent on inflammatory changes in the subjacent bone, from which it receives its nourishment in health, or may be the result of extension of inflammation from the surrounding synovial membranes. The cartilage is sometimes sodden and thickened, but more commonly there is an appearance of gouging away of the surface, or a softened worm-eaten condition. When synovial inflammation is the primary disease, the changes which are set up in the cartilage are softening and ultimate thinning ; when inflammation in the bone is the primary disease, there is at first atrophy and loss of texture from the surface of the cartilage, owing to the normal supply being cut off ; later on the cartilage is more or less completely separated, and is said to exfoliate. The bone

underneath has by this time usually become carious. Cartilage appears in some instances to become absorbed through the agency of superposed false membranes. If the diseased action be limited to the cartilage, reparation is effected by the production of a smooth hard surface on the bone itself, like porcelain **(eburnation). Ulceration** (so-called) of cartilage is usually secondary on caries of cancellous bone, or from the extension of mischief from a sequestrum in the epiphysis. Acute inflammation and suppurative destruction of the joint ensues as soon as the cartilage is perforated, and great suffering and constitutional disturbance are entailed. In this condition excision is often demanded. The same result may, however, ensue, as a sequence of wound, or of acute inflammation of the external appendages of a joint.

The *treatment* consists in absolute rest of the joint ; early counter-irritation may be employed ; in which case the moxa made by caustic potash is the best. If abscess exist, the joint must be opened by a sufficiently free incision to ensure the egress of the pus. Gentle extension by means of a weight and pulley often affords relief. If reparation occur, it is by ankylosis, in which case position is very important. If not supported, there is a tendency to dislocation, as in the hip from loss of texture and muscular action ; in the knee, principally from gravitation.

Ligaments.—The ligaments in the interior of joints are involved in the destructive inflammation of synovial membrane and softening of cartilage. This disorganizing process necessarily precedes the spontaneous dislocation which occurs in the later stage of knee and hip disease. External articular ligaments are the seat of gouty and rheumatic inflammation ; also from violence and cold they become inflamed, such attacks being accompanied by acute tenderness, some swelling, and subsequent thickening around the joint. This tenderness is best elicited by extension ; the interior of the joint may be secondarily affected. Treat by constant and perfect rest, leeching and blistering at first. These attacks are often very tedious, and are serious when they extend to any articular cavity. The wrist is frequently the seat of this affection.

CANCELLOUS BONE.—The articular ends of bones are the seat of primary disease, especially in the young. *Caries* succeeds *inflammation* usually; the cartilage is next involved, and finally the interior of the joint is invaded. A *sequestrum* may be the nucleus from which all this mischief spreads. A joint thus disorganized presents purulent infiltration, probably finding an exit at one or more spots, an erosion or separation of cartilage, destruction of synovial membrane and ligaments, with carious cavities in the expanded cancellous structure. This primary affection of cancellous bone is often associated with the tubercular diathesis, and is exemplified in knee and hip disease.

In **scrofulous** patients articular disease generally assumes a chronic type, with feeble reparative power. Cancellous disease will thus travel from bone to bone of the tarsus, guided by the synovial membrane or by contiguity. In this form of caries, affecting the neighbourhood of joints, the disease is insidious, causing little pain till the joint is invaded; as pus forms there are swelling, sharp pain, and spasmodic twitchings. Dislocation, and consequent distortion, are the consequences of spoiled ligaments, and interstitial softening and removal of bone; then spontaneous reparation may ensue. The early symptoms of this chronic form of scrofulous *hip-joint* disease are often overlooked; and even the symptomatic fever accompanying the acute form is frequently misinterpreted. Slight lameness with pain in walking, attracts attention. A shock conveyed through the limb, or rotation whilst the articular surfaces are pressed together, induces pain. From disease of the limb, the pelvis subsequently becomes tilted, producing apparent lengthening; the nates are flattened, the limb shrinks, and the groin is tender and swollen, aching pain being referred to the inner side of the knee. Suppuration follows, and pus is discharged at one or more points; dislocation upwards and backwards occurs (rarely forwards); the limb is shortened, and the patient becomes the victim of emaciation and hectic.

The *treatment* of such a case must be chiefly constitutional. (See "Scrofula.") Perfect rest must be enjoined, and the limb placed in the most favorable position, either by the employment

of a long outside splint, if it can be borne, or one of leather or gutta percha moulded to the hip and thigh. Sayre's splints combine the principles of removing pressure from the articular surfaces of joints, and of allowing freedom of movement. Counter-irritants, such as blister and moxa, are useful in the early stage, but not available at a later. In some of these cases the necrosed head of the bone remains as a sequestrum in the acetabulum, requiring operation for its removal. Excision of both hip- and knee-joints is sometimes applicable in this form of disease, and successful, if cases be selected judiciously.

Cancer affects joints as it affects bones. (See " Diseases of Bone.")

Hysterical neuralgia of joints is often very deceptive : it is marked by the temperament of the patient, the intermittent and shifting character of the pain, which is complained of on the slightest pressure ; and the joint may be even slightly swollen and hot, but not continuously so. The patient's rest is not disturbed, and, if the attention be distracted, even rough manipulation can be borne. The treatment is that of hysteria generally, and keeping the joint at rest.

Ankylosis.—This may occur in *two forms ;* the more common is that in which fibroid tissue replaces the normal textures which have perished under destructive inflammation, whereby the adjoining bones are bound together both externally and internally, so as to limit or annihilate motion. In the second form the union is by bone, which may be either partial or complete. Ankylosis is often the most favorable result that can be looked for in joint-disease ; and in such case it is of the utmost importance that the affected limb should be placed in the most convenient position : the knee nearly straight ; the elbow at right angles. If these positions were reversed the several limbs would be comparatively useless. The utmost discretion should be exercised in attempting to alter the position of an ankylosed limb. Forced extension may be available where there is motion ; this may be gradual, or immediate under chloroform. In the latter case it may be necessary to divide obstructing contracted muscles or tendons. Recently, subcutaneous section of the neck of the thigh-bone has been successfully performed

for firm fibrous and bony ankylosis. In bony ankylosis of the knee at a right angle, a wedge-shaped portion of bone has been sawn out and the limb straightened. This is a serious proceeding.

INJURIES OF JOINTS.

Sprains.—These injuries result from force tending to produce dislocation, but stopping short of that effect. The condition in a sprain, as of the ankle, is, that the ligaments, capsule, tendons and their sheaths are stretched, and sometimes partially lacerated; blood is extravasated, constituting ecchymosis, and the joint becomes puffy from effusion into the capsule. The *treatment* consists chiefly in perfect rest and a favourable position, as the horizontal posture when the leg is the seat of injury. Warmth and moisture, by fomentation and poultice, are generally more agreeable to the patient; but there is no objection to evaporating lotions if preferred. A few leeches may be of service. In the later stage friction, with carefully applied support, should be employed; the cold or tepid douche is often a valuable auxiliary : but, above all, forbid early use of the injured joint, remembering that, under favouring circumstances, sprains often lay the foundation of serious disease, if neglected; they often leave permanent thickening. Ligaments are occasionally quite torn through, and the result is, probably, permanent weakness of the joint ; as where the internal lateral ament of the knee gives way. Support must be supplied by a strong elastic or laced knee-cap.

Dislocation.—By dislocation is meant displacement of the articular surface of a bone from its normal position. This may be produced, like fracture, in three ways :—1. By direct violence acting on the bone near to the joint. 2. Indirectly, the bone itself being acted on as a lever. 3. By muscular action. The first and last are rare without the aid of the second ; and in each of the first two the muscles generally aid importantly. The following axioms may be laid down in reference to muscles, as bearing upon dislocation :—1. They preserve joints in their normal relation. 2. They aid in pro-

ducing dislocation when the position of the bone favours it. 3. They retain the displaced bone in its abnormal position. 4. They assist, under judicious management, in the reduction of dislocation. Atmospheric pressure is also, doubtless, influential in preserving the integrity of joints.

Conditions.—Dislocation, when complete, generally involves laceration of ligament, of muscle or tendon, or of the capsule of the joint, and extravasation of synovia and blood.

The *Symptoms* are—deformity, resulting from displacement and muscular spasm ; swelling, from effusion of synovia, serum and blood ; immobility, from the same causes as deformity ; pain, from tension, and abnormal pressure on nerves, and laceration of neighbouring tissues.

The *Causes* of dislocation may be predisposing, as from paralysis of muscles, disease of joints, laxity of ligaments, previous displacement ; under which circumstances very trifling external violence is sufficient to produce dislocation. The exciting or immediate cause of dislocation is force applied as already noticed.

The *characteristics which distinguish dislocation from fracture* are—immobility, absence of crepitus, and permanence of the deformity. But it must be remembered that in old people, and where the muscles are flaccid and feeble, a dislocated limb is more readily moveable ; and that, even under other circumstances, rigid, tonic spasm does not always occur until the lapse of some hours after the injury is received. Further, the crepitus of effusion must not be mistaken for that of fracture. These remarks apply especially to the deep, *i. e.*, the ball-and-socket joints. Dislocation may be complicated with fracture, in which case the diagnosis is often obscure.

TREATMENT.—Dislocation should be reduced as soon as possible. The indications are—to overcome muscular spasm, and to *help* the muscles to restore the bone to its normal position ; therefore, the direction of the dislocation should be carefully borne in mind, and the force and manipulation directed accordingly. It must be remembered that, the capsule of the joint being torn, the head of the bone has to be brought back through the same opening as it has already been forced

through, and that this laceration may be linear or small. If the patient be still sick and faint from the injury, so much the better. With the aid of chloroform pulleys are rarely needed, and bloodletting and tartar emetic have been superseded. Extension may be carried too far, even to preventing reduction, and risking the laceration of arteries, nerves, muscles, or fracture of the bone. Rotation, flexion or extension, as the case may demand, must be practised whilst the muscular action is being overcome; and the dislocated bone should be drawn, raised, or lowered into its right place. If the patient be conscious, his attention should be distracted by directing him to perform some other movement. Reduction is indicated by restored symmetry, normal mobility, and relaxation of previously tense muscles: an audible snap accompanies, in some instances, the reduction of a dislocated ball-and-socket joint, and occasionally so in others.

After what interval may reduction of dislocation be attempted? This question cannot be answered unconditionally. The age, sex, health and wish of the patient, as well as the form of the joint, and the degree of impaired or recovered use of it, must all constitute elements for consideration. No doubt many dislocated bones have been reduced after a protracted interval. But it must be remembered that, after a time, the normal cavity may be partially or entirely filled with inflammatory effusion ; the adhesions may be strong enough to oppose most forcible manipulation or they may be bony ; the large vessels may have become bound to the bones, and would be injured by reduction of the dislocation ; the form of the displaced head may be changed; or the muscles may be permanently shortened : moreover, a new articulating cavity may be formed or in process of development. As a rule, it is certainly better to leave a long-dislocated bone unreduced, than to incur the risks accompanying an attempt to reduce it by the employment of great force.

Compound dislocation is a complication which is serious, for the same reasons as apply to a similar aggravation attending fracture. But, in the former, a wound communicating with the joint is still more important on account of the sympathetic

constitutional disturbance entailed, and the risk of future dis-
organization or loss of movement, from inflammation and its
consequences.

PARTICULAR DISLOCATIONS.

The **lower jaw** may be dislocated, both condyles being
usually thrown forward by muscular spasm, especially of the
external pterygoid, when the mouth is widely opened, as in
gaping. One condyle only is occasionally, though rarely, dis-
located. The jaw is projected and the mouth open, the patient
being unable to articulate. Where dislocation has once taken
place, it is apt to recur, and may be renewed by very trifling
causes, where the ligaments are stretched or the joint is diseased.
To be reduced by placing the thumbs, well protected, on the
back teeth, and pressing firmly downwards and backwards.
The occurrence and reduction of this dislocation is a simple
but clear illustration of the axioms referred to above, respecting
the influence of muscular action in the production, continuance,
and relief of dislocation.

Vertebræ.—Simple dislocation of these bones, generally,
can scarcely occur; but it is accompanied by fracture of the
articular processes, of the arch, laminæ, or body of the vertebræ,
or rupture of the intervertebral fibro-cartilage. (See " Fractures
of Vertebræ," and " Injuries to Nervous system.") The
strength of the ligamentous connections between the head,
atlas, and axis, renders these dislocations almost impossible
without disease existing. If diseases of ligament or bone allow
of the head being partially and gradually dislocated from the
atlas, ankylosis may follow, and the patient survive ; or death
may be sudden.

Cases are recorded of the second vertebra being dislocated
from the first laterally or backwards, without disease, the liga-
ments being of course ruptured. When the moderator liga-
ments are torn through, the odontoid process may slip under
the transverse ligament ; this was supposed to be the explana-

tion of a recorded case in which a struggling child was raised by the head ; although, anatomically, it seems almost impossible.

Ribs.—These bones are never dislocated except when weakened by disease : force applied so much more readily breaks them.

Pelvis.—Dislocation is rare in consequence of the character and strength of the articulations, and can result only from the application of great violence, which is usually fatal from other injuries which it entails. The sacrum may be forced forwards, or one ilium separated at its synchondrosis ; or the ossa pubis may be separated : but these injuries are usually complicated with other lesions. Prolonged rest is imperative.

The **clavicle** may be dislocated at either extremity, but more often at the acromial end. Either displacement involves extensive laceration of strong ligaments. The *sternal* end is usually driven forwards and upwards, by force indirectly applied through the shoulder. The position of the displaced bone is sufficiently apparent, as it is superficial. If the shoulder be raised and carried backwards, it can be replaced ; but dislocation again occurs unless this position be maintained by treatment similar to that applicable to fracture : the arm must be fixed to the side, with a pad in the axilla, and the shoulder drawn back. Dislocation backwards is a very rare but serious injury, from pressure on the thoracic outlet : it would probably be the consequence of direct force ; and would require similar treatment for reduction. Dislocation of the *acromial* extremity upwards entails loss of power and deformity, similar to fracture near to this end of the bone, for which it is often mistaken. Its treatment must be the same : but the cure is much more tedious. The movements of the arm are not seriously curtailed in permanent dislocation of the clavicle.

Humerus.—The head of the humerus may be dislocated from its shallow cavity downwards, forwards, or backwards. This accident is almost invariably the consequence of indirect violence, as in a fall on the elbow and hand, the arm being outstretched and separated from the side : this position is favorable for the powerful muscles near the joint to drag the bone downwards into the *axilla*, the greater part of the articular

head being already out of the glenoid cavity in this direction. The forward, or *subpectoral* dislocation is usually secondary, occurring not infrequently in the attempt to reduce the axillary dislocation. In the *dorsal* dislocation, which is very rare, the direction of the force and position of the arm determine the direction of the displacement. In all, the capsule and capsular muscles are more or less lacerated, and there is consequent effusion.

The signs of AXILLARY DISLOCATION are, sinking of the deltoid and prominence of the acromion ; the arm being somewhat lengthened and separated from the side. The patient supports it to assist in relieving pressure on the axillary nerves. Pain, numbness and swelling result from pressure in the axilla. Mobility is limited in this as in the other dislocations ; and the head of the bone may be felt in its abnormal position on the outer border of the scapula, if the humerus be raised from the side. In the FORWARD DISLOCATION, the arm is somewhat shortened, and the elbow directed backwards and outwards. The head of the bone may be seen or felt beneath the pectoral muscle. In the BACKWARD DISLOCATION the head of the bone is seen or felt beneath the infra-spinatus muscle, and the elbow is directed forwards. A partial dislocation may occur, in which the head of the bone rests against the outer side of the coracoid process. *Reduction* is to be effected by fixing the scapula, and making extension. In the axillary dislocation, the patient may be seated ; and a jack-towel, passed around the chest and including the scapula, is held by an assistant : extension is then to be made at right angles from the body ; and the operator's knee in the axilla (the foot resting on the chair), is to be used as a fulcrum, when the arm is depressed : or, the patient and surgeon both being recumbent, head to heel, the latter places his unbooted heel in the axilla, whilst he makes extension from the forearm. Other methods have been suggested, but one of the above almost always succeeds. In the forward dislocation, extension should be made downwards and backwards ; and the backward dislocation is reduced by extending the arm downwards and forwards, or by elevating it. The arm should be subsequently fixed to the side and supported.

Dislocation into the axilla *may be confounded with* fracture of the neck of the humerus ; they are to be distinguished by the determining cause of the accident, which is almost invariably direct violence in the latter, indirect in the former ; further, in fracture, the limb is more movable, the fractured extremity of the shaft may be felt usually in the axilla, at the same time that the limb is shortened, and the rotundity of the shoulder may be partially restored by manipulation and preserved whilst it is supported.   But it must be remembered that the laxity of the muscles in the aged renders a dislocated limb far more movable than in the young and robust.   Dislocation may be complicated with fracture of the neck, but these cases are rare.

Elbow-joint.—The most common dislocation at this joint is that in which both bones of the forearm are thrown backwards and upwards.   The limb is therefore shortened, bent, fixed, and deformed by the prominence of the olecranon behind the condyles of the humerus.   Though usually described as a sufficiently complete dislocation for the coronoid process (if not broken) to rest in the posterior depression on the humerus, probably this is rarely the case, and is then most likely attended by considerable muscular laceration, especially of the brachialis anticus.   This accident is usually the *consequence of* a fall on the palm, the arm being outstretched, but the elbow somewhat bent, as in coming to the ground on the hands in playing at leap-frog ; and it is most commonly met with in the young. When recent, the *reduction* is not difficult, and may be effected by forcible flexion of the arm with the knee in the hollow of its bend ; or by extension of the forearm and counter extension of the humerus.   Both bones may be dislocated laterally, though this is, relatively to the last, a rare accident.   When driven inwards, the head of the radius usually falls into the posterior fossa on the base of the humerus : in the luxation outwards, the coronoid process of the ulna rests on the outer condyle. The reduction is to be effected in the same way as in the former, the bones being at the same time pressed into their position.   These lateral dislocations are necessarily incomplete.

The head of the RADIUS may be dislocated alone, either forwards or backwards, the latter being very rare.   The de-

formity is well marked ; and the head of the radius can be felt, in its abnormal position, when rotation is attempted. These accidents are *caused by* a fall on the palm, whilst the arm is extended ; and in both the arm is somewhat bent and prone, and its mobility limited. *Reduction* is to be effected by extension through the hand, that is, upon the radius, the displaced head being at the same time pressed into position.

The ULNA alone may be displaced backwards, or backwards and inwards ; but this is a very rare accident.

In all these dislocations at the elbow-joint, there is necessarily much laceration of ligament, which renders the retention of the radius, when reduced, very difficult : and the chance of complication with fracture should not be lost sight of. In attempting reduction, the attachment of the muscles, especially of the biceps, brachialis anticus, and triceps, should be remembered. Reduction should be effected as soon as possible, because of subsequent difficulty. Rest should be secured and rigidly enjoined for several days ; and then passive motion should be cautiously commenced.

Wrist-joint.—Dislocation of the carpal end of the radius is described ; but *it is doubtful whether this ever occurs* except in a diseased wrist. Cases so described appear to be, at least generally, fractures of the bone near to the joint. Probably the resistance of the large mass of flexor tendons, in a state of tension, prevents this displacement. The carpal extremity of the ulna may be dislocated either backwards or forwards—the latter very rarely—and then appears, loose and prominent, the interosseous fibro-cartilage being lacerated. This dislocation is not very difficult to reduce, but it readily recurs if the joint be not carefully secured.

Carpus.—The head of the os magnum has been dislocated from its cup-shaped cavity, or the scaphoid bone driven out of its place. Simple dislocation of the metacarpus from the carpus could scarcely occur.

Hand.—Dislocation of the phalanges of the fingers or thumb is usually produced by violence acting on their palmar surface, aided by muscular action : the displacement being generally of the distal phalanx on the back of the proximal. Reduction is

effected by extension with the assistance, if necessary, of a tape noose, and by pressure with the finger and thumb of the operator. If left unreduced, these dislocations soon obstinately resist reduction : division of the strong lateral ligaments may be justifiable under these circumstances. Displacement of the proximal phalanx of the thumb on to the back of the metacarpal bone is difficult to reduce ; extension should be made across the palm. A clove hitch of bandage or strong tape will afford the means of using traction, or the toy called Siamese link may be used for the same purpose. Great care must be taken in using a door-key, guarded with lint, and passed over a dislocated joint, as a lever in reducing these dislocations of the fingers. Dislocation of the first phalanges of the fingers on the metacarpal bones is rare, and could scarcely occur except backwards.

Hip-joint.—The relation of the trochanter major, the anterior superior spine of the ilium and the pubic spine, as the angles of a triangle, should be carefully studied in connection with the displacements of this articulation. Dislocation of the hip may take place in four directions, and *each is determined by the position of the limb at the time of the accident*, and the direction in which the force from without is applied, aided by muscular action. Thus the forward dislocations are most likely to occur when the femur is so rotated and abducted as to throw a considerable portion of the fore and inner part of its head out of the acetabulum. Therefore, we generally find that the thighs are widely separated when the head of the femur is thrown into the thyroid foramen : that a similar position, with rotation outwards, favours displacement on to the pubes, whereas, in both the backward dislocations, on the dorsum ilii and into the ischiatic notch, the accident occurs when the limb is rotated inwards and thrown across the other.

In the DORSAL DISLOCATION the limb is shortened from one to two inches and a half, according to the degree of elevation of the displaced head ; it is inverted considerably ; the roundness of the hip is diminished, whilst that of the buttock is increased ; the head of the bone may be usually felt in the latter place when rotation is attempted. The small rotators which cluster around the joint, the round ligament, and the capsule, are torn.

The ISCHIATIC dislocation is a modification of the last in respect of all its signs, and is attended by similar lesion. The limb is less shortened and inverted, and the prominence of the buttock but trifling, as the head of the bone sinks into the ilio-ischiatic notch, between the pyriformis muscle and the sciatic ligaments. The consequence is that this dislocation is more likely to escape detection than any other; it is sometimes a secondary dislocation, produced by ill-directed efforts to reduce the dorsal or thyroid form.

In the THYROID dislocation the limb is lengthened from an inch and a half to two inches, and advanced with the toes directed forwards; the trochanter is much sunk, and the body is bent forwards to relax the stretched psoas and iliacus muscles; the limb cannot be carried over the other. A prominence towards the perinæum may be felt, but the displaced head of the bone is thickly covered by the adductor mass of muscles in its new position.

In the PUBIC dislocation the head of the femur rests on the body of the pubes, under Poupart's ligament and external to the femoral vessels, where it may be felt and seen; the limb is a little shortened and everted, and cannot be rotated inwards.

TREATMENT.—In reducing these dislocations, extension must be made in such direction as to favour the co-operation of the muscles in accomplishing the reduction, at the same time that the limb is rotated so as to present as much as possible of the head of the femur towards the acetabulum. But, as in both the thyroid and ischiatic dislocations, the head of the bone rests in a depression, it generally requires to be lifted directly out. Therefore, dislocation on to the dorsum ilii may be reduced by extension across the opposite limb, and then rotation of the thigh outwards. In dislocation into the ischiatic notch, extension must be made in the same direction, with similar rotation at the proper time, the head of the bone being likewise lifted out of its abnormal position, if necessary. In the thyroid dislocation extension should be made downwards and outwards, the upper part of the limb being drawn outwards, whilst the foot is forcibly adducted. It is in reducing this dislocation

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especially that there is a risk of conversion into an ischiatic dislocation by carrying the limb forwards. The pubic dislocation is to be reduced by extending the limb backwards, and then raising it into position, whilst it is rotated inwards. Chloroform has superseded the use of pulleys in almost all recent cases, which may be generally reduced by the hand only.

Other modes of reduction have been adopted with considerable success, and among them that recently brought into notice by Dr. Bigelow, but practised by Anderson, of Leith, as early as 1772. Manipulation without pulleys, but in a definite manner, is all that is needed, the femur being used partly as a lever. In dislocation backwards, iliac or ischiadic, flex the thigh to rather more than a right angle, adduct across the opposite side, then rotate outwards and bring down ; sometimes sudden abduction assists the extension in replacing the head of the bone. In dislocation forwards, supra- or infra-pubic, abduct the thigh, rotate it somewhat outwards, extend fully, then rapidly rotate inwards and place the limb straight.

Considering the great leverage which can be obtained in manipulation, or in any of these methods of reduction, it is necessary to exercise great caution with old people, in whom the neck of the bone is easily fractured.

The *characteristics by which fractured neck of the femur is to be distinguished from these dislocations* are, that though drawn up and everted in the former, the limb may be drawn out to its full length, and moved in various directions. Further, the presence of crepitus and the history of the accident rarely leave room to doubt the nature of this far more common accident, especially in the aged.

Knee-joint.—The **patella** may be dislocated either outwards or inwards, but usually the former. It is easily reduced, but is liable to redislocation, as the capsule must be lax or partially torn. To reduce it, the knee should be extended and the thigh flexed. The accident is not common. If the extensor muscle or ligamentum patellæ be torn or cut, the bone will rise or fall as the case may be: the cure, in either instance, necessarily requires protracted rest in a suitable position, as in fractured patella.

Dislocations of the **tibia** from the femur, either partial or complete, are rare. In either instance there must be more or less laceration of ligaments. Partial displacement to either side is not difficult to reduce, and is compatible with restored motion ; but complete lateral or antero-posterior dislocation is necessarily accompanied by more serious mischief and consesequences, involving, probably, the necessity of amputation, especially if the injury include laceration of the integuments : yet recovery from complete dislocation has been recorded.

The **fibula** can scarcely be dislocated from the tibia, unless the joints be diseased ; it may be forced upwards.

One or both **semilunar cartilages** may be dislocated, and may be felt projecting between the bones. In this injury there is sudden inability to straighten the limb, and unless the cartilages be replaced, the usefulness of the joint may be materially impaired. Reduction must be made by manipulation during extreme flexion and by sudden extension.

Ankle-joint.—Though there is considerable lateral as well as antero-posterior movement at the ankle-joint, the malleoli are a great protection against dislocation, and are almost always fractured when it occurs. Displacement INWARDS or OUTWARDS is necessarily accompanied by fracture of one or both malleoli, or of the fibula above the malleolus ; these injuries are not infrequently compound : the strength of the lateral ligaments secures them usually from laceration. Dislocation BACKWARDS of the tibia, in which that bone rests on the os calcis, is very rare ; dislocation FORWARDS on to the neck of the astragalus is more common, and is marked by elongation of the heel and shortening of the instep : both are usually attended by fracture of the fibula or malleoli.

The forward dislocation may be partial, and is to be reduced by extending the foot, the astragalus being broader in front. Fracture may render this dislocation difficult to keep in position, in consequence of spasm of the gastrocnemius muscle ; in which case its tendon may be divided. In all these dislocations the limb must be placed in an easy position, in a long splint with a foot-piece, the knee being flexed. Even compound dislocations do well with care : in rare cases it may be requisite

to remove a protruding portion of bone, to facilitate the adjustment.

Tarsus.—The astragalus is sometimes wrenched or jammed out of its place, being torn from its connections and thrown inwards, or forwards on the navicular bone, rarely backwards. This injury may be simple, but the skin more often gives way, and there is extensive laceration of soft parts, and probably fracture of the bone itself : it is usually, but not necessarily, attended by fracture of one or both malleoli, or of the leg bones higher up. It is rarely of any avail to attempt reduction, should the state of parts justify the preservation of the foot. The displaced bone has been removed and a useful limb restored. Dislocation of other bones of the tarsus may occur, but they are rare ; as of the anterior part of it from the astragalus and os calcis, or of the inner cuneiform bone : the reduction of such displacement is difficult and impracticable, unless dealt with immediately.

The **metatarsus** may be dislocated from the tarsus : such a case is recorded from the fall of a heavy weight on the foot ; but fracture is much more likely to result from violence thus applied.

When the **phalanges** are dislocated, the injury is generally complicated and compound. The ungual phalanx of the great toe may be dislocated by muscular action, combined with external force : it should be reduced immediately.

INJURIES AND DISEASES OF THE BLOOD-VESSELS AND LYMPHATICS.

INJURIES OF ARTERIES.—Serious or even fatal **hæmorrhage** may result from ulceration, rupture, or wound of an artery. If practicable, a wounded artery should be secured at the seat of lesion, a ligature being placed above and below the point from which the blood issues ; if impracticable, either a ligature must be placed on the supplying trunk, or it must be compressed

above and at the seat of injury.   A ruptured or ulcerated artery
cannot usually be secured at the bleeding point : in such case,
if styptics and compression fail, either the supplying trunk must
be tied, or amputation (in a limb) be resorted to.   A partially
opened artery will often bleed more persistently than one
entirely divided, because it can neither retract nor contract.
A ruptured artery or burst aneurysm may threaten life in-
directly, by gangrene from general distension and obstructed
circulation ; under such circumstances the election lies between
ligature of the arterial trunk, and amputation of a limb.

The consequence of ruptured or punctured artery, where the
blood does not find an external vent, is **false aneurysm ;** and
this may be either diffused or circumscribed.   In the former,
where the surrounding tissues are infiltrated, the treatment
must be as just stated ; in the latter, where the limits of ex-
travasation are bounded and defined, and a circumscribed sac is
walled in and lined with fibrin, the treatment is the same as for
true aneurysm.   A penetrating wound, involving an adjoining
artery and vein, is followed by one of two consequences ; either
the direct ingress of arterial blood into the vein, the latter being
distended into a pouch (*aneurysmal varix*) ; or by the formation
of an intermediate sac, similar to that of circumscribed false
aneurysm (*varicose aneurysm*).   Uniform pressure, by bandaging
at an early period, may arrest these results.   If not, cut down
and tie the artery above and below, if the sac be small ; or, if
large, tie the artery above.

Healing process.—The action of a ligature upon an artery
is to divide its middle and inner coats, leaving its outer or
cellular coat intact.   When an artery is entirely divided, it
retracts, and its tube contracts as far as the next branch, if that
be large and not far distant.   An external plug of coagulum
first forms in the arterial sheath, and then an internal plug in
the canal, though this does not appear to be essential.   The
formation of this plug is probably due to the influence of
diminished impulse by diversion of the current of blood, con-
joined to the irritation of a ligature where such is applied.
Inflammation of the cellular coat is followed by deposit of
plastic matter and adhesion.   Subsequent suppurative softening

of the cellular sheath liberates the ligature, and permits it to be withdrawn from its plastic bed : if this action extend to the neighbouring portion of the artery, secondary hæmorrhage ensues.

When an artery has been *twisted* the inner and middle coats are ruptured and the external coat is twisted. A plug is formed in the vessel at, and for a short distance above, the rupture of the inner and middle coats, and the end becomes embedded in surrounding clot and fibrinous exudation. Besides, however, simply rupturing the two inner coats, torsion causes an invagination of them, which materially assists in preventing any untwisting from the pressure of the blood above. (For further information, see " Hæmorrhage.")

DISEASES OF ARTERIES.—The absence of vessels in the elastic and lining coats of arteries, throws upon the cellular coat the task of healing lesions ; this coat is, therefore, the seat of inflammation and its consequences. The redness and softening of the other coats is due to infiltration and imbibition ; and the appearance of inflammatory product within them to transudation from the outer coat.

Inflammation of an artery is far more prone to terminate in adhesion than suppuration, and the result of arteritis, whether spontaneous or traumatic, is either adhesion with or without a plug, or simple plugging of the affected vessel by coagulum, and consequent arrest of the circulation through it. If, however, ulcerative softening with suppuration occur—which is of extreme rarity in idiopathic arteritis—hæmorrhage ensues. If arteritis attack the vessels of a limb, their contents coagulate, and mortification is the consequence. This condition is different from that in which a ligature is applied upon an artery ; because in arteritis the branches as well as the trunk are plugged, and collateral circulation by anastomosing branches is arrested. Plugging of an artery may also result from the presence of an embolon, set free from a point nearer to the heart, and gangrene may ensue. The rarity of blood-poisoning in this affection is probably due to the infrequency of the suppurative termination of arteritis.

Ulceration of an artery is often consequent on extension of

ulceration from contiguous textures ; and causes sudden, and often fatal, hæmorrhage.

Atheroma is a degenerative action, commencing in the lining membrane or immediately external to it, and these parts become thickened and opaque ; fat-globules, albumen, and particles of calcareous matter are found in it. Calcification is a later change, having the same texture for its seat. The aorta is most frequently thus attacked, and generally near the origin of a branch, but the arteries of the extremities, brain, heart, &c., are also liable to this degeneration ; those supplying the liver and membranous abdominal viscera most rarely so. In the same order of frequency aneurysm occurs.

Aneurysm is not a restricted term, but is applied to the effects of injury as well as of disease. **False aneurysm,** the consequence of injury, has been already noticed. Aneurysm proper, or **true aneurysm,** is a circumscribed dilatation of an artery, dependent on the loss of the elastic and contractile property of its coats, or of chronic inflammation of its cellular sheath. The simplest type of aneurysm is that so frequently seen in the aorta, in which the dilatation is uniform and cylindrical, and includes the whole of the coats. But, after attaining a certain magnitude, the middle coat yields by expansion and separation of its fibres, allowing an abrupt projection of the inner and outer coats. This condition prevails in many instances at an early period, and then constitutes what is denominated the mixed or *hernial aneurysm.* It is questionable whether the inner coat is ever rent ; but on this point opinions differ.

Aneurysms thus formed usually contain coagulum deposited in laminæ, which is more abundant in the hernial form, because the sac is more removed from the direct current of the blood. Aneurysms are of various magnitude ; many may exist in the same individual, and even in the same artery. As the sac increases in bulk, it presses upon, and causes absorption and other changes in, contiguous textures.

The natural *tendency* of this disease is to a fatal issue, either by inflammation and gangrene, or by bursting and fatal hæmorrhage. The latter termination is not limited to large sacs only ;

small hernial aneurysms are more prone to burst than large ones, because the fibrinous deposit is more scanty at an early period of the disease. When aneurysms in the extremities burst, it is usually the sequel of inflammation and suppuration. Internal aneurysms burst, spontaneously or under some sudden exertion, into the air-passages, œsophagus, pericardium, &c. Bone is absorbed under their pressure, as the sternum, where the aorta is the seat of the disease.

An aneurysm may be cured spontaneously, though this is rare, by its compressing the supplied artery, by arteritis, or by the lodgment of a detached plug.

Accidental causes may determine aneurysm, as in the extremities ; a wrench or jerk or strain may thus act on an artery probably deteriorated in elasticity, by producing laceration of its inner or middle coat.

The *symptoms* of aneurysm are the presence of a pulsating tumour, thrilling to the touch and ear, distending with each ventricular systole, and collapsing on pressure of the supplying trunk ; accompanied, in the extremities, by pain, numbness, coldness, œdema, and feebleness, dependent on pressure of neighbouring veins and nerves. A solid vascular tumour, or a tumour placed over a large artery, may convey pulsation to the touch ; but it does not vary in size, expanding with each systole of the ventricle, and by emptying itself when the supplying trunk is compressed, and refilling when the pressure is removed. The rare occurrence of an artery opening into an abscess may lead to error in diagnosis and treatment. In all cases the history is an important element in the diagnosis of aneurysm.

Cure of aneurysm.—Before deciding on the course to be pursued for the cure of aneurysm, many circumstances must be considered, such as the age and general health of the patient, his freedom from heart disease, and other aneurysmal swellings, as well as the condition of the artery to be operated on. If the mode of treatment by pressure be determined on, it should be borne in mind that the object in view is, not to stop the current of blood through the sac, but to moderate it, so as thereby to promote the natural tendency to the accumulation of fibrinous

deposit within it, and thus gradually obliterate it. The pressure, therefore, should be carefully graduated, varied in its position, and, if requisite, occasionally intermitted ; the attention should be unremitting. Patients of excitable temper do not bear pressure well. The condition of the sac should be daily watched, as it is sometimes prone to suppuration under these circumstances. Pressure by forced flexion of the knee in popliteal aneurysm has proved efficacious.

In tying an artery, the external incision should be free, but the vessel itself should be disturbed as little as possible. Care must be taken to exclude everything but the artery ; and after ascertaining with certainty the connection between it and the sac, a strong ligature should be firmly tightened so as to cut through the middle and inner coats of the vessel. The wound should then be closed, leaving sufficient aperture for the escape of discharge, and carefully securing the ligature.

The period of separation of a silk ligature varies from ten days to three weeks or longer, according to the size of the artery, and its distance of the heart. Mr. Lister has recently introduced carbolized catgut in place of silk ligatures. The ends may be cut short and left in the wound. The catgut does not cause suppuration, but becomes identified with the fibrin thrown out around it, and there is said to be consequently less risk of secondary hæmorrhage. The catgut softens, but the artery remains closed by the pressure of the surrounding exudation and the internal clot. In most cases the circulation is speedily re-established through collateral channels ; for, though the temperature of a limb thus treated at first falls, it soon rises above the normal standard.

The *risks* attending ligature of an artery are gangrene, from inanition ; suppuration of the sac ; hæmorrhage at the seat of ligature. *Gangrene* may be limited, *e.g.* to the foot or toes where the femoral artery is tied ; but if it extend, the only alternative is to amputate, at least as high as the artery is tied. In *suppuration of the sac* after ligature there is no risk of hæmorrhage ; it must be freely laid open and treated as a foul abscess. *Secondary hæmorrhage* at the seat of ligature is the most dreaded risk ; it occurs usually in the second week after

the ligature is applied, and is the consequence of ulceration into an unsealed artery. It usually occurs from the distal end of the ligatured vessel. It commences insidiously, but proves generally intractable. If pressure fail to arrest it, the artery should, if possible, be tied higher up, or the limb, in some cases, be amputated.

DISEASES OF VEINS.—**Phlebitis,** or inflammation of veins, is more often acute than chronic, and has its chief seat in the outer or cellular coat of the vessels. It may be primary and the result of mechanical lesion, as contusion, puncture or ligature ; or secondary, by extension from contiguous textures, or from the neighbourhood of an abscess. Phlebitis is a common result of difficult labour, and then usually affects the left lower extremity.

The cellular coat of an inflamed vein is first injected and then infiltrated ; and this condition involves the thin fibrous coat, the lining membrane also becoming discoloured and softened, by imbibing the exudations from the inflamed outer coat. A plug subsequently forms in the then dilated vessel, the products of inflammation meanwhile separating the coats, and being deposited in the interior of the vein, by transudation or perforation. The plug being softened or expelled, lymph or pus occupies its place ; and, by mingling with the circulation, they poison the blood. Hence the constitutional phenomena which characterise this condition, and the secondary consequences in *local external deposits of pus ;* or in *pyæmia,* where abscess occurs in the liver, lungs, or other internal organs. Portions of the clot or of the fibrinous plug may be detached and carried by means of the circulation into the lungs, brain, liver, spleen, &c., where it may block an important vessel and give rise to serious or fatal symptoms. The detached portion is called an **Embolus.** (For general symptoms of blood-poisoning, see " Animal poisons.") Local abscess may occur in an inflamed vein ; and, being limited by plugging and obliteration of the vessel, is unaccompanied by symptoms attending absorption. Phlebitis may also terminate by simple thickening, dilatation or obliteration of the vessel.

TREATMENT.—By rest, leeches, warm applications ; and

open abscess early. Mild purgatives and general support, unless otherwise indicated.

Operations for obliteration of veins, by ligature or otherwise, are always attended with risk. It is necessary sometimes to tie or twist veins in operations, as amputation. The admission of air into an opened vein is sometimes speedily fatal.

Dilatation of a vein, accompanied by thickening, is sometimes one-sided, and thus gives rise to a convoluted appearance, and what is termed **varix**. The valves cease to perform their office. This condition of varicosity is not always dependent on obstructed circulation alone, but may result from increased local action, as in malignant growths. Varix more commonly affects the left lower extremity owing to the anatomical arrangement of the large venous trunks in the pelvis. When affecting the veins of the spermatic cord, it is termed varicocele; in the rectum, hæmorrhoids. (For further remarks on Varicose veins, see " Ulcers.")

Vascular tumours are sometimes formed by the dilatation of the minute arteries and veins and intervening capillary network; this is **nævus,** or erectile tumour. When the small *arteries* are chiefly the seat of this disease, it is accompanied by pulsation, and often extends to the larger supplying trunks. Such pulsating tumour is termed aneurysm by anastomosis. There is a constant tendency, in all of these tumours, to grow. They often resemble, in texture, the erectile tissues.

Nævus is usually congenital, and grows rapidly. Its seat is either the skin or subjacent areolar tissue; and it appears in the former as a bright, slightly raised, scarlet stain; in the latter as a bluish swelling with a doughy feeling: both forms may co-exist. Nævi occur on every part of the body and limbs, though, most rarely on the hands and feet; sometimes they are single, at other times numerous. The free application of strong nitric acid or potassa fusa generally suffices for the cutaneous nævus; the subcutaneous disease requires the ligature, or injection, or the introduction of a probe armed with nitrate of silver; or the actual cautery may be used with good effect, and sweet oil should be applied to the surface afterwards.

Vaccination has been found useful; pressure or simple puncture is rarely effective.

In aneurysm by anastomosis, the supplying arteries, and even the main trunk, have been tied ineffectually. Excision is dangerous. It is best to tie such a tumour in sections if large, first dividing the skin if it be not involved, and using cross pins, or ligatures without them. These pulsating tumours may occur in muscle, or occupy a finger, or the ear, &c., and are very intractable.

DISEASES OF LYMPHATICS.—These delicate vessels play an important part in many surgical affections, by removing fluid or solid deposits, the consequence of inflammation or other morbid action. Such effort may be promoted in various ways; *e. g.*, by internal medicine, as mercury or iodine; by the local application of the same; by friction or pressure. The last-mentioned influence operates spontaneously on surrounding textures, in the growth of tumours, in the bursting of aneurysm or abscess. Poisons are taken up by the absorbents and veins.

Lymphatic vessels may become the seat of **inflammation,** and their glands of suppuration, resulting from simple irritation or the absorption of poison. Such inflammation is characterised by the bright scarlet lines, narrow and well defined, which indicate the course of the vessels; and may be distinguished from phlebitis by the breadth, hardness, and greater tenderness accompanying the latter, which is also usually slower in its development. Absorbent inflammation generally subsides spontaneously, but may terminate in suppuration or obliteration of the lymphatics. When suppuration occurs in the lymph-glands, generally the preceding inflammation of the vessels subsides, and with it the constitutional disturbance: such suppuration is probably the elimination, in many instances, of absorbed poison thus arrested, and the pus should, therefore, be speedily evacuated. (See also " Poisoned wounds.")

These little bodies are also the occasional seat of chronic enlargement and induration; also of tuberculous deposit, as in the mesentery; likewise of cancer, though more often as a secondary than as a primary formation. The thoracic duct is occasionally the seat of mechanical obstruction.

DISEASES AND INJURIES OF THE NERVOUS SYSTEM.

In **Hydrocephalus,** the fluid accumulates usually in the ventricles, which are distended and thinned ; rarely in the sac of the arachnoid, which may then present a circumscribed bulging swelling. This accumulation is sometimes very great, separating the bones widely and extending their membranous connections. In such cases an operation has been resorted to, sometimes with permanent benefit. It consists in perforating the top of the head with a trochar and canula of small size, on one side of the median line, to avoid the longitudinal sinus. Support should be afforded during the withdrawal of a limited quantity of the fluid, and a bandage afterwards applied. This operation should be repeated at intervals, as the fluid is sure to collect again.

In **Spina bifida** the accumulation of fluid is within the sac of the arachnoid, which presents a more or less prominent fluctuating swelling beneath the distended skin. Tapping in these cases is useless. Injection and the ligature have been tried ; but both are usually highly dangerous, for inflammation cannot be limited ; and the nerves may be included in the noose.

NERVES are atrophied by pressure, such as that of tumours, all nerve texture sometimes disappearing. When simply divided, nerves can reunite and their function is restored ; not so when there is any considerable loss of texture. When the bulbous extremities of nerves, in an amputated limb, become adherent to a conical stump, their extreme sensitiveness may render re-section necessary. Usually, however, they shrink and become atrophied. *Inflammation* of a nerve may result from injury, or exist as a rheumatic affection, or as tic. The function of the facial motor nerve sometimes becomes suspended from cold.

Cysts in nerves are rare. **Neuroma** is an adventitious deposit between the fasciculi of a nerve. These tumours some-times attain a large size ; their removal necessarily involves

the destruction of the nerve. Tubercle is not deposited primarily in nerves; but they are the seat of both primary and secondary medullary *cancer* as in the retina.

THE BRAIN, *injuries of*. (For fracture, see "Injuries of Bone.") **Concussion** or commotion of the brain is the immediate consequence of a blow or similar injury, and varies in intensity and duration according to the severity of such injury; in some instances being transient, in others lasting for hours or even days. The *symptoms* are prostration, indicated by a feeble pulse, cold skin, and slow breathing; stupor more less profound, but not complete; pupils inactive, and generally contracted; sometimes one is dilated, the other contracted : stomach irritable. After a time the patient can be more readily roused to consciousness, but immediately relapses into stupor.

The early *treatment* must be expectant, keeping the patient warm, but not giving stimulants except in case of urgent need from extreme or long-continued prostration; the bladder should be attended to if necessary. Rigor often precedes reaction; the pulse becomes irritable under disturbance and rises; the skin becomes hot. Perfect quiet should then be enjoined, and a cold lotion applied to the shaven scalp; a purge should be administered, and, if necessary, some leeches should be applied to the temples, and a blister to the nape of the neck. General bloodletting is scarcely ever needed.

Compression of the brain may result from the skull being driven in, or from blood being extravasated on the surface or into the substance of the brain, or into the cavity of the arachnoid, or between the dura mater and bone. In depression, the apoplectic condition exists from the first : where extravasation is the cause, the symptoms may supervene when reaction comes on, after the lapse of an interval from the receipt of the injury. The *symptoms* of compression are those of apoplexy : profound stupor, slow, and labouring pulse, slow and stertorous breathing; muscles flaccid, bladder inactive, involuntary discharge of fæces; pupils dilated and fixed. In this condition the patient remains, if unrelieved, until he dies from exhaustion, or perhaps suddenly from further effusion of blood, as the heart regains some power. Symptoms of a less defined or more mixed kind

may exist, where the base of the skull is fractured, or the substance of the brain torn.   Bleeding or serous oozing from the ears is suggestive of fractured base, though not a conclusive sign.   Convulsion or jactitation are often present in torn brain ; in such cases, if inflammation supervene, great suffering and violent delirium may follow, if stupor be not profound.   Extensive fracture with depression, and extensive laceration and even loss of substance of one hemisphere, may occur, without symptoms of compression, if there be space for the brain to protrude.   From this condition recovery is possible ; but the patients usually die from secondary effusion into the substance of the brain, or from inflammatory softening extending to the neighbouring cerebral structure.

TREATMENT.—In depression of a defined portion of skull, with profound apoplexy, elevate or trephine at once.   In extensive depression with extrusion of brain, but little good can be done, unless the depressed fragment can be raised with the elevator.   In limited depression, where all symptoms of compressed or injured brain are absent, no interference is called for or justifiable ; but such a case requires careful and constant watching.   In doubtful cases, where there is no scalp wound, hasty exploration by incision is to be deprecated.   In secondary symptoms of compression, which may arise from extravasated blood or accumulation of pus, the trephine may be required, and is often used advantageously when proper discretion is exercised.   But this operation should never be resorted to unless clearly indicated ; for it is, in itself, a serious evil, entailing probable sloughing of the dura mater at the circumference of the aperture, and consequent **hernia of the brain.** Should such protrusion occur, a carefully adjusted pad over the opening, the effect of which must be watched, is the best treatment.

In applying the trephine, the object may be to elevate a depressed fragment of bone, or to remove an overhanging angle so as to apply the elevator to the depressed piece.   In either case much caution must be exercised in cutting through the bone ; and it should always be borne in mind that the smaller the chasm made, the less mischief will have been inflicted.   A

small saw will in some cases supersede the use of the trephine, and is then to be preferred.

THE SPINAL CORD, *injuries of.* (For fracture, see "Injuries of Bone.")—**Concussion** of the spinal cord may result from a blow, or from a fall on the sacrum. The symptoms of paraplegia which follow may be long persistent if the blow have been severe. The prognosis in such cases should be cautious. Little can be done, but symptoms must be met as they arise. **Compression** may result from extravasated blood, which may occur primarily or secondarily ; death may thus rapidly supervene, if an artery have been torn. Fracture with depression is *characterised by* paraplegia, more or less complete, below the seat of injury ; retention of urine, priapism, involuntary discharge of fæces. The cord itself being crushed, the urgency and extent of the symptoms vary according to the height of the injury ; and the same cause determines, in great measure, the issue of the case. The intellect is clear, and the general condition of the patient is often illusory. Death is usually the consequence of inflammatory softening, extending upwards, until the respiratory centre is reached and asphyxia ensues. But when the injury is low down the patient has a better chance of recovery, or may ultimately die exhausted. When the respiratory centre in the neck is crushed, death is instantaneous.

TREATMENT.—By rest on an elastic mattress ; regular attention to the bladder, for the urine becomes ammoniacal ; regulation of diet and bowels ; and precautions should be taken against bed-sores. Operations for raising depressed bone have been proved to be unavailing ; the mischief done at the time of the injury is irremediable by such means, and the body of the vertebra is generally involved in the displacement.

SECTION V.

INJURIES AND DISEASES OF REGIONS.

INJURIES AND DISEASES OF THE FACE AND ORGANS OF SENSE.

FACE.—Lacerated or incised *wounds* of the face generally heal kindly ; and *contusions*, though followed by much ecchymosis, rarely entail more serious consequences. Wounded arteries may require to be twisted or tied ; and division of the *facial nerve* is followed by paralysis of the corresponding side of the face, which is, however, usually only temporary, unless there be loss of substance. Division of the *parotid duct* is very likely to be followed by fistula, which may also be the consequence of ulceration. If such fistulous opening be small, a touch with a point of caustic or actual cautery will suffice often to close it : if large, a plastic operation or paring of the edges may be required, care being taken at the same time to secure the communication of the duct with the mouth ; if this be closed, an artificial opening must first be established by the introduction of a small seton. If a *salivary calculus* lodge in the duct, it should be removed from within the mouth. The *parotid gland* is the subject of inflammation (cynanche parotidea) ; probably this is chiefly, if not wholly, confined to its fibrous envelope ; it is also occasionally the seat of tumours, generally of the glandular type. *Neuralgia* of the face has been treated by division of the offending nerve, but not with sufficient success to encourage the repetition of the operation, except in a few cases where the mischief may be reasonably referred to the sensient extremities of the nerve only. *Erysipelas* of the face is of common occurrence, and is usually associated

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with disorder of the digestive functions. It is best treated by exclusion of light and air, in addition to attending to the state of the alimentary canal.

MOUTH.—**Aphthous ulcers** of the mouth are usually dependent on disorder of stomach : touching them with a point of nitrate of silver hastens their healing. Deeper ulcers of the tongue and lips may require nitric acid.

Cancrum oris is phagedænic ulceration of the lips, cheek, or gums, attended with excessive secretion of saliva. It usually attacks children between teething time and about eight years old. The ulceration generally commences in the gums, which have a spongy, livid appearance; the fangs of the teeth and alveoli are exposed, and exfoliation of even large fragments of bone, with the teeth, occasionally occurs. The mucous surface of the lips and cheeks is often extensively ulcerated ; even to perforation, in rarer instances, of the latter. Medicinal treatment should include careful attention to the bowels and secretions generally. The mineral acids, with bark, are useful ; and any detergent gargle may be employed. But unquestionably the most valuable remedy, in almost all cases, is the chlorate of potash, which may be given internally in doses of from five to eight grains, with or without the addition of a few minims of dilute hydrochloric acid, and bark : the best wash also is composed of the same salt, in the proportion of ten or twenty grains to an ounce of water, with which the affected part should be frequently bathed. A single application of strong nitric acid may be needed in some cases, but this is rare. Carious teeth should be removed, as well as any loose fragments of bone.

Epulis is a term applied to tumours of the gums, varying much in size and external characters. They usually spring from the fleshy or bony socket of a tooth, are more common in the lower than the upper jaw, and are not malignant in character, though they often attain a large size. These tumours grow slowly, are almost painless, and generally uniform on the surface and fibroid in texture. Their removal is generally facilitated by the extraction of a neighbouring tooth or teeth ; and if removed entire they are not recurrent. If firmly adherent to or growing from bone, it is safer and may be requi-

site to remove more or less of the jaw to eradicate these tumours. The characteristics of true cancer are readily distinguishable, as contrasted with the above.

Dilated salivary ducts, and other fluid tumours of the mouth and lips, are most readily cured by free incision and the subsequent application of caustic—nitrate of silver or potassa fusa—to the secreting surface.

Warty excrescence on the margin of either lip may be destroyed by strong caustic, but generally their doubtful or truly malignant character renders removal with the knife safer. In such case, the incisions on either side should be made to meet at an acute angle, so as to avoid subsequent deformity, when the edges of the wound are approximated. The removal of an entire lip may necessitate a plastic operation for its restoration; but the risk of contracting the opening of the mouth must be borne in mind. Such *contraction* is sometimes the consequence of cicatrisation after ulceration: it may be remedied by excising a portion of the cheek on either side, exclusive of the mucous membrane, which is then to be divided horizontally in the centre, and fixed to either border of the cutaneous margin: this is a very satisfactory proceeding, if carefully conducted. To form a new lower lip, the skin covering the chin must be borrowed from either side, and raised in the form of two flaps, which are left connected at their outer extremities, and fixed with pins in the centre. The space thus denuded of skin is left to granulate, or, if necessary, small islands of skin may be grafted.

THE ANTRUM may be the seat of *inflammation*, excited by carious teeth or exposure to cold, or both combined. Suppuration may be thus established, and the patient suffers much from the confinement of matter, which does not readily escape through the small nasal opening. The sinus must therefore be perforated; and this may be effected either from its lower wall, after removing the offending tooth or stump, generally the second molar; or through the outer wall, by raising a portion of the mucous membrane reflected from the cheek, when the teeth are perfectly sound. The cavity should be repeatedly washed out, and the artificial opening maintained for a time,

and a zinc lotion injected. The antrum may be the seat of *scrofulous deposit*, and its walls become thinned by expansion. The same effect may result from the slow growth of a *fibroid tumour*, which sometimes attains great magnitude ; this form may be safely removed, and with it, if necessary, a portion of the upper jaw or the whole, as the case may be. To attempt the same operation in *medullary cancer* of this cavity is not only useless, but fraught with immediate danger to the patient, on account of the great vascularity of the parts, and the difficulty of controlling the hæmorrhage.

In relaxed and permanently elongated UVULA, it may be desirable to remove the redundant portion. If so, this is readily accomplished by seizing the uvula with the forceps, and snipping off its point with a pair of scissors. Small perforations in the soft PALATE may be closed by the application—repeated if necessary—of a heated wire to the circumference, or by paring the edges and bringing them together with suture. Cleft palate requires a more complicated operation. Chronic enlargement of the TONSILS may be relieved by operation ; but this should not be undertaken indiscriminately and unadvisedly : the proper test is, interference with respiration and articulation, or liability to attacks of cynanche tonsillaris. The guillotine is a simple, safe and efficient instrument for this purpose : after cicatrization, the gland tissue still further shrinks. Abscess of the tonsil should not be opened too early ; it is dangerous to plunge in a knife deeply and at random ; and moreover, such opening will close again if dense tissue have to be perforated before pus is reached.

Post-pharyngeal abscess projects at the back of the fauces or pharynx, and may seriously interfere with deglutition or even with respiration. It must be incised. It is sometimes associated with disease of the cervical vertebræ, or with local injury, but it is more often due to constitutional causes, and is allied closely to abscess of the tonsils in its causes and symptoms.

TONGUE.—Children are not often *tongue-tied*, though mothers think they are ; if an infant can suck freely it is undesirable to cut the frænum, but if this little operation be necessary it

should be done with blunt-pointed scissors, directed downwards towards the floor of the mouth, and the section should be limited. The tongue may be the seat of *inflammation* from various causes, such as the agency of mercury or mechanical injury, or it may occur without apparent cause. If accompanied by œdema, respiration may be interfered with : blood must then be taken from the organ by leeches, punctures, or incision. *Ulcers* of various character attack the tongue ; simple aphtha, indicative of stomach derangement, and from the mechanical irritation due to decayed or broken teeth. Sometimes the tongue is *fissured*, and this is a more troublesome condition to deal with. Attention to the general health may be aided by the local application of nitrate of silver or nitric acid. Syphilitic sores are common upon the tongue, but they have no special characteristics. The absence of other probable causes for the sores will lead to the suspicion of syphilis which the result of treatment will confirm or negative. Excavated ulcers, with hardened circumference and *warty growths*, may be sometimes removed in this way, or with a knife ; but the true *cancerous* character is developed in others, which resists all treatment, and is only amenable to the questionable operation of excision ; the statistics of this operation, except in the early stage of the disease, are not encouraging. The ligature or écraseur is, in most cases, safer than the knife. In removal of the entire tongue the incision should be made through or beneath the jaw, in the median line. More success has attended this operation than partial removal. The tongue is occasionally the seat of *nævus*, which may be destroyed, if superficial, with nitric acid ; but, if deep, should be tied. Encysted and fatty *tumours* are sometimes (not often) met with beneath the tongue and admit of removal. *Ranula* is a fluctuating tumour caused by obstruction and consequent distension of the sublingual duct ; it should be freely incised, and caustic should be applied to the dried secreting surface. In the rare affection of chronic enlargement or *hypertrophy* of the tongue, if compression do not suffice, excision of the redundant portion must be practised, so that the protruding organ may be returned within the mouth.

NOSE.—*Laceration* of the skin or cartilages of the nose gene-rally heals kindly, if carefully treated by replacing the partially severed portions. If there be loss of structure from contusion, sloughing or other cause, a plastic operation may relieve the deformity, as when an ala is lost. Other deformities, resulting from fracture and depression of the nasal bones, and obstruction of the nostrils, may be remedied by similar surgical interference.

In **epistaxis** it is necessary to investigate the cause of persistent bleeding before adopting surgical interference. But if the ordinary remedies fail of affording relief, it may become necessary to arrest the hæmorrhage by plugging the nostril from which it proceeds. For this purpose a wax bougie (if a specially contrived instrument be not at hand) must be armed with a stout ligature, and carried along the floor of the nostril until it makes its appearance beyond the soft palate. The ligature is to be seized with a pair of forceps and brought for-wards, the bougie being at the same time removed. An oiled pledget of lint (preferable to sponge) is then to be attached to the portion of the ligature pendent from the mouth, and to be drawn into the posterior nares by pulling the end which hangs from the nostril until the compress is firmly fixed. One end of the ligature may be left passing through the mouth, to be used in removing the plug subsequently. It should not be left too long, as it may produce irritation, and even suppuration. If requisite the nostril should also be plugged in front.

Lupus is an eroding ulcer which frequently destroys the entire nose and spreads to the cheeks and lip. It commences usually as a tubercle or warty growth, which then ulcerates beneath the concretion formed by the discharge. It spreads with varying rapidity, and is, in some instances, much less controllable than in others. The general treatment consists in administering alterative and tonic medicines, and a generous diet. Locally, if the sore be foul, its surface should be destroyed with nitric acid or chloride of zinc, and subsequently dressed with soothing applications, and the edges of the ulcer should be supported. A lotion of two grains of nitrate of silver in an ounce of lime-water agrees well with these sores.

Ozœna is a term applied to a fœtid suppurative discharge

from one or both nostrils, which is frequently dependent on the presence of dead bone, but not necessarily so. Ulceration of the mucous membrane may account for this condition. It is often a very intractable disease. The general health must be attended to, for the subjects of this complaint are often scrofulous. The nose must be frequently washed out with warm water to prevent accumulation of inspissated secretion, and a weak solution of alum or sulphate of zinc or iodine may be injected. Inhalation of diluted mercurial or chlorine vapour, by the affected nostril, may be useful.

Syphilitic rupia may attack the nose, and, by ulceration, destroy a considerable part of it. Exfoliation of the bones also occurs in this disease, or as a consequent of excessive mercurialization. The treatment must be that for secondary syphilis.

Polypus.—The soft mucous polypus of the nose is a serious mechanical inconvenience, but otherwise innocuous. These growths, which rarely occur singly, spring from the mucous membrane covering the turbinated and spongy bones of one or both nostrils, thereby more or less obstructing them, often entirely so ; and when they attain a large size, great disfigurement is the result, from the bulging of the nostril. These hypertrophic productions are invested with mucous membrane, and are pedunculated, and soft and yielding in their texture, containing but little solid matter. The discharge of mucus from the nose is increased, and the patient experiences great discomfort in breathing or speaking. Occasionally these polypi hang back over the soft palate, in which case a ligature may be required for their removal ; but generally they are readily taken away by seizing the growth as near to its attachment as possible, and twisting it off with a suitable pair of forceps ; a repetition of the operation is often needed. The consequent bleeding will soon cease ; and the patient should be directed to facilitate the operation by forcibly blowing the nose. Cancer may attack the nose, but admits of no cure by operation or otherwise.

Lipoma is hypertrophy of the skin and subcutaneous adipose tissue of the nose, and sometimes attains a large size. The

redundant growth may be removed by excision, care being taken to control the bleeding.

Foreign bodies sometimes find their way into the nostrils, especially in children ; and require surgical assistance for their removal. For this purpose an expanding speculum should be introduced to ascertain the position of the offending body, which then may be hooked out with a small scoop, or an eyed-probe bent at the extremity.

Partial loss of the nose, as of one ala, may be remedied by transplanting a flap from the cheek ; or, when any portion of the cartilage is left, by subcutaneous separation and shifting of the neighbouring skin to the chasm it is intended to fill. A new septum may be made by borrowing it from the centre of the upper lip, and, without twisting it, attaching it to the tip of the nose. Where the entire nose is lost, it may be replaced by borrowing the frontal integument, if healthy. After preparing the circumference of the nasal aperture by dissecting out a sufficiently wide and deep strip of skin, a heart-shaped flap is marked out and carefully detached from the pericranium of the forehead : the peduncle of this must be left tolerably broad and as thick as possible ; and is to be separated a little lower on one side than the other, to allow more readily of its being twisted. When bleeding has ceased, the flap is to be attached in its new position with pins or interrupted suture. Subsequent operation allows of the twisted peduncle being rendered less unsightly. It is well to mark the line of incision by previously fitting and adapting a model of leather on the forehead. The gap left must be drawn together as well as may be, and small pieces of skin may be subsequently grafted in it.

EAR.—*Foreign bodies* in the ear cause great inconvenience and frequently suffering, when they are deeply lodged against the membrane of the tympanum. If syringing fail of washing them out, a bent probe or noose of wire, or small scoop, is the best instrument to use, as for the nose. The probe should be bent at an obtuse angle at its eyed extremity, and close to the end. Peas or beans swell, and, in consequence, become more firmly impacted.

In the examination of a patient for deafness, it is necessary to
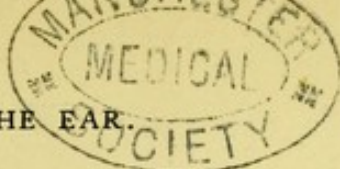
determine whether the cause of it is to be found in the external auditory meatus, and for this a speculum must be used ; next, the Eustachian tube and tympanum should be examined by inflation or by the catheter ; if the cause does not exist in either of these, then it must be in the internal ear, and for such cases very little good can be done.

Abscess of the meatus or of the tympanum is attended with much suffering, which can be only mitigated by fomentation and anodynes ; the escape of pus affords relief. In some instances discharge from the ear becomes chronic, and requires mild astringent injections for its relief. In others, again, purulent discharge is associated with deep-seated disease in the temporal bone, which may, by contiguity, involve the brain and prove fatal : or it may involve the carotid artery or jugular vein as they pass through the base of the skull. Fungous *granulations* in the ear are troublesome to deal with : caustic, solid or in solution, may be employed. *Polypi* occupying the meatus must be removed with forceps. *Accumulation* of *cerumen* is often a cause of temporary deafness, and is to be relieved by free and repeated syringing with warm soap and water. The introduction of cotton often adds to this obstruction. *Chronic thickening* of the meatus and membrana tympani, and *obstruction of the Eustachian tube* from inflammation or hypertrophied tonsils, are among the causes of deafness, and are in some instances remediable : thus, the membrane of the drum has been perforated so as to allow of the evacuation of fluid or mucus retained in the Eustachian tube, and the Eustachian tube may be dilated by the use of a catheter, or by injection of air or fluid.

The external ear is sometimes the seat of *injury* by laceration or otherwise ; if torn down, it must be carefully replaced. The concha is occasionally the seat of an intractable form of pulsating nævus which gives rise to enlargement with lividity ; it may be treated by obliterating the vascular supply.

EYE.—The **orbit** is liable to injury and to disease. Under the latter head may be included *inflammation*, generally from some morbid change in the bony walls, protrusion of the globe (*exophthalmos*) from accumulation of blood in the vessels of the orbit in certain conditions of the system, and *tumours* which

may also lead to protrusion of the globe or to lateral displacement.

Exophthalmos, or protrusion of the eyeball, may result from the growth of a tumour behind it, such as the development of an exostosis of the orbit : in these cases, vision is disturbed by tension of the optic nerve and pressure on the globe. A natural fulness and prominence of the eyeball may exist, without these effects ; and it is in such cases that rough handling of the upper lid may force it back beyond the vertical axis of the globe : it must of course be carefully replaced. It has been questioned whether the eyeball can be forced from its socket without destruction of vision ; one instance is known to the writer in which such was the case, and it was gently pressed back into its cavity.

Tumours are usually erectile or malignant, but exostoses, cystic, and other simple tumours may spring from the walls of the orbit. For a rapidly growing or bleeding growth it may be necessary to ligature the common carotid. Simple tumours may be removed cautiously when within reach. The frontal sinuses and ethmoidal cells may be distended and should be laid open : they give rise to great deformity.

In *Strabismus*, it is usually the inversion of the eye which requires rectifying by division of the internal rectus muscle. For this purpose the eyelids are kept separated, and the eyeball is fixed by seizing a portion of conjunctiva with forceps on the outer side of the cornea. Then a fold of that membrane is similarly taken up midway between the caruncle and cornea, and divided horizontally with suitable scissors : a blunt hook is next introduced beneath the muscle, which is drawn forward and divided near to its attachment into the sclerotic. There should be as small a wound and as little disturbance as possible. The eye should be protected for a day or two.

Lachrymal apparatus.—The lachrymal sac is inflamed as a consequence of disease in neighbouring structures, or primarily ; it becomes swollen, red, and painful, and pus exudes through the puncta on pressure. It is attended with epiphora and sometimes with dryness of the nostril, and may result in the formation of an external opening. Use warm fomentations and

evacuate any pus at once by a small puncture. Treat afterwards, if necessary, for fistula lachrymalis.

Epiphora, or watering of the eye, may arise from excessive secretion, from altered position or obstruction of the orifices of the puncta, or from obstruction in the course of the canals, or in the duct. The punctum probe must be cautiously used to relieve constriction of the canals, which may be slit up if they obstinately close. When there has been inflammation and consequent obstruction of the duct, mucus or pus will accumulate in the sac. If this be not pressed out from time to time, its presence will produce ulceration, and consequent *fistula* lachrymalis. This condition may be relieved by astringent lotions and counter-irritation, but most likely will entail a permanent fistulous opening, which may require the introduction of a style, to guide the tears to the nasal cavity. If possible this alternative should be avoided, and may so be in most cases by diligent attention and continual emptying of the distended sac by pressure. Occasionally earthy concretions in the sac require removal.

Eyelids.—*Ptosis* or dropping of the upper lid may be the result of hypertrophy of the lid from repeated inflammation, of hypertrophy of the orbicularis from protracted intolerance of light, weakness of the levator palpebræ in the aged, or, most commonly, paralysis of the third nerve; the treatment of it will therefore differ. With one of the first two of the above-mentioned causes present, removal of a portion of skin will remedy the defect. In paralysis of the third nerve the treatment must be directed against its cause (syphilis, tumour, cerebral disease).

Neuralgia is sometimes accompanied by *spasmodic closure* of the lids, and the cause is generally constitutional.

Inflammation of the eyelid results from injury or is a sequel of scarlatina, erysipelas, or other severe illness. Suppuration frequently occurs, and care must be taken to evacuate the pus before sloughing of the skin has taken place. These cases commonly do well.

In spasmodic *Entropion*, the cause, usually ophthalmia, must be dealt with; where this inversion of either eyelid is perma-

nent, the only remedy is excision of a small fold of the palpebral integument. Chronic *Ectropion* may be relieved in many instances by carefully planned plastic operations. Where eyelashes irritate the surface of the globe, they must be carefully extracted.

Hordeolum, or stye, is abscess on the margin of the tarsus : it must be treated by fomentations, and be punctured when ripe. *Tinea* and *Lippitudo* are terms applied to different conditions or stages of inflammation of the tarsal border, accompanied by ulceration at the roots of the eyelashes. Crusts form, and the bulbs of the lashes are destroyed. Cleanliness, astringent lotions, and the diluted citrine ointment constitute the local treatment.

Various *tumours* form in the eyelids ; such as cysts between the skin and tarsal cartilage : some of these are sebaceous, others are connected with the meibomian glands : they may be numerous : to be treated by incision through the thinned cartilage, and irritation, with a probe, of the interior of the sac, or by infriction of dilute citrine ointment. Small solid tumours in the same position may require removal from within. *Warts* may be snipped off, or destroyed with caustic. Nævi involving the eyelids require much care and judgment in treating. Nitric acid or nitrate of silver should be employed : the former in surface nævus ; the latter, fused and introduced on a probe, in cellular nævus. (See Vascular system — " Nævus.") *Cancer* may involve and destroy the eyelids and contiguous textures.

Wounds of the eyelids generally heal kindly, if the severed parts are carefully adjusted with fine sutures. *Ecchymosis* occurs readily in the loose tissue of the palpebræ, for which a poultice, mixed with an infusion of black bryony or the scraped root, is an efficient remedy.

Emphysema may occur as a consequence of communication being established, by violence, between the nose and the areolar tissue of the lids. It is of no importance.

Conjunctiva.—In inflammation of this membrane where it covers the eyeball, the vessels may be seen converging in a tortuous network towards the cornea ; and the colour thus

imparted is vermilion, by which they may be distinguished from the more uniform pink hue of the sclerotic vessels when injected.

Different forms of conjunctival inflammation or *Ophthalmia* are designated in accordance with their origin or actual condition. Thus it may arise from injury, and be either transient or lasting; it is then termed *traumatic*. A similar simple condition accompanies cold in the head, and is said to be *catarrhal* ophthalmia. These forms are characterised by increased secretion, a pricking sensation in the eye, and sensitiveness to light; the pain is sometimes acute. The local treatment consists in first soothing the eye by protection from light, and warm fomentations; a small blister behind the ear or to the temple; afterwards an astringent wash. This condition may degenerate or ripen into *purulent* ophthalmia, in which the membrane is folded around the cornea and secretes pus. The destructive form of disease may result from simple inflammation, from injury, or from the contact of poison, especially that of gonorrhœa. In purulent ophthalmia, the lids are red and swollen, so that it is often difficult to obtain a sight of the globe; the raised and deeply injected conjunctiva is folded over the border of the cornea, ulceration or sloughing of which is a probable consequence, and, of course, irretrievable loss of vision. A purge should be followed by occasional alteratives, combined with tonics and stimulants, as the patient may require or can bear them. The local treatment must be cleanliness, fomentation, frequent injection of alum wash—ten grains to the ounce —or of nitrate of silver one third of that strength. The prognosis in these cases is usually unfavorable.

Purulent ophthalmia occurs in *new-born children*, the result probably, in some cases, of contact with leucorrhœal or gonorrhœal matter. The eye should be frequently washed with a weak solution of alum—two or three grains to the ounce—and the child must be well nourished as long as chemosis or swelling of the conjunctiva around the cornea exists; solution of nitrate of silver ten grains to the ounce should be applied once or twice a day.

Strumous ophthalmia occurs in scrofulous children, and is

very intractable. There is great intolerance of light, copious lachrymation, and the cornea is often involved in the consequences of inflammation. The treatment should be tonic, with occasional alteratives. Locally, a shade, warm fomentations, some simple ointment to the margin of the tarsus, and occasional but careful application of tincture of iodine to the lids, or a blister on the temple.

In *pustular* ophthalmia, little vascular prominences are found most commonly at the margin of the cornea, on the horizontal meridian. They are not really pustules ; and require a simple astringent lotion, and tonic treatment, as in the strumous form without pustule.

Granular lids is a term applied to a condition of the conjunctiva in which the papillæ are inflamed and enlarged. Patients thus affected complain of the irritation, which is accompanied by lachrymation, and impaired vision from a hazy cornea. Treatment, tonic and alterative ; local application of nitrate of silver in the stick, properly prepared to remove its brittleness ; the employment of sulphur in powder or ointment to the interior of the lids.

Pterygium is a reddish hypertrophic growth of the conjunctiva and subjacent areolar tissue, extending slowly from the caruncle outwards, and narrowing as it approaches the cornea. It should be removed by dissecting it upwards from the sclerotic.

The conjunctiva is also liable to fatty tumours, nævus, and cancer of the epithelial and melanotic forms.

Injuries to the surface of the globe may be mechanical or chemical. Particles of grit or fragments of heated iron may be lodged between the lids and globe, or impacted in the conjunctiva or cornea. In the former case the upper lid should be exposed, by placing a probe upon it and everting it by the lashes ; a fine camel-hair pencil may be then used to cleanse the surface. In the latter, when a pointed body is fixed, a lancet or broad needle must be carefully used to dislodge it. Mineral acids, molten metal, or unslacked lime produce mischief ; but the chemical effect of the first and last is the most destructive : corneal opacity produced thereby is irrecoverable ;

the surgeon can only soothe. Continued injudicious use of nitrate of silver in solution leaves an indelible stain in the conjunctiva.

Cornea.—*Inflammation* of the cornea (*Keratitis*) is characterised by vascularity and loss of transparency ; there is also a zone of vessels around its margin : it is most common in early life, and less permanent in its effects on children. It may be simple, pustular, strumous, or syphilitic, and may be either chronic or acute. When chronic it is generally the result of local irritation, as inverted eyelashes, tinea, granular lids, and must be treated by the removal of the cause. Syphilitic keratitis may occur as an acute disease in adults, or its effects may be seen in the opaque interstitial corneal spots in children suffering from hereditary syphilis. Intolerance of light, severe pain, and lachrymation accompany the acuter forms of the attack. The treatment should be tonic with counter-irritation on the temple or behind the ear, nitrate of silver solution ten grains to the ounce in the earlier stage, or even the local application of calomel, and afterwards soothing applications to the eye. If interstitial suppuration and ulceration occur in this texture, permanent opacity follows ; the pus may be poured into the anterior chamber (*hypopyon*) or the cornea may be entirely perforated. This condition is usually accompanied by much pain ; the patient must be supported and the eye soothed and protected.

In *ulceration* of the cornea the destructive process is marked by a depression without opacity ; and this may be accompanied by inflammation in the neighbouring vascular tissues, or may be atrophic as seen in ill-nourished children. In reparation the edge of the ulcer becomes opaque, and fine vessels may be seen shooting into it : when healed, the edge of the opaque depression, if any exist, is smooth and rounded off. Escape of the aqueous humour and prolapse of the iris are consequences of perforation of the cornea by ulceration.

The cornea may be bulged (*staphyloma*) as the result of softening after or during inflammation, and the iris may be prolapsed and form a small projecting tumour, which is a source of constant irritation. It should be touched with nitrate of silver.

Little can be done to remove *opacities* of the cornea which have existed a long time and are well defined ; but an artificial pupil may be made when both eyes are obscured by partial corneal opacity.

The treatment of *wounds* of the cornea must be by rest and soothing remedies. Penetrating wounds may reach the lens and produce opacity ; or suppuration in the chambers may ensue. It may be necessary to remove the lens early when it has been injured and is likely to cause irritation in the globe : if suppuration occurs in the eyeball excise or abscise. The removal of *foreign bodies* sticking in the cornea requires great care, that its delicate tissue be not injured.

Conical cornea is a change (not inflammatory) affecting usually both eyes. It is irremediable by treatment, but may be palliated, as to its effects, by glasses. *Arcus senilis* is an opaque circle occupying the marginal circumference of the cornea, and appears to be an interstitial fatty degeneration, not affecting the sight.

The cornea is tapped with or without iridectomy for glaucoma, and may require to be tapped to relieve staphyloma.

Sclerotic.—Inflammation of this fibrous coat may be acute or chronic, and may be independent of, or coexist with, inflammation of other textures of the globe. The acute form is characterised by a diffused pink injection of the globe, becoming, however, more intense around the cornea : there is acute pain and great sensitiveness to light. When complicated, as is often the case, with rheumatism, the treatment must be influenced accordingly. Otherwise, alteratives, anodynes internally and locally, and an occasional blister and purge, are the proper remedies. In the chronic form, counter-irritation is more valuable, combined with tonics. *Staphyloma* is thinning and bulging of the sclerotic from pressure ; this may be partial or uniform, and the attenuated membrane assumes a leaden hue. This condition is indicative of disease of the globe, and therefore is not suitable for operation, except to remove deformity. The sclerotic may be wounded or ruptured by blow, in which case soothing and rest constitute the only treatment. Sometimes these injuries are complicated with serious or even fatal mischief to the iris or lens.

Eyeball.—*Tension* of the eyeball may be increased or diminished, and is determined by the feeling of resistance obtained in manipulation, and also by observing the degree of indentation and alteration of curve produced by pressure. Increase of tension is one of the characteristics of glaucoma, it is also present when the intra-ocular pressure has been increased by any cause, as effusion in traumatic cataract, iritis, choroiditis, &c. Decrease in tension is the result of diminution of the vascular supply, and is seen in cases where deposits of lymph, &c., have obliterated the vessels, as after long-continued choroido-iritis, especially of the syphilitic form.

The curves and densities of the transparent media (cornea, aqueous humour, lens and capsule, vitreous humour, retina) modify their refracting properties, and an alteration in these may give rise to abnormalities of *refraction ;* and, on the other hand, alteration in the curve of the retina by bulging or flattening of the sclerotic will equally interfere with the formation of a correct image. Thus, in a *myopic* or short-sighted eye, the retina is thrown too far back to receive the image of objects at a distance ; the parallel rays are not brought to a focus upon it. In the *hypermetropic* or far-sighted eye the retina lies too far forward. When parallel rays converge to their focus exactly upon the retina the eye is normal or *emmetropic.*

The curves, and perhaps the position of the lens, can, however, be modified by means of the ciliary muscle, so as to accommodate the eye to near as well as distant objects—to diverging and converging as well as parallel rays. Want of power in or control over these structures constitutes the abnormality known as *want of accommodation ;* and this condition is seen in paralysis of the ciliary muscle from over-use, from exhausting illness, special poisons (diphtheria), &c. For these the obvious treatment is rest and tonics.

Astigmatism, or the want of power to see points clearly—inability to bring the rays to a correct focus, but without interference to their transmission—is due to an abnormal state of the curves of the cornea. It is often inherited, and usually congenital. Too great convexity of the cornea brings parallel rays to a focus in front of the retina, and produces myopic astigmatism ;

too little convexity produces hypermetropic astigmatism. This defect of sight is remedied by the use of suitable glasses, and the degree of astigmatism is determined by ascertaining the power of the patient to distinguish parallel or concentric lines, and the kind of lens which most perfectly restores his clearness of sight.

The **ophthalmoscope** is constantly required for the examination of the interior of the eye, and the only instruments necessary are a perforated, slightly concave mirror and a convex lens. The reflector should possess a much smaller sight-hole than is usually made. In using the instrument care and practice are required to enable the observer to keep the fundus of the eye constantly in view. But it is not only the fundus which is to be examined with the instrument; the surface of the eye and the different transparent media are also to be examined, and this is readily effected by *lateral illumination*—light is thrown upon the different media by means of the reflector placed at the side of the eye. Lateral illumination should always precede examination of the fundus. It will detect abnormalities of the surface in the presence of irregularities, opacities, foreign bodies, &c., upon or in the cornea, in the aqueous chamber, capsule, lens, or vitreous, and will prevent errors which might otherwise occur in noting and explaining the appearances of the fundus.

In using the ophthalmoscope for the back of the eye, the convex lens may or may not be used. If used, it must be remembered that the appearance of things is reversed. The points of chief importance to be borne in mind in using the instrument are—(*a*) to have the patient's eyes on a level with the observer's, and the flame of a lamp on the same level by the side of, but rather behind, the patient; (*b*) to hold the reflector with the right hand about twelve to fifteen inches from the patient, and to keep the reflected light steadily thrown into the eye while looking through the sight hole; this is effected by practice, and the reddish glare which is seen in the patient's pupillary opening will indicate the steadiness of the illumination; (*c*) to hold with the left hand the convex lens obliquely in front of the eye, steadying it by means of the little finger placed upon the cheek or forehead, while the middle or ring finger is available for raising the lid or pressing upon the globe; the

distance of the convex lens from the front of the globe is determined by practice and by the power of the glasses used ; (*d*) to look into the eye in the direction of the entrance of the optic nerve ; this is effected by making the patient look slightly inwards, or by the surgeon carrying his own eye outwards while the patient looks straight before him.

Besides examining the optic disc, the rest of the fundus must be examined, and particularly the region of the "yellow spot" in the optic axis of the eye.

Care must be taken not to injure the eye by prolonged examination, and it is usually advisable to dilate the pupil previously by means of atropine.

Suppuration of the eyeball occurs as a consequence of injury or after operation for cataract, also after scarlatina, erysipelas, pyæmia, and is particularly liable to affect an eye which has been previously diseased.   It is to be treated as an ordinary abscess and incised ; the suffering of the patient demands prompt and thorough treatment.

Excision and *enucleation* of the eyeball is required if its vision be lost and sympathetic changes appear in the other eye ; also, for acute pain in a blind eye, for foreign bodies not otherwise removable, and for cancer.   The conjunctiva should be divided close around the margins of the cornea, and the muscles close to their insertion : the optic nerve must be cut through where it is about to perforate the sclerotic, the scissors being carried along close to the surface of the sclerotic. Free bleeding follows, and the orbit must be carefully plugged with lint and light pressure applied.

Abscission of the eyeball is the removal of the anterior portion of the globe, the section being made by the scissors through the sclerotic instead of through the optic nerve. The edges of the sclerotic are to be brought together by silk sutures and a good stump remains, which, if the insertions of the muscles have not been interfered with, is more capable of movement than the stump after excison.   An artificial eye may be adapted, and moves readily.   Abscission is particularly applicable in cases of staphyloma, when the sight has been destroyed.

Iris.—*Inflammation* of the iris (*iritis*) may be acute or

chronic ; and either form is influenced by syphilis, as well as by gouty and scrofulous temperaments. The remarkable tendency to fibrinous effusion demands special attention, particularly in the treatment of the acute form of the disease. In iritis, the colour of the affected part is changed, and a zone of sclerotic vessels around the margin of the cornea is always present ; the iris becomes sluggish in its movements ; and speedily patches of fibrin are deposited on its thickened border or its surface : there is increased sensitiveness to light, though not remarkably so. Such inflammation may be the consequence of wound or of cold, or be determined by a specific constitutional cause ; it may also be secondary to inflammation of other parts of the eye. Pain is often severe, especially in the rheumatic form or the disease. The syphilitic form is met with in the secondary stage of syphilis ; and in it the fibrinous deposit is rapid and abundant ; and organization, involving adhesions of the iris to the lens or cornea, speedily ensues if not checked : pain, especially at night, is severe. In all forms of acute iritis, dependence must be placed mainly on the action of mercury, but especially so in syphilis. The mouth must be affected, often rapidly, to save the eye. Combined with this treatment, general support may be afforded, and even tonics are necessary in feeble patients ; anodynes must be given at night to allay pain. The local treatment is leeching on the temple and counter-irritation. Belladonna should be applied around, or atropine dropped into, the eye ; some surgeons, however, disapprove of this application. Syphilitic iritis occurs oc- casionally in infants.

In cleft iris (*coloboma iridis*) the defect in development is usually seen at the lower margin of the pupil ; it is sometimes associated with a similar cleft in the choroid. A further error in development is seen in *irideremia* or absence of the iris ; also in persistence of the pupillary membrane and displacement of the pupil.

The iris may be injured, and blood be poured out into the anterior chamber, or it may be prolapsed through a wound in the cornea. Concussion of the iris by blows, &c., may pro- duce dilatation of the pupil (*mydriasis*) or dislocation of the iris.

Abnormal *dilatation* of the pupil may also arise from paralysis of the third nerve or from irritation of the sympathetic, and accompanies glaucoma, injuries, hæmorrhage into the brain, hydrocephalus, and certain special poisons of the Belladonna type. Abnormal *contraction* of the pupil is sometimes associated with cerebral or spinal disease especially of the irritative character, paralysis of the sympathetic from morbid changes about the medulla oblongata, or pressure upon the cervical sympathetic by enlarged tonsils, aneurism, &c. It is also the consequence of over-sensibility of the retina from continued or close work, and is produced by poisons of the opium type. Atropine or morphia counteracts these two opposed conditions, but the cause of the abnormal state should be ascertained and removed.

Tremulous iris is seen when the iris loses the support of the lens, or when the posterior aqueous chamber is enlarged, or the vitreous abnormally fluid.

Abnormalities in *form* and *colour* may be congenital or be the result of inflammatory exudations.

In *closure* of the pupil, after iritis or in central corneal opacity, it may be requisite to make an *artificial pupil*, by drawing a small portion of the iris through an opening at the margin of the cornea, and snipping it off.

The **Choroid** is liable to defects of development, and is often inflamed in company with the iris, the two structures being continuous. It is also associated with retinitis. *Choroiditis* is often syphilitic, in which case it may be general, or partial, or scattered, and accordingly we are able to find numerous small or few larger patches of opaque lymph as the result of it : if the optic disc and retina be affected at the same time the disc is ill-defined and the retina opaque. These appearances are discovered by means of the ophthalmoscope, but it is not usually possible or justifiable to examine the fundus during the acute stages of the inflammation. In simple choroiditis there is less tendency to the deposit of exudation material, and the inflammation is more general. The symptoms are pain in and around the eye, intolerance of light, sclerotic vascularity, and sometimes iritis ; misty vision, muscæ and flashes are complained of

particularly when the optic nerve and retina are involved. After subsidence of syphilitic choroiditis in particular, patches of pigmentation can be commonly detected, and often interspersed with white patches, which are due to the sclerotic showing through spots of atrophied choroid.

The choroid may be *displaced* by clot or tumour, and with it the retina; and tubercle may be developed in the form of miliary granulations in it.

Glaucoma is the term applied to a series of morbid changes in the eye, the most important of which is an increase in the tension of the eyeball; but what the cause of this increased tension is has not been determined. Chronic glaucoma is more common than acute; in the latter the attacks of inflammation are infrequent and not so acute as in acute glaucoma, and they are sometimes so slight as to cause only temporary dimness of vision. The earliest symptom is increased tension of the eyeball, and this tension is still further increased during an acute attack of inflammation; the eyeball becomes more globular, the conjunctiva subsequently sodden or ecchymosed; the sclerotic in acute glaucoma is injected especially around the margin of the cornea; the cornea becomes anæsthetic, and the iris less movable and usually contracted. Examined with the ophthalmoscope the choroid may be seen to be the seat of hæmorrhage, anæmia, atrophy, or staphyloma, according to the extent to which the disease has progressed. The lens is not necessarily altered in character, but the vitreous is generally firmer than normal, and of a yellowish or greenish tint in chronic glaucoma, while it is more often normal in consistence, but containing spots of extravasation in the acute forms of the disease. In the retina hæmorrhages or their consequences may be found, and the optic disc becomes cupped, a condition which is determined by tracing the course of the vessels; the disc is generally somewhat anæmic, and surrounded by a narrow whitish ill-defined ring.

Glaucoma occurs most frequently between the ages of fifty and sixty; and the acute attacks of inflammation are attended with severe intra-orbital pain, which comes on suddenly without any obvious cause.

The treatment should be by early operation for the relief of the tension. Iridectomy is to be performed so long as there is perception of light, or even for some days after it has been lost in acute glaucoma.

Retina.—Inflammation of the retina (*retinitis*) is more often associated with general disorders, as syphilis, albuminuria, &c., than idiopathic, and it is not uncommonly found to be the consequence of cerebral disease, as apoplexy and tumours. It may affect the region of the optic disc or other part of the fundus, and it may be secondary to inflammation of the neighbouring tissues. Intolerance of light and impairment of vision commonly occur, and the lids may be swollen and inflamed, but the symptoms naturally vary with the intenseness and extent of the inflammation. During the acute stage the eye cannot be examined with the ophthalmoscope, but when the inflammation has subsided an examination will frequently detect changes in the vessels of the fundus, in the appearance of the optic disc, and in the character of the fundus itself. The veins are usually seen to be gorged and the arteries usually scanty and hidden by the swollen retina; the optic disc is blurred at its edges, and its colour is at first a reddish yellow; and the fundus may exhibit patches of extravasation, fibrin, or pigment. The essential treatment is by rest, and atropia to prevent adhesions of the iris occurring in a position likely to interfere subsequently with vision; attention must, of course, be given to any constitutional causes of the disease.

Amblyopia is a term employed to signify dulness of vision due to morbid changes in the retina, and *amaurosis* to total loss of sight from the same cause or from disease of the brain or optic nerve.

Atrophy of the optic disc and retina is common in albuminuria and after disease in this membrane or in the brain. It is indicated by a peculiarly white condition of the disc and the vessels are usually seen to be contracted and scanty, and sometimes with aneurismal dilatations. The treatment for such a condition is necessarily unsatisfactory.

In medullary cancer of the retina, this membrane first appears injected, and then exhibits a yellow deposit which gradually

accumulates and advances, until the lens, and subsequently the cornea, becomes opaque : the pressure from behind protrudes the sclerotic, and is accompanied by much pain ; the anterior wall of the globe then gives way, and permits the escape of the humours, a soft and vascular growth subsequently protruding from the orifice. Profuse discharge and frequent bleeding ultimately destroy the patient. This form of cancer is almost confined to children : the melanotic form occasionally occurs at a later period of life. The eye may be destroyed in a similar way by scrofulous deposit ; but this is not fatal to life. Extirpation of the globe for cancer is, at least, as questionable a proceeding as other operations for cancer of an unequivocal character in other organs or parts ; it is at best a most uncertain remedy.

The **Vitreous humour** may exhibit *anomalies in consistence* and be too firm or too fluid : the too firm variety is more often found in the glaucomatous eye, and the too fluid where the nutrition of the vitreous has been interfered with, as in atrophy of the choroid, hæmorrhage into the vitreous, and in glaucoma where the tension has been below par. Tremulous iris is sometimes associated with a fluid condition of the vitreous, and occasionally the lens floats freely in the fluid vitreous humour. *Muscæ* are small beaded filaments floating in the vitreous, which are reflected upon the retina, and are generally observed by myopic persons ; they are of but little consequence, though often troublesome. *Opacities* are seen by an observer by means of the ophthalmoscope and lateral illumination. The vitreous is sometimes the seat of *hæmorrhagic effusion, and of cysticercus :* among the remedies which have been found of use in the removal of blood iridectomy has been recommended, or the long-continued use of atropia. In chronic glaucoma the vitreous becomes firm and of a yellowish colour ; in acute glaucoma its consistence is usually normal, but blood clots are found on it.

The **lens** may be examined by reflected light or by the ophthalmoscope, and the former should be used in all cases while it is possible. Sometimes irregularities in outline are congenital. It may be *injured* by perforation, and such a form of injury may be followed by severe irritation to the rest of the

globe, and opacity of the lens must be expected. It may be *displaced* by injury, and may then act as a foreign body and produce irritation.

Presbyopia (aged sight or far sightedness) is the result of a senile change in the lens by which it becomes firmer and less elastic; consequently the ciliary muscle is unable to compress it so as to accommodate it for sight at short distances. Presbyopics therefore hold objects at long distances. When the nearest point of distinct vision exceeds eight inches from the eye a person is considered to be presbyopic. Spectacles with convex lenses supply the want felt by this defect.

Cataract is the term applied to the change resulting in loss of transparency in the lens. The pathology of this change is degeneration of some form—usually fatty, sometimes calcareous—of the substances of the lens. This degeneration commences at the circumference in senile and traumatic cataract, but in congenital it is more commonly central. *Hard* and *soft* cataracts are merely evidences of different degrees of degeneration, and are often associated. In the ordinary soft cataract the fibres lose their distinctness of outline, become filled with molecular and oily matter, and separate from one another; the lens swells at first, and by swelling may cause irritation. Subsequently the opaque fluid which results from the degeneration may become absorbed, or may be removed by operation. The nucleus in old people is generally amber-coloured and flat or slightly biconvex. The opacity commences with opaque striæ at the margin of the lens, which radiate towards the centre and indicate the original arrangement of the fibres of the lens. Sometimes the colour of the opaque lens is dark brown. Hard cataract may be the result of a primary or secondary change; it may follow or be followed by soft cataract. It generally occurs in the nucleus, and may remain as a central opacity in congenital cataract for years without discovery. It is calcareous in nature and if interfering with sight must be removed.

The best mode of examining for cataract is by lateral illumination, the pupil being dilated with atropine. When the presence of cataract has been determined, then examine the

condition of the retina and of the rest of the globe, by testing the sensibility of the retina, observing the choroid and optic disc through the less opaque portions of the cataract. Attention should be paid to the existence of large and numerous vessels in the sclerotic just beyond the margin of the cornea, which commonly indicate some diseased state of the circulation in the globe, and frequently glaucoma. The depth of the anterior chamber should be observed, the iris examined for tremulousness, and the shape of the eye noted.

Cataract may be caused by injury or by altered nutrition, as from old-age or after choroido-iritis (secondary cataract), and hæmatin may be deposited in the substance of the lens and produce a green or black form of opacity. Cataract is a not uncommon symptom of long standing diabetes; the congenital variety is not infrequently found associated with hereditary syphilis.

Operation for cataract.—Cataract may be removed by various means, but it is advisable not to interfere with it while one eye is unaffected or useful, or unless the presence of the cataractous lens is a source of irritation to the eye. Care should be taken that the health of the patient is good at the time of operation, that cough is not likely to interfere with its success, and that other surrounding circumstances are favorable. It is not advisable to operate upon both eyes at one time.

Couching or depression is now rarely practised.

Extraction may be effected by transfixing the cornea and making a flap of the upper half of it, the capsule of the lens being torn by needles (cystotomes) sufficiently to allow of the subsequent escape of the lens, which escape is effected by manipulation or by an instrument (the scoop). Graefe introduced a modification in which the cornea was incised to a very limited extent, and an iridectomy performed before the removal of the lens. Liebreich has recently advocated the transfixion of the cornea, cutting out through it half way between the horizontal meridian and lower edge, and removing the lens by manipulation; by this means excellent results are obtained without the deformity which necessarily attends Graefe's operation.*

* Vide ' St. Thomas's Hospital Reports.' New Series. Vol. II.

Suction has been made use of by means of a suction syringe to empty the fluid contents of a capsule.

It may happen that during the operation the aqueous humour escapes too soon, in which case the iris may be wounded. If the iris be bulged by aqueous humour retained behind adhesions to the capsule (synechia posterior), perform iridectomy; if the lens will not escape it may be necessary to use the needles more freely. Vitreous humour may escape during the operation and the eye partially collapse, but it may recover itself; this accident occurs more frequently after the use of the scoop.

The treatment after operation is to cover the eyes with dry or wet linen, and use light pressure by means of a pad of cotton wool under a Liebreich's bandage.

The dangers afterwards are from prolapse of the iris, iritis, and suppuration in the globe.

Opaque capsule not infrequently follows the removal of cataract, but may occur without that operation. In the former case the shreds of capsule may require to be removed by means of a fine pair of canula forceps. When opacity of the capsule occurs without previous operation for cataract it may be necessary to perforate. *Adhesions* may take place, as the result of iritis, between the iris and capsule (synechia posterior), and for this it may be necessary to make an artificial pupil when such adhesions obstruct the sight to any great extent. Synechia anterior is where adhesions have taken place between the iris and the cornea.

When the lens is displaced into the anterior chamber it need not be interfered with, if it remain transparent and does not cause irritation; otherwise it should be removed.

With injury to the lens examine carefully for foreign bodies with the ophthalmoscope; and when the lens becomes opaque after injury remove as in ordinary cataract.

DISEASES AND INJURIES OF THE NECK.

Tumours of various kinds occur in the neck, beneath the chin, or in the parotid region. They may be fatty, fibrous, or glandular growths. These must be distinguished from malignant tumours, which it is rarely justifiable to meddle with in these localities. Fibrous tumours are found in connection with pre-existing fibrous tissue : fatty are usually seen on the nape of the neck ; glandular tumours may be single or multiple and are connected with pre-existing glands. When the latter are growing rapidly attention must be given to the occurrence of similar growths elsewhere, and to their connection with the anterior mediastinum. Such growths (lymphomata, lymphadenomata) may terminate fatally by pressure upon the recurrent laryngeal nerve or larynx, by extension of disease into the lungs, &c. Fibrous or fatty growths may be safely removed, but great care is required in the necessary dissection. The parotid gland is rarely diseased, though morbid growth occasionally occurs in its neighbourhood or even interior, and causes displacement or absorption of its texture. The depth to which such tumours may extend renders their removal hazardous. Cysts are rare.

Abscess of the neck, when deep, often assumes large proportions, and is attended with much suffering and constitutional disturbance, in consequence of the density of the superficial tissues. Such abscesses ought, therefore, to be opened as early as fluctuation is perceived, to prevent the matter from burrowing.

The THYROID BODY is the subject of *hypertrophy* termed bronchocele, which is usually solid, and moves, in deglutition, with the larynx. The great vascularity of this texture forbids surgical interference by operation : ligature of the supplying arteries has been proved to be useless. When moderate in size, the influence of iodine, both locally and internally, is often sufficient to arrest the growth, and even reduce considerably the size, of the morbidly enlarged mass. No suffering attends its growth, unless the mechanical inconvenience interfere with respiration. It is common in certain districts, and is sometimes

associated with cretinism. *Cysts* in the thyroid are not infrequent. If punctured, the fluid again accumulates, and such cysts sometimes attain a large size ; suppuration may be induced by a seton or the introduction of a piece of lint ; sometimes these cysts suppurate spontaneously. The body of the thyroid is rarely the seat of suppuration.

Aneurysm in the neck is rare ; but the carotid artery may require a ligature for aneurysm by anastomosis of the orbit ; and it has also been tied for a similar disease affecting the scalp. This operation has been more often performed for hæmorrhage, in wounds involving the trunk or branches of this vessel. Such injuries may be deep and penetrating, or from incised wounds as in attempted suicide : in the latter case, the proper course to pursue is to seek for and tie the divided branch or branches, probably the thyroid, lingual or facial. In deep, penetrating wounds high in the neck, accompanied by profuse arterial hæmorrhage, it is safer to tie the carotid lower down, as it is impossible to ascertain whether the blood proceeds from either of the main branches or from the divisions of the external branch. In wound of the trunk, lower down, the seat of injury must be exposed, and a ligature applied above and below it.

Cut-throat, in attempted suicide, may be confined to the superficial textures, in consequence of the incision being made over the cartilages of the larynx. But the air-tube may be laid open at any part of its course through the neck, though the large vessels are rarely implicated. The wound may be above the thyroid cartilage, or between it and the cricoid ; rarely lower down ; the cartilages are sometimes jagged and partially divided. When the wound is long, the extremities may be held together with suture ; but no attempt should be made to close the centre, except by position of the head, for the injury must heal by granulation ; and suffocation, from accumulated secretion or clot, may be the consequence of an attempt to keep the wound closed. When the bleeding has ceased, the patient should be placed with the head raised, so as to approximate the chin to the chest ; and the front of the neck should be protected with some loose covering, so as to raise the temperature of the air inspired through the artificial opening :

for patients in this condition often die of bronchitis. The parts should be frequently cleansed, and, if necessary, food must be conveyed to the stomach through a tube. No further dressing is required until the breathing is natural; at a later period, care is essential to procure union between the severed parts.

Œdema of the glottis is usually so insidious and rapid as to afford no opportunity for surgical relief. The treatment would be tracheotomy. Laryngitis, or ulceration of the larynx from syphilis or other causes, also frequently demands this operation; and it is the readiest method of disengaging foreign bodies which may have lodged in the air-tubes, by quieting the irritability of the glottis, and presenting an artificial aperture by which the patient may respire. It may likewise be needed for obstructed respiration resulting from scalding or similar injury to the fauces, involving the glottis.

Laryngotomy is performed by opening transversely the crico-thyroid membrane: it is a simple operation, but is rarely to be preferred to tracheotomy, as the latter operation affords more room, and is further removed from probable disease for which it is practised. The former is more rapidly performed, and therefore more suitable for sudden emergency.

In *tracheotomy* the patient may either sit or lie, with the head moderately thrown back. The incision must be accurately in the median line, extending for an inch and a half from the cricoid cartilage downwards. The edges of the sterno-thyroid muscles must be carefully separated, and the isthmus of the thyroid body drawn upwards, if in the way. When the rings of the trachea are exposed, if admissible, time should be allowed for bleeding to cease, before it is opened; but venous distension subsides as soon as free respiration is restored. It should then be fixed with a small hook, and punctured transversely with the scalpel, a blunt-pointed bistoury being subsequently used to divide two rings from below upwards; or the scalpel may be employed throughout: in which case care is required not to push it abruptly or deeply into the tube. The canula should be immediately introduced on a pilot blunt trochar. It must be fixed in its position, and kept clear by the occasional

introduction of a feather, which must be used cautiously. A double canula is preferable, but the inner tube should move easily within the outer.

The presence of a **foreign body** in the air-passages may be generally ascertained from the history of the case, and the physical signs in auscultation and percussion. The amount of irritation varies as the body changes its position, and a sense of impending suffocation may be succeeded by a comparative calm. With the lapse of time the symptoms become more urgent; or the body may become fixed in one or other bronchus, more often the right. Distressing cough and expectoration ensue, and a fatal result may be anticipated as almost certain, sooner or later. By tracheotomy alone, in many instances, the patient has been enabled to eject the foreign body by the mouth; this operation renders the rima less irritable, and permits respiration more easily when the extraneous body is thrown upon the chink of the glottis. If this fail it must be sought for, and, if possible, extracted with suitable forceps.

The œsophagus is sometimes the seat of *stricture*. This may arise from malignant growth, usually epithelioma, sometimes scirrhus. If simple, and at an early stage, the bougie is employed with advantage. At a later period, little can be done. Masses of solid food may lodge in the pharynx and produce serious, if not fatal result, and the œsophagus may be dilated above the stricture. An emetic, if fluid will pass, or stimulating the fauces, will aid in its rejection. When a stricture becomes impassable, even for liquid food, the stomach may be opened in the left hypochondrium, and life prolonged. This operation has usually been postponed until too late to be of real service. *Foreign bodies* have sometimes been intentionally lodged in the pharynx, and extracted with difficulty. Fragments of bone or other hard matter may lodge lower down, in the œsophagus, and be displaced by the passage of a bougie or probang. Pins or other small sharp bodies may lodge in the pharynx and be reached with the finger, and removed by it, or with forceps. The only cases in which œsophagotomy would be justifiable, are those in which a foreign body cannot be moved within it, and gives rise to serious disturbance: the

prominence of such offending body would then be the guide for the operator.

INJURIES AND DISEASES OF THE VISCERA OF THE CHEST.

Penetrating *wounds* of the lung, by ball or otherwise, may prove fatal from hæmorrhage or suffocation; or pneumonia may subsequently destroy life; but recovery not infrequently occurs. Wounds of the heart are generally, but not necessarily, immediately fatal: they have been recovered from. **Tapping** the chest for distension of the pleura with fluid is sometimes required. In such cases the affected side is more distended and the intercostal spaces bulge. The trochar should be introduced as low as possible, *i. e.*, between the seventh and eighth ribs, and near the angle of the scapula, avoiding the latissimus dorsi muscle. The elevation of the diaphragm on the right side should be remembered. The patient should sit, if possible, and the trochar be passed in close to the lower rib. The fluid should be withdrawn slowly, and precaution adopted to avoid the admission of air by tying a piece of gutta-percha tissue or goldbeater's skin over the mouth of the canula so as to form a self-acting valve: or the canula may be made to drain under water through an india-rubber tube. This operation will probably require repetition. The presence of air in the pleura is indicated by increased resonance on percussion, with absence of respiratory murmur. When it accumulates by extravasation from a wound in the lung, this organ becomes gradually compressed, until finally air ceases altogether to enter it. The symptoms at this critical period are urgent, and suggest the propriety of tapping to withdraw the air from the pleural cavity. Such interference, however, is rarely needed; for, as soon as air ceases to enter the lung, the lacerated opening is closed by plastic effusion, and further escape is arrested; the lung resuming its function, as the extravasated air is absorbed. For further remarks, see the author's 'Lectures on the Diagnosis of Visceral Lesions,' No. VIII. (See also "Fractures of the Sternum and Ribs.")

INJURIES AND DISEASES OF THE VISCERA OF ABDOMEN.

The abdominal viscera are liable to **injury** from contusions or a fall, as well as from penetrating or incised wounds. Collapse, which is usual in such cases, may be the consequence of simple shock, of hæmorrhage, or of actual lesion, from rupture or other wound of the liver, kidney, spleen, or some portion of the membranous viscera. Under such circumstances the treatment can be only expectant. Restore warmth ; avoid stimulants as far as possible ; watch for reaction ; empty the bladder ; and give an anodyne when reaction is coming on. Endeavour to obtain perfect rest for the intestines from peristaltic action until the injured parts shall have had time to recover themselves. Peritonitis may ensue as a consequence of contusion or of visceral lesion ; and it may result also from wounds which only open the peritoneal cavity. In wound of a membranous viscus, it is best, under ordinary circumstances, to leave nature to her own resources. Certainly the viscera should not be disturbed or drawn out to search for a suspected wound ; if an intestinal lesion present itself at a wound in the parietes, it would be expedient to close the opening in the bowel with a fine suture before dressing the external wound. The symptoms which indicate these injuries are often vague : sometimes the injured viscus may present at an external wound ; but frequently a small surface bruise or graize may coincide with a severe internal injury. Observe carefully the cause, the extent of collapse, the presence and position of abdominal tenderness, the occurrence of peritonitis, jaundice, and disturbance of visceral functions.

Abscess in the abdominal parietes should be opened early. *Abscess of the iliac fossa* may be acute or chronic ; it is more frequent on the right side, and usually caused by hardened fæces in the caput coli, or by some other source of local irritation, exciting inflammation in the cellular tissue beneath the colon. It may also arise from the ulceration of the cæcum occurring in typhoid fever, dysentery, and tubercle. This may open spon-

taneously into the colon, bladder, vagina, or externally. It is occasionally a sequence of parturition. A fæcal odour from an abscess of the iliac fossa or of the immediate neighbourhood of the intestines is not necessarily an indication of perforation of the intestines. Treat by fomentation, gentle laxative medicines, and general support; open as soon as the abscess points.

Ulceration of the appendix vermiformis of the cæcum occasionally results from mechanical irritation as from the intrusion of some irritating matter; and is likely to prove fatal from consequent extravasation of the intestinal contents.

Abscess in the liver may point and require opening in the right hypochondrium or epigastrium. In opening a hydatid cyst in the liver, it is well to secure adhesion between the walls of the cyst and the abdominal parietes, if such do not exist. This may be accomplished by producing a slough with caustic potash, subsequently introducing a trochar. Abscess in the pelvis and in the neighbourhood of the inguinal and femoral canals may be mistaken for hernia.

The operation of *tapping*, for ascites, or for ovarian dropsy, is to be performed by making a short incision in the median line, midway between the umbilicus and pubes, down the linea alba, and then introducing a trochar and canula : the abdomen should be compressed with a jack towel, whilst the fluid is escaping; and afterwards a flannel bandage should be firmly applied. The contents of an ovarian cyst may be albumenoid or even gelatinous in consistence ; this cannot be ascertained before operating. The character of the fluid removed will usually indicate its ovarian or peritoneal origin. If ovarian, it is generally of high specific gravity, often grumous, and sometimes too gelatinous to flow through the canula. If peritoneal it is clear, limpid and straw coloured. Where doubt exists previous to operation it may be determined by cutting carefully through the skin, and observing whether a cyst wall presents itself before the escape of the fluid ; ascites may, however, be combined with ovarian dropsy. Occasionally where the abdomen is much distended a redness with œdema appears near the umbilicus : this is a warning not to delay operation. Excision of an ovarian

cyst is now an adopted operation in surgery, and merits this position from the frequent success which has attended it. A limited incision below the umbilicus, when practicable, and the use of a clamp to strangulate the peduncle of cyst, are now generally insisted on, in performing this operation.

Hernia.—The term Hernia is generally restricted to the abdomen, though applicable to the protrusion of any viscus from its natural cavity. Abdominal hernia may occur either at the natural apertures, or at openings resulting from defective formation or injury : the former class includes inguinal, femoral and umbilical ; to which may be added the very rare forms of thyroid, gluteal and phrenic : the latter class comprises direct inguinal, ventral, and, though very rarely, phrenic, perineal and vaginal. The usual varieties of hernia met with are, therefore, oblique inguinal, femoral (or crural), and umbilical.

The ordinary *contents* of a hernial sac are, small intestine, omentum, or both : the large intestine, the stomach, bladder or ovaries have been found in a hernial sac, but very rarely.

A hernia may be either reducible, irreducible, or strangulated. A *reducible* hernia presents itself as a soft and usually oval tumour, increasing in size and tension under exertion, such as coughing, and at the same time conveying an impulse to the hand ; but generally disappearing spontaneously when the recumbent posture is assumed. A suitable truss is the proper protection in this form of rupture ; and the suitableness of such support depends on the adapted strength of the spring, its length and form, and the size and consistence of the pad.

Operation is sometimes resorted to where the inguinal ring is so large as to prevent a truss being successfully applied, and where the size of the hernia, though reducible, is such as to be a constant and unbearable annoyance to the patient. The operation consists in bringing the two pillars of the ring together by means of a wire or catgut suture, and a portion of the scrotum may be invaginated. The operation may be performed subcutaneously ; care must be taken not to include the vas deferens in the ligature.

A hernia may be simply *irreducible*, without strangulation, in consequence of its size, or of adhesions within the sac, or of

the presence of thickened omentum. If permanently irre-
ducible, such rupture must be supported by a suspensory bandage
or truss, with a concave pad of suitable dimensions. Operation
for its relief is very rarely justifiable.

A *strangulated* hernia may be of small or large size, but the
symptoms are little influenced by its magnitude. The charac-
teristic signs of strangulation are local and general. The local
symptoms are the presence of a tumour, more or less tense and
tender, in a position where rupture may occur, with pain ex-
tending over the abdomen, and especially in the umbilical or
epigastric region.   The general symptoms are, obstructed
bowels (usually), nausea or sickness ; and, in a more advanced
stage, stercoraceous vomiting, hiccup, general abdominal tender-
ness and distension, with a quick, sharp pulse, hot skin, restless-
ness, and an anxious countenance. Cessation of local tenderness
and collapse mark the still later stage of mortification of the
contents of the sac. The local signs may resemble abscess, in-
flamed glands, malignant tumour, inflamed hydrocele of the
cord, or undescended testicle ; the general symptoms are like-
wise indicative of intus-susception, or of mechanical obstruction
from internal strangulation, from the presence of malignant
tumour, or from impacted fæces. The presence of both local
and general symptoms, together with the history, rarely leaves
room for doubt.

The *taxis* should be first attempted, by flexing the thigh,
and making firm but gentle pressure on the tumour, whilst the
forefinger and thumb of the free hand grasp the neck of the sac
so as to direct the rupture in its proper course : violence is in-
admissible ; and the continuance of this manipulation must be
determined by circumstances. Gentle, uninterrupted pressure
will sometimes empty the intestine, which is indicated by a
gurgling sensation ; this often precedes the reduction. A lesson
may often be learned by directing a patient to attempt the re-
turn of an old hernia, when strangulated. Sometimes a rup-
ture may be reduced by elevating a patient's thighs and pelvis,
and thus compelling its return by the gravitation and traction
of the viscera within the abdomen. If these means fail, warm-

bath or chloroform *may* be tried, but they rarely succeed, and have the disadvantage often of inducing sickness, and suscepti-bility to cold from subsequent exposure. More confidence may be placed in the continuous application of ice to the tumour, which acts as a powerful astringent ; but this is not always admissible : a full injection of warm water sometimes accom-plishes the desired relief ; and the same effect has followed the diligent use of the hot fomentations. An operation should not be delayed ; it is far better to operate early, where there is doubt, than to subject the patient to the extra risk of delay : ill suc-cess rarely attends the former error, if such it be, but frequently the latter.

Inguinal hernia may be either oblique, direct, or con-genital. It is more common than femoral in the male, because the inguinal ring is larger, and less protected than in the female. In the *oblique* form, the rupture descends through the inguinal canal in the course of the cord ; in the *direct*, it bursts directly through the external ring : in *congenital*, the internal ring remain-ing open, the intestine is contained in the vaginal tunic of the testicle, and the testicle instead of being below and behind is above and behind : in *infantile*, the hernial sac is pushed into the interior of an abnormally large tunica vaginalis. In the two former the sac of the rupture is a prolongation of peritoneum : the other coverings vary considerably in thickness and divisibility, according to circumstances ; and their anatomical description is therefore not to be followed and relied on in actual practice, though valuable as a guide to the operator.

Oblique inguinal hernia may be limited to the inguinal canal, or may descend into and distend the scrotum in the male, or labium in the female. In the male, the presence of enlarged glands, varicocele, hydrocele, or any tumour of the cord, may be mistaken for inguinal rupture ; but the continuity of the neck of the tumour with the abdomen, the impulse on coughing, the retention of the tumour, when returned, by plugging the ring, together with the history, can scarcely leave a doubt, unless in very exceptional and obscure cases. The only satis-factory method of determining the nature of an irreducible hernia, whether it be inguinal or femoral, is to distinguish between the

fundus and neck of the tumour, and trace the latter to the point where it is lost, whether above or below Poupart's ligament : careful examination rarely fails to lead to a correct discrimination.

Direct inguinal hernia is comparatively rare, and the consequence usually of violence. The relation of the neck of the sac to the epigastric vessels in these two forms is important : in the oblique, the vessels are internal ; in the direct, external, to the usual seat of stricture. Congenital hernia is usually not characterised by peculiarities of practical importance : its sac is the vaginal tunic of the testicle, the anterior loose portion of which it occupies ; orchitis is therefore a not uncommon sequel of operation for its relief.

Distinction between inguinal hernia and other tumours. Inflamed glands are generally the result of some peripheral irritation : they are not usually attended by the constitutional symptoms of strangulated hernia, and are amenable to local treatment and rest. In cases of doubt, however, operate as for hernia. Inflamed sac, when suppuration has occurred, requires opening, and search should be made for any knuckle of intestine. In the early stages of inflammation, there would not usually be interference with the action of the bowels, but in the later stages it may closely resemble strangulated hernia. Malignant tumour of the cord, or hydrocele of the cord are associated with a history of their gradual growth ; there is usually no history of obstruction ; and on pulling the cord the tumour is moved with it ; in the case of malignant tumour manipulation may assist in determining the solid character of the tumour. Undescended testicle would be evidenced by the absence of the testicle from the scrotum and by the peculiar pain on pressure. In all these cases there would be no impulse on coughing, but this sign is also absent in irreducible omental hernia, and in all forms of strangulated rupture.

Femoral hernia is more common in the female, because the crural arch is wider, and the inguinal ring is smaller. It descends between Gimbernat's ligament, the femoral vein, Poupart's ligament, and the pubes. This rupture may be limited to the crural space below the ligament, and then it is

readily distinguishable ; if it extend further, it ascends upwards and inwards over Poupart's ligament, occupying the inguinal region : it may then be distinguished from the inguinal form, by the position of the neck or more fixed portion of the tumour. The spine of the pubes will assist in determining between femoral and inguinal hernia ; it can be felt internal to a femoral and external to an inguinal hernia which has descended rather low down.

Umbilical hernia is not infrequent in children, rare in the adult male, but more common in females, especially those who are stout. The rupture protrudes through the umbilical opening, and often attains a great size : under these circumstances the superjacent skin becomes at parts attenuated, and the fat absorbed. Such ruptures usually contain omentum and small intestine, sometimes colon, very rarely stomach. They may be irreducible, and then require careful support. In children this form of rupture may be cured by diligent support with a properly fitted pad.

Ventral hernia may occur at any part of the abdominal parietes, but most commonly in or near to the linea alba. *Thyroid* or obturator hernia protrudes through the obturator foramen of the pelvis. *Ischiatic* or gluteal hernia escapes by the great ischiatic foramen. *Vaginal* hernia descends between the uterus and bladder or uterus and rectum. In the *Perineal* form the descent is between the bladder and rectum in the male, between the vagina and rectum in the female ; but any of these latter forms of rupture are rarely met with in practice. *Phrenic* or diaphragmatic hernia is the result of rupture of the diaphragm permitting some portion of the abdominal contents to intrude into the chest.

Operations for strangulated hernia.—Operation for the relief of strangulation should not be delayed, after the means referred to have been fairly tried, without effect : and this remark will be found generally applicable, even when the symptoms are not apparently urgent, or some of them are absent ; as where an ordinarily reducible rupture resists the taxis, and the patient is suffering from obstructed bowels and some other local or general symptoms associated with the rupture. It must be,

further, remembered, that the lower bowel may be relieved of its contents by injection or even spontaneously, whilst strangulation higher up exists. It is better not to administer chloroform, as it is likely to induce sickness in the susceptible state of the stomach. A simple incision is generally sufficient, and this need not, in most cases, exceed from two to three inches in extent. When a rupture is large, as in the scrotal or umbilical, the incision should be over the neck of the sac. If convenient, the skin may be nipped between the finger and thumb, and perforated with a narrow bistoury. The dissection should be carefully conducted and bleeding arteries twisted or tied. The anatomical description of the coverings cannot be relied on, for they may be thickened, thinned, or absorbed, or fat or fluid may be deposited between them. Fat must not be mistaken for omentum. The sac is sometimes recognisable by its irregularly arranged vessels, and it is often possible to feel the intestine underneath. When the sac is reached it should be nipped between the finger and thumb, and if gently rolled, the intestine will probably be felt to slip from the pressure ; then a light touch with the knife will open the sac sufficiently to introduce a director, on which it may be farther slit up. If a jet of fluid escapes it is a sure indication of the sac having been opened. But the sac and its contents may be adherent ; and fluid is not constant within the former. If the tension do not permit of the manipulation described, a small opening may be cautiously scratched in the sac, and its perforation is generally indicated by the escape of fluid, or at least a moist exudation. As regards operating without opening the sac, it should be the exception to the rule : the most fitting cases for this operation are recent cases of femoral hernia. The increased risk of opening the sac is much magnified ; and the advantages of doing so are, that the nature and condition of the contents are ascertained and satisfactorily dealt with : moreover, the inflammatory exudation from the interior finds a ready exit, instead of being retained. Always examine the condition of the intestine at the seat of strangulation after opening the sac.

The *condition* of a hernial protrusion varies according to the length of time it has been strangulated, and the degree of con-

striction to which it has been subjected. Omentum may be congested, inflamed, or gangrenous : intestine may be the same, or may be tympanitic, ulcerated, or thickened. Discoloration of intestine may vary from slight injection to a deep claret hue ; and this may degenerate into a livid, leaden or ashy tint, which, together with diminished lustre and temperature, betokens an irrecoverable condition. Either intestine or omentum may be adherent to the sac.

Omentum is often found in hernial sacs with intestine ; and a not infrequent form of crural hernia is, a small knuckle of the latter concealed behind a fold of the former. Omentum is more often found on the left than on the right side, and this is explained by the greater length of the omentum on that side. It is better not to return a mass of omentum if its condition be at all doubtful : if it do not bleed much, it may be torn or cut away with scissors. To divide a stricture and then encircle a mass of omentum with a ligature is simply to substitute one form of strangulation for another. Omentum often sloughs.

If intestine be in an irrecoverable condition or in an ulcerated or mortified state, it must be left undisturbed after the stricture is divided : if recoverable, it should be gently returned into the abdomen, first pressing its contents inwards if it be distended. If adherent *feebly* by the deposit of recent lymph, such adhesions may be very cautiously separated ; but if they are at all firm such interference is unjustifiable : adherent omentum may be treated with less delicacy ; but even in this case it is better to leave undisturbed firm and extensive adhesions. Mortified intestine may be recovered from, with artificial anus ; and by careful management this may ultimately close. When closed it sometimes constitutes a source of great trouble to the patient : for upon taking coarse or indigestible food obstruction readily occurs and the wound breaks out afresh. Operations have been performed for the relief of this condition by the removal of the tongue of projecting intestinal wall.

Seat of stricture.—In oblique inguinal hernia the most frequent seat of stricture is the neck of the sac itself ; yet it may be at the external ring. The latter, or the rent fibres of the conjoined tendons, is the seat of stricture in direct hernia. In

dividing the stricture, the edge of the knife should be directed upwards, with a slight inclination inwards, *i.e.* parallel to the course of the epigastric artery. In crural hernia, the strangulating band will be felt running inwards to Gimbernat's ligament, beneath the upper border of the falciform opening in the fascia lata: it should be divided forwards and inwards. In umbilical hernia, it is better to divide the stricture downwards, to avoid interfering with the round ligament. The extent to which a stricture is divided should always be limited to the necessities of the case.

After-treatment.—After an operation, the upper part of the wound should be brought together with a suture, sufficient space being left below for the free escape of discharge. The outlet by which the rupture escaped should then be supported with a pad of lint and a bandage, or a light sand bag may be placed over the wound which is simply protected by a piece of lint. The knees should be flexed, and supported beneath by a pillow.

The diet should at first be light and unstimulating, unless the patient be very low; and all aperient medicine should be withheld, as a rule, for at least thirty-six or forty-eight hours. If the bowels do not then act, a simple enema may be administered; or, if requisite, and if there be tympanites, a warm aperient draught may subsequently be given. Diarrhœa may follow an operation, especially if aperients have been previously administered, and this will require control: if expected, an opiate should immediately follow the operation. In case of peritonitis, especially if general, the belly should be freely fomented, and small repeated doses of blue pill, guarded by opium, should be given, the patient being at the same time supported. For distressing tympanites the intestines may be punctured through the abdominal walls by means of a fine trochar and canula. Pain and tenderness in tympanites should not be mistaken for inflammation: there is always more or less tenderness at and around the wound.

Complications which occasionally occur with strangulated hernia are, abscess, hydrocele, or diseased testicle. The discovery of either of these should not arrest an operation, if the symptoms of strangulation are well marked. In obscure and doubtful cases,

the wisest course is to perform an exploratory operation : it is better to operate unnecessarily, than to risk allowing a patient to perish from want of an operation.

Internal strangulation may occur from twisting of some portion of the intestine, or from a coil passing through an abnormal opening in the mesentery or omentum, or under a band of adhesion between neighbouring parts of the peritoneum. The same symptoms may be the consequence of intus-susception, or of mechanical obstruction from hardened fæces or other concretions, or of a tumour pressing on the bowel. The question of gastrotomy may then be raised ; and if decided on, should be performed by section of the linea alba below the umbilicus. If the obstruction be below the commencement of the colon, an artificial anus may be established by opening the ascending or descending colon, as the symptoms may indicate, in either loin. This may be accomplished, according to Amussat's plan, by a transverse incision of three inches long, midway between the last rib and crest of the ilium, and extending from the longitudinal muscles outwards. This incision will divide the internal oblique and transversalis muscles, and a portion of the external oblique and quadratus lumborum. Before the exposed intestine is opened, it must be secured by passing a ligature through it ; and subsequently, by fixing its margins to the external wound. A longitudinal incision is preferred by some.

INJURIES AND DISEASES OF THE VISCERA OF THE PELVIS, AND OF THE URINARY AND GENITAL ORGANS.

The RECTUM may suffer **injury** from within or from without. Fragments of undigested matter, as bone, or foreign bodies accidently swallowed, may lodge in the rectum and lacerate the bowel. When felt, such objects should be carefully removed with the finger, or with the aid of forceps. Foreign bodies have been occasionally introduced into the rectum. The bowel may

be wounded in lithotomy; or it may be lacerated by the in-
cautious use of the clyster pipe, or from constipation and the
effort to expel hardened fæces, or during parturition. A catheter
has been driven into the rectum. In falls, pointed bodies may
penetrate the rectum; or its orifice may be torn by a chamber
utensil giving way beneath the sitter. In all such cases the
treatment must be determined by the nature of the injury.
Fæces are sometimes impacted in a large, hard globular mass
in the lower part of the bowel, occasioning obstinate constipation:
such condition should be relieved by breaking up the mass with
the handle of a spoon or some such instrument, and the subse-
quent injection of warm water: this may require frequent re-
petition. An enlarged uterus, or a tumour growing from it, or
a large, hard prostate has been mistaken for a tumour of the
bowel itself.

Prolapsus of the rectum may require operation. This con-
dition may result from irritation or from relaxation. It occurs
from straining, in stone in the bladder, and in habitual consti-
pation: it may also be the concomitant of habitual diarrhœa, or
of piles, or condylomatous growths and redundant skin. When
irritation is the exciting cause it should be removed if possible.
In constipation, or in an atonic condition, the bowels should be
kept gently relaxed, and the general health attended to. The
removal of hæmorrhoids or redundant integument will frequently
effect a cure; or the partial destruction, by nitric acid, of the
relaxed mucous membrane. If necessary, a portion, or
even the entire circumference (in segments) of the prolapsed
bowel may be removed by ligature. In strangulated prolapse,
it may be requisite to puncture the congested bowel at several
points, to relieve the tension consequent on congestion.

Hæmorrhoids, or piles, may be a varicose distension of the
veins at the lower part of the rectum, and this is the commonest
form of external piles. The varicose condition is often attended
with considerable thickening of the veins and of the mucous
membrane covering it. Another form is that of erectile growth
—a kind of venous nævus, involving the mucous and sub-
mucous tissues, and this may occur in internal piles. They may
be permanently internal or external; or internal piles may be

occasionally extruded beyond the sphincter. When internal they cause tenesmus, and occasionally, sometimes habitually, bleed. External or extruded internal piles are liable to attacks of strangulation and inflammation, being girt by the sphincter. The most common cause of piles is habitual constipation, causing mechanical obstruction to the return of the blood : but they may result from irritation caused by habitual relaxation of the bowels : in the latter cases, especially, abundant mucus is secreted ; and prolapse after stool is common. Much relief may be given by hygienic treatment ; and in constipation, by gentle laxative medicines and alteratives where the liver is sluggish, which is often the case. The habit of relieving the bowels at night is desirable, as the recumbent posture is soon afterwards assumed. Cold or astringent injections may be used in internal piles ; and preparations of pepper, including cubebs, are useful : copaiba may afford relief. If the piles or bowel descend, they should be returned by gentle pressure. When hæmorrhoids are inflamed or strangulated, leeches may be applied ; but if the tension be great, it is preferable to puncture the swelling freely with a lancet. As a rule it is unsafe to cut away internal piles, for it is difficult to control the hæmorrhage : if pedunculated they may be brought down and tied, the ligature being cut off close and the tumour returned : or, if more convenient, from size and form, strong nitric acid may be applied. In large piles, which habitually descend or are always external, the ligature is the safest remedy ; and if effectually applied, it is certain and not very painful. Two or three ligatures should be employed, and the skin divided where the mass is large. An operation should not be performed, when the parts are in-flamed. The bowels having been previously evacuated, the patient should be directed to strain in order to bring the mass fully into view, and a strong needle, doubly armed with a stout ligature, should be carried through the base of the swelling, and then tied firmly on either side. In case of hæmorrhage from the interior of the rectum, a sponge tent, or ice, or a mem-branous tube introduced and subsequently distended with cold water, may be employed : the use of the crushing forceps with cautery is a safe proceeding.

Abscess, and **fistula** as its sequence, may be spontaneous, *i.e.,* dependent on the general health, as in liver or lung disease, or on functional disturbance ; or it may be dependent on local irritation and consequent inflammation : foreign bodies, which have perforated the bowel, have been occasionally found in abscesses. The formation of abscess in the recto-ischial fossa is generally accompanied by much pain, and the pus, when it is deep, usually finds its way slowly to the surface : the abscess may burst into the rectum ; at other times it opens into the bowel and externally. Such abscess should be lanced as soon as fluctuation is perceptible, to curtail suffering and prevent burrowing. It is better to delay the division of a fistula until the cavity has contracted. The operation of dividing the sphincter may be effected with a blunt bistoury and the finger in the bowel, when there is a communication with the latter : otherwise a hollowed bougie of wood should be introduced into the rectum, and a director with open end be fixed against it ; along this a pointed bistoury may be passed, and made to perforate the bowel, fixing itself in the bougie ; both can then be withdrawn together. The best position is with the patient leaning over the end of a bed or chair. If the fistula be very deep, it is not requisite or desirable to divide it to the bottom ; but the sphincter must be cut through. Oiled lint should be kept in the wound for a few days. In phthisis, fistula should not, as a rule, be meddled with.

Stricture affects the rectum, as it does the urethra ; but is more rare than is usually considered, and generally within reach of the finger. Much mischief is often done by maltreatment in supposed stricture. Displaced or diseased uterus, enlarged prostate, a tumour pressing in the bowel, may be mistaken for stricture. Simple stricture is usually annular, and produced by plastic deposit in the submucous areolar tissue. The causes are irritation, drastic purgatives, &c. ; or contraction may be the consequence of cicatrization of an ulcer. The treatment is by cautious dilatation with a bougie ; belladonna clysters have been given with good effect. The bowels should be kept relieved. If necessary, the stricture should be divided by a blunt-pointed bistoury. In complete obstruction high up,

it may be requisite to give relief by making an artificial anus: where stricture is associated with syphilis, as is sometimes the case, specific treatment must be adopted.

Cancer of the rectum is a painful and incurable disease. It commences usually in the submucous areolar tissue ; and, as it advances, is attended by difficult defecation and discharge of bloody mucus. When the finger is introduced, it meets with an irregular indurated growth, which more or less fills the cavity of the bowel, and is painfully sensitive to the touch and readily bleeds. The treatment can be only palliative; by gentle laxatives, opiates, and suppositories. When the obstruction is complete it may be necessary to relieve by opening the descending colon in the loin ; by this means life may be prolonged with comfort, and comparative freedom from pain for many months. Sometimes, the obstruction being valvular and increased by the accumulation of fæces above, the operation for artificial anus gives not only relief from the distension, but is followed by the renewal of the passage of the fæces through the rectum. The intestine may ulcerate above the stricture and a peritoneal abscess be formed : this may open again below the stricture and the obstruction be relieved spontaneously. Cancer of the rectum is usually scirrhus.

Prurigo is characterised by distressing itching around the anus, often leading to excoriation, and occurring more commonly in elderly persons. Frequent cold ablution, and zinc ointment or powder, and gentle laxatives will afford relief : but astringent lotions may be needed ; or the ordinary yellow wash, which, with a dilute nitrate of mercury ointment, is the most efficacious remedy in obstinate cases.

Mucous tubercles around the anus, and warty growths, are of a syphilitic origin, and sometimes very extensive. Strong nitric acid or some other strong caustic will destroy them, if combined with suitable constitutional treatment. Calomel in powder, or savine, are often equally effectual and less irritating. Removal with the knife is sometimes expedient.

Fissure and **Ulcer** of the rectum are usually near to the anus, and more frequent at the back of the bowel than at any other part. The symptoms are acute suffering during defecation;

rigidity of the sphincter ; the motions streaked with pus or blood. The great pain complained of suggests the idea of malignant disease, or inflammation of the prostate or uterus, for which it has been mistaken. The ulcer may be readily seen or even felt ; and the fissure, with its usually indurated edges, still more easily. Laxative medicines and caustic may be tried, but are rarely successful ; belladonna injections or clysters will sometimes reduce the spasm of the sphincter, but the only certain cure is by operation. For this purpose the finger should be introduced into the rectum, and a blunt-pointed, narrow, straight bistoury is to be passed along and between it and the back of the bowel ; the edge, being then turned backwards, is to be withdrawn along the fissure, fairly dividing it and the margin of the muscle at the back of the gut. No dressing is needed.

Malformations. (See section on Operations.)

The **KIDNEY** may be injured by a blow or contusion. Such injury, if slight, may be followed only by bloody urine for a few hours ; or this symptom may endure longer and be more severe. In the latter case, cupping, with or without abstraction of blood, will give relief ; in the former, a mild aperient and anodyne, with perfect rest, will suffice. If requisite, some astringent, such as the perchloride of iron, may be subsequently given. If the kidney be ruptured, as from crushing injury, a fatal issue may be anticipated.

The *diseases* of this organ belong principally to the physician ; but those associated with **calculus** require notice. The presence of a stone in the kidney may, by obstructing the outlet of urine, produce distension and absorption of the secreting part of the organ, which is thus converted into a membranous sac or series of sacs, the other kidney being usually hypertrophied. A simpler consequence of renal calculus is hæmorrhage, blood being mixed with the urine. The stone may also give rise to inflammation of the lining membrane of the pelvis and calices of the kidney (pyelitis), and the pus from this source will be liable to cause irritation in the bladder, with, generally, chronic cystitis. Or, though rarely, abscess may result from the same source of irritation, and this may point in the loins, where it should be opened as any other abscess, when near the surface. It may be

possible by this means to remove the stone from the kidney, but unless it has already been brought towards the surface by such a process of suppuration, it would be unwarrantable to cut into the kidney from the loins for the purpose of discovering the stone.   Abscesses in the loins, the result of renal disease, are more commonly connected with the exterior of the kidney—are peri-renal rather than renal.   A renal abscess may discharge its contents into the colon or burst into the peritoneal cavity with speedily fatal issue ; but these cases are very rare.

The URETERS may be distended, sometimes to an enormous degree, by obstruction : occasionally they are hypertrophied. The passage of a renal calculus to the bladder often occasions very severe pain, referred to the loins and affecting sympathetically the thigh and testicle.   Hot fomentation and opiates will give some relief.   A common seat of obstruction is at the entrance of the ureter into the bladder ; here the calibre of the vessel is small as it runs obliquely in the walls of the bladder.

The BLADDER.—The position, connections and texture of bladder allow of considerable distension ; and such distension, the consequence of enforced retention or negligence, may lead to paralysis and atrophy of the muscular coat.   Obstruction, as from enlarged prostate, will engender hypertrophy of the muscular coat.   The bladder is liable to **rupture** from violence. This may occur, during over-distension, from sudden violence, as a heavy fall ; or it may be the consequence of fracture of the pelvis, or of some penetrating wound. Fatal collapse or peritonitis usually terminates life.   Gunshot wounds of this organ have been recovered from ; patients may have survived this injury in other cases, where the nature of the lesion was doubtful.   Perforation and other injuries of the bladder, in lithotomy, are usually fatal.   **Foreign bodies** are sometimes introduced into the bladder and left there ; and fragments of bougie or catheter have been broken into this viscus.   An effort should always be made to remove such foreign bodies with a double-bladed spring sound ; and some interesting cases of success are recorded : otherwise the lateral operation must be resorted to.   Foreign bodies are much more easily removed from the female than the male bladder, for the urethra is short and more readily dilated.

Irritability of the bladder may be simply sympathetic with primary disease of the kidneys. Nervousness, and the habit of frequent micturition may render the bladder irritable, or the same effect may be the consequence of an acrid condition of the urine, or of morbid sensitiveness of the mucous membrane. The treatment must be adapted to the particular case, by the exhibition of tonics, anodynes, or alkaline medicines, separately or in combination. *Paralysis* of the bladder rarely exists as a simple disease in the male; but inability to micturate is common in hysterical women, and is increased by indulgence in the use of the catheter. Steel medicines, and a blister on the sacrum will often relieve it. A paralytic condition of the bladder accompanies disease or injury of the spinal cord, and requires the regular use of the catheter.

Incontinence of urine may result from injury to the urethra, as in dilating the female passage for the removal of calculus, and sometimes occurs after lithotomy. It is also a consequence of over-distension of the bladder, the water dribbling away, as in paralysis; or of obstruction from a large prostate or stricture. It may be hysterical and spasmodic. Incontinence is frequent in children, especially during sleep, and becomes a habit which is difficult to cure. In weakly children tonics may be of service; but moral treatment will do more than physic: if the waking habit be cured, the period, which is usually regular, when the bladder empties itself during sleep, should be watched and anticipated by taking the child up or changing his position. Small doses of cantharides may be tried in obstinate cases.

Inflammation of the bladder may be either acute or chronic. The former is rare, and probably never occurs as a primary affection without the existence of some local source of irritation, as the retention of a catheter beyond the proper time, or the presence of an angular or rough calculus: it occasionally accompanies or is the sequel of gonorrhœa. It is characterised by severe pain and extreme sensitiveness of the organ, together with constitutional disturbance, hypogastric pain and tenderness, discharge of mucus, sometimes hematuria; and requires antiphlogistic treatment, with anodynes and alkaline medicines.

Chronic inflammation may result from various causes, the most common being disease of the urethra, especially its prostatic portion, or the presence of stone; but it is occasionally present without apparent cause. The kidneys may be primarily or secondarily affected. Ropy mucus or pus, in considerable quantity, and derived often from the kidney as well as the bladder, is discharged with the urine in the more severe forms of this disease. It may terminate fatally by ulceration or sloughing of the mucous membrane of the bladder, or by disorganization of the kidney.

The *treatment* of this troublesome complaint is by removing the cause, if evident and practicable. Otherwise by anodynes, alkaline or mineral acid medicines, according to circumstances. Fomentations, and leeches if necessary, to the abdomen. Decoction of pareira brava, with henbane and liquor potassæ, sometimes affords relief; or an injection of warm water alone, or a decoction of poppy heads, in small quantity; or the injection of a solution of nitrate of silver, one or two grains to the ounce; where the urine is extremely ammoniacal acid solutions may be injected (dilute nitric acid one or two drachms to the pint); and where the alkalinity is suspected to be the result of ferment change, quinine or sulphurous acid in solution may be substituted. Specific medicines which act on the urethra are also serviceable in the milder forms of the disease.

Hæmorrhage may take place into the bladder, by which the organ is distended with blood. The catheter must be used, and warm water should be injected if clots be present.

Cancer, usually of the encephaloid variety, occasionally attacks the bladder. The early stages of this disease are obscure; hæmorrhage almost constantly attends the latter stage, and the suffering is very severe, attended by difficult micturition. The treatment can be only palliative.

THE PROSTATE GLAND is subject to inflammation and its consequences, to enlargement and to cancer. It is occasionally, perhaps not infrequently, lacerated or perforated by violent or injudicious use of the catheter.

Inflammation may be acute, as from extension in gonorrhœa; or chronic; and it may be spontaneous. It is charac-

terised by deep-seated pain, irritability of bladder with frequent desire to pass water, and difficulty in doing so; fulness and tenderness of the gland when felt from the rectum. The perinæum should be leeched and fomented, and a purgative administered; an anodyne at night: it is desirable, often necessary, to draw off the water with an elastic catheter. Severe rigor may usher in suppuration, and the pus from such abscess may find its way to the perineal surface or into the urethra or rectum : such cases are often tedious and complicated from the access of urine to the parts involved. If accessible, pus should be evacuated early.

Temporary enlargement of the prostate may result from inflammation.

Chronic inflammation is characterised by gradual enlargement and induration of the gland, with frequently an exudation of glairy fluid : this may alarm the nervous into the belief that they are suffering from spermatorrhœa.

Permanent **enlargement** of the prostate is rare before middle life, but common aftor this period. In some instances it appears like simple hypertrophy, but in the majority of cases there is also hardening. The size varies considerably, and may be ascertained by examination per anum. The progress of the change is slow, and is marked by difficulty in emptying the urethra and bladder, especially when the middle lobular isthmus is enlarged and projects inwards : increased frequency in micturition with some straining entails hypertrophy of the muscular coat of the bladder, which is then never entirely emptied, although the patient fancies it is. Too long retention of the water, a fit of drinking, or any special irritation, may entirely incapacitate the patient from evacuating the bladder ; and when the distension is excessive, the urine may begin to dribble away. Under these circumstances the coats of the bladder may slough ; but this is a rare occurrence. The *treatment* consists in introducing a large and long catheter of metal or gum ; an elastic instrument without a stilet is preferable, but cannot always be made to enter the bladder : the finger in the rectum will aid in directing the point of the instrument. This operation must be repeated until the bladder has recovered its tone. Attempts to

pass a short catheter not infrequently terminate in perforation of the gland and profuse hæmorrhage.

Scirrhus of the prostate occasionally occurs, and is characterised by induration and much suffering, in addition to the ordinary symptoms of enlargement.

Stone in the bladder is far more common in the male than in the female. It may result in either sex from the introduction of a foreign body, around which an incrustation takes place. The nucleus is, however, usually a renal calculus, which has descended to the bladder. A stone usually lies loose in the bladder, but is sometimes encysted, *i.e.* contained in a sacculus of the mucous and muscular coats. Stones vary in size generally according to their age or duration ; there may be but one, which is usual, or there may be many. A large and brittle stone may be broken up in the bladder without operation ; this is of very rare occurrence : or two or more stones may be joined together in their growth, which is less uncommon. The nucleus of most calculi is either lithic acid or oxalate of lime, more often the former. Some calculi are formed by the deposit of laminæ concentrically arranged ; but this is not the case in others ; the lithic acid is a good exemplification of the former arrangement, the triple phosphate of the latter. Some calculi, on section, present variations or alternations in their laminated crystalline deposits, in consequence of change in health, locality, diet, or medicine.

The most common stones are the *lithic acid*, of a light-brown colour, smooth and laminated in texture ; *oxalate of lime*, called mulberry from its form, which is very dark and hard, and tuberculated or even spiked on the surface ; *triple phosphate*, which consists chiefly of the ammonio-phosphate of magnesia ; it has a crystalline but otherwise not uneven surface, and is usually light in colour, friable, and not laminated ; occasionally it is hard : this stone is very liable to reproduction, and even rapidly so. *Phosphate of lime* is rarely found pure, but is not infrequently combined with the last : it is then, in appearance and consistence, not unlike chalk, and from its property of melting when subjected to a strong heat, it has been called the fusible calculus. *Urate of ammonia* is met with chiefly in

children. The *cystic oxide* stone is very rare, and so are *lithate of soda* and *carbonate of lime*, while the rarest of all stones is the *xanthic oxide*. Lithic acid calculi often have mixed with them some oxalate of lime or the phosphates ; and are calculated to constitute nearly one third of all stones, and to form the nucleus of two thirds. Phosphatic stones are probably next in order of frequency, and the mulberry and mixed or alternating calculi are nearly equally numerous. Occasionally the lithic acid or mulberry calculus is coated with phosphatic deposit, or the different constituents may alternate.

Blowpipe tests for calculi or fragments of calculi. Lithic acid or lithate of ammonia gradually disappears. Cystic oxide also disappears, emitting an odour like that of carbon bisulphide. Xanthic oxide leaves a white ash, and gives off a fœtid odour. The naked-eye and microscopical appearances of the two latter forms of calculi will readily distinguish them from lithic calculus ; and they are extremely rare. Fusible calculus readily fuses. Oxalate of lime leaves quick-lime, which when moistened stains turmeric paper red. Carbonate of lime dissolves at once in nitric acid with effervescence : it will leave quick-lime after being tested by the blowpipe. Triple phosphate fuses imperfectly, emitting an ammoniacal odour. Phosphate of lime resists the action of the blowpipe except at intense heat.

The predisposing *causes* of calculus are both intrinsic and external. Mal-assimilation of food from disordered digestion or unwholesome diet is the common cause of calculus among the lower classes ; suppressed excretion from insufficient exercise, enlarged prostate acting mechanically in detaining a small calculus, may be reckoned as the cause of stone among the wealthier classes, in whom, however, the occurrence of stone is far less common. Certain localities seem, from some ill-explained cause, to favour the formation of stone ; and, as already remarked, the introduction of a foreign body into the bladder induces the same results even in healthy urine. Disease of the bladder or kidneys may act as a predisposing cause, or be the consequence, of calculus. No age is exempt from stone, although it is certainly less frequent in middle life than in children or elderly persons. The irritation caused by the long-

continued presence of a stone in the bladder may lead to ulceration of the prostate, or of the bladder itself, and the rare occurrence of rapidly fatal extravasation of urine or sloughing abscess ; or inflammation may extend along the ureters to the kidneys.

The *symptoms* of stone in the bladder vary much in intensity, but little in character : and the degree of suffering depends far more on the sensibility, either natural or from inflammation, of the bladder, than on the size or surface of the stone. Indeed, in many instances, where inflammation is not present, a smooth stone excites more pain than a rough one, possibly because the mucous membrane may have become thickened or otherwise altered by the attrition of a rough stone, or more abundant mucus may be secreted. *Cæteris paribus*, large stones usually cause more pain than small, but not always so. The symptoms are, frequent and urgent desire to make water, with inability to restrain the impulse ; the act is accompanied by straining, and succeeded by increased pain from the contact of the bladder with the stone : sudden arrest in the stream as it flows, from the obstruction caused by the stone : pain referred to the hypogastrium, but especially to the extremity of the urethra and glans penis ; children seek to relieve this by pinching and pulling the prepuce : suffering is aggravated by any jarring movement : the water contains more or less mucus, and sometimes pus or blood. In children, prolapse of the rectum is often the result of straining. These symptoms are not, however, exclusively peculiar to stone in the bladder ; they are suggestive but not conclusive. They may indicate disease of the kidney, inflammation of the bladder, especially its neck ; worms or intestinal irritation from other causes : the latter are frequent in children. Therefore, no opinion should be given until the sound has detected the stone.

For this purpose a solid iron instrument is to be preferred, of sufficient length, small in size, with a short curve and bulbous extremity. It may require to be passed far into the bladder, or to be turned from side to side, or suddenly withdrawn towards the neck of the bladder ; or it may be requisite to inject the bladder with water or change the position of the patient. The

stone must be *struck :* any other sensation is deceptive, such as drawing the point of the sound over a fold of the bladder. Sounding may be often repeated without a stone being detected, though there be one ; therefore negative evidence is not to be trusted at once as conclusive. Analysis of the urine should not be neglected. A stone may sometimes be felt through the rectum in children ; and the application of a stethoscope over the pubes will aid the ear.

Small calculi often escape spontaneously from the bladder with the stream of urine. Sometimes they lodge and require extraction with suitable forceps; or, if they remain firmly impacted, with sufficient space for the water to pass, they may require to be cut out. The eyed end of a probe, slightly bent, is a good instrument with which to dislodge a stone lodged in the urethra within reach.

Although medicines and medicated injections have been re-commended and employed as solvents of stone, the cases in which they have been serviceable are, for the most part, questionable, or at least rare ; and therefore the only alternatives which remain are, either to crush the stone or remove it by cutting.

Lithotrity is not applicable to all cases. In recent for-mations where the stone is not very large nor the bladder irri-table or inflamed, this operation has the best prospect of success. The small size of the urethra in children, and the rare fatality of lithotomy in childhood, render the latter operation preferable at an early age. The mechanical obstacles, occasioned by an enlarged prostate, are an objection to lithotrity. When crushing is determined on, the urethra should be accustomed to the presence of a large instrument. In seizing the stone tact is required which habit alone can give. Probably the best direction is, to carry the lithotrite to the centre of the bladder ; and then to turn it from side to side and to invert it, opening and closing the blades at each successive move, until the stone is seized. By this method the mucous membrane is less liable to injury. It is easier both to seize and crush fragments than an entire stone. Some cases may be relieved at one sitting ; others require repeated operations.

Lithotomy.—The operation of removing a stone from the

bladder by cutting is performed by making an oblique incision on the left side of the perineum, between the crus penis and bulb, and thus reaching the membranous part of the urethra, which is then perforated ; and the left side of the prostate is next divided to an extent sufficient to allow of the introduction of the forefinger : a pair of forceps is then guided through this opening into the bladder, and the stone seized. Various cutting instruments are employed ; but a staff of full size deeply grooved laterally either curved or straight, is essential to guide the operator in entering the urethra and bladder. If the operator take the staff into his own hand when he enters the bladder, it should be either straight or moderately curved ; if he entrust it throughout to an assistant, it should have a large and long curve, and should be held immovable and well hooked up under the pubes. The desiderata in this, the lateral operation, are :—1. To make a free external and well depending opening. 2. To open the urethra as far back as convenient. 3. To make a definite and sufficient opening in the prostate. 4. To take care that all cellular tissue and fascia intervening between the external wound and the prostatic opening are freely divided. To accomplish these objects, the external incision should commence at the left side of the raphe, about an inch in front of the anus, and be carried downwards and outwards between it and the tuberosity of the ischium. When the staff is depressed by the operator, it is safer to lay aside the scalpel with which the urethra is opened, and to substitute a broad-beaked knife for incising the prostate. The ordinary risks attending and following this operation are, hæmorrhage ; and infiltration of the cellular tissue around the neck of the bladder with urine, leading to abscess or sloughing. The former accident may be the consequence of cutting too high, or of lateralising the knife too much as it is carried into the bladder ; or it may arise from enlargement of the venous plexus around the prostate, as in the aged. The latter sequence may result from too free an incision into the bladder, whereby the limit of the prostate is overstepped, and the loose cellular tissue around it is thus exposed to infiltration.

Urinary calculus in the female may be removed, either by

dilating the urethra with a suitable instrument ; or, if the stone be too large, by incision. If the latter step be requisite, the urethra should be put on the stretch with a three-pronged dilator ; and a straight blunt-pointed bistoury being then introduced into the bladder, a sufficient incision should be made downwards and towards the left side, to admit of the introduction of a pair of forceps : this is a close imitation of the later step of the same operation in the male.

Retention of urine may be the consequence of paralysis of the bladder, of over-distension, of enlarged prostate, of malignant disease, of ruptured urethra, of stone in the urethra, of abscess in the perineum, or of spasmodic or permanent stricture. (*Reference may be made to each of these headings.*) *Suppression of urine* is the consequence of organic disease, or obstruction in the ureters.

PENIS.—The prepuce is sometimes redundant ; and if this be associated with congenital phimosis, it is best to circumcise the patient. **Phimosis** from disease generally yields as the producing inflammation subsides. But if, from the presence of an extending chancre on the glans, or of large warts, it be necessary to divide the prepuce, it is preferable to do so by the side of the frænum ; a director and bistoury should be used : the inner and outer skin may be afterwards connected by suture, though it is often fruitless to do so. In **paraphimosis,** regulated pressure on the glans, after puncturing it if necessary, will generally accomplish the reduction. After a few days, however, inflammatory adhesions may prevent this result ; but the glans does not often suffer seriously from the strangulation : if tight, the constricting band may be divided.

Warty growths, usually of venereal origin, sometimes attain a great size ; and, if growing from the covered glans, may perforate the prepuce. When small or flat, such growths may be destroyed by the application of calomel, or savine leaves powdered ; or by the application of liquor plumbi, or nitric acid. If very large, it is better to remove them at once with a knife or scissors : they may grow either from the prepuce or glans, and are often very vascular. It is often advisable to circumcise or slit up the prepuce in order to expose the glans thoroughly.

Cancer sometimes attacks the penis, eating deeply and often rapidly into its texture. Amputation at an early period, and before the inguinal glands are affected, is the only remedy ; and this is often unavailing.

URETHRA.—The course of this canal beneath the arch of the pubes renders it liable to **laceration** in fracture of this bone, and also from falls on the perineum. The usual symptoms are swelling and pain in the perineum ; bleeding from the urethra, which is sometimes persistent, and difficult to check : blood may be also extravasated into the scrotum ; micturition is difficult or impossible, and the effort occasions great suffering. The patient should be forbidden to make any effort to pass water, and an attempt should be made to pass a gum catheter immediately. With careful perseverancc this may be generally accomplished : the finger on the perineum or in the rectum will help. If a catheter cannot be got into the bladder, this organ should be punctured through the rectum, and the canula kept in ; or when the symptoms indicate that urine has already found its way through the rent, it is better at once to cut into the perineum, and then pass a catheter into the bladder. Under any circumstances, the instrument must be worn for a time. Although the urethra is often lacerated in rough and clumsy efforts to pass the catheter in stricture, extravasation of urine is not a necessary or frequent consequence of these false passages, probably on account of their direction being contrary to the course of the urine. Such injuries, however, sometimes lay the foundation for urinary abscess, in the way to be presently described.

The urethra is sometimes burst by violent efforts to relieve the bladder, in stricture.

Stricture of the urethra may arise from various causes, which may be classed under two heads ; mechanical injury and inflammation. Thus, the cause may be contusion or laceration of the passage ; or specific inflammation, as in long-continued gonorrhœa, or from the injudicious use of injections. Spasmodic stricture never occurs in a healthy urethra ; it is generally an aggravating concomitant of permanent stricture. The usual *seat* of permanent or organic stricture is in the membranous or

bulbous portion of the urethra; but it may be farther forward, and even near to the external orifice : sometimes there are two or three strictures coexisting. The proximate *cause* of the obstruction is either thickening of the mucous membrane, or, more commonly, inflammatory deposit in the submucous areolar tissue : the canal behind is usually dilated. The *symptoms* are difficulty in micturition, a small, twisted, or divided stream, and obstruction to the ingress of an instrument. The bladder is sometimes irritable and contracted, at others preternaturally dilated.

In ordinary stricture, the regular and patient use of a bougie or metal sound will overcome the difficulty. The instrument should be adapted to the stricture : in some cases more may be accomplished with a small or conical bougie ; in others a short metallic sound carried daily down to a callous stricture, and kept pressed firmly against it for some minutes, will effect much, apparently by promoting absorption. Sometimes a long catgut bougie may be used as a guide to pass a catheter over. The conical bougie is useful in dilating a stricture into which it has been passed. Under all circumstances, violence must be avoided. If something more than the above treatment be required, in the majority of cases of indurated stricture, without other mischief, the cautious employment of potassa fusa is preferable to cutting ; it is both safe and efficacious, especially where the stricture is irritable. Many surgeons, however, prefer section, or forced and sudden dilatation.

Effects of stricture.—Complete retention of urine is the consequence either of neglect in the strictured patient to empty the bladder when required, or of spasmodic added to permanent stricture : it often follows excess in drinking. The natural expedient is the introduction of an instrument ; but great care should be exercised that the urethra is not lacerated. After a fair trial, if unsuccessful, it is better to place the patient in a warm bath, and give a good dose of opium, combined with a saline purgative. After two or three hours, and when the aperient begins to act, the patient will probably pass water without assistance ; or, the spasm having been allayed, an instrument can be passed. The size of the instrument must be determined by the

ordinary stream of water : an elastic gum catheter is preferable, where available, to one of silver : if the latter be used, the fore-finger of the left hand should guide it along the perineum, and (by being passed into the rectum) until it has reached the prostate. Gentle friction of the perineum will sometimes relieve spasm. The following plan will sometimes succeed. Pass a small bougie down to the stricture ; and, whilst holding it there, bid the patient make an effort to pass water, and then suddenly withdraw it. The opium may be thrown into the rectum.

If all expedients fail, the urethra being free from injury or disease except the stricture, it is preferable to puncture the bladder by the rectum. This **operation**, which is simple and safe, is performed with a curved trochar and canula, which must be guided by the forefinger of the left hand to the centre of the bowel, immediately above the prostate. There the bulging bladder will usually be felt, and the instrument must be pressed gently but firmly into it : the canula is to be fixed in its position with tapes. If it be thought expedient to open the urethra by the perineum—which becomes a necessity if there be extravasated urine or abscess—the patient should be placed as for lithotomy ; and a staff or catheter being passed down to and held against the stricture, an incision is made along the raphe, and the staff being exposed, the knife is to be carried beyond it, so as to divide the stricture : as a guide to reach the bladder, a probe or director may be used, along which a silver catheter may be passed. But this is often a tedious and troublesome operation. Tapping the bladder above the pubes is seldom practised, and rarely justifiable.

Perineal abscess is a not infrequent consequence of per-manent stricture. This may be circumscribed and limited, or diffused. It generally presents itself in the form of a hard tender swelling in the perineum, usually in the middle, but sometimes laterally. This may subside spontaneously, pus passing by the urethra ; but generally it increases in size and becomes more diffused. These abscesses appear to arise from the ingress of a minute quantity of urine into the submucous areolar tissue, through a small ulcerated opening behind a stricture : inflam-

matory deposit walls in the abscess and prevents extravasation. If left unrelieved, this condition may terminate either by sudden extravasation of urine, or, more commonly, in urinary fistula. The proper *treatment* is immediate and free incision into the abscess : a catheter may then be passed on into the bladder, or the urine may be left to drain through the perineal opening ; the latter is preferable if the urethra be much disorganized and the drainage free : under these circumstances the presence of a catheter is not only superfluous but mischievously irritating. At a later period, a catheter may be passed from time to time to enlarge the narrowed part of the urethra.

Extravasation of urine is the consequence of the urethra (or an abscess) suddenly giving way behind a stricture. Speedily the areolar texture of the perineum and scrotum perishes ; and, as the urine is further diffused by the pressure from behind, gangrene involves the skin of the penis, occasionally the glans and body of the penis—though this is rare—and extends over the groins towards the umbilicus. Immediate, deep, and free incisions, wherever the urine has invaded the textures, afford the only chance for the patient : no catheter is needed ; the urine finds a ready exit by the perineal opening. Patients sometimes recover after sloughing of the entire scrotum, skin of the penis, and skin over the lower wall of the abdomen. The cause of death is commonly exhaustion with blood poisoning and sometimes pyæmia. Beer-grounds poultice, with a stimulating, nutritious diet, constitutes the chief part of the treatment.

Urinary fistulæ may be the consequence of injury of the urethra, of abscess, or of extravasation of urine. The external openings may be many, or there may be only one ; and these may be in the perineum, or scrotum, or in the penis anterior to the scrotum. Under any circumstances it is useless to attempt to deal with these fistulæ until the strictured portion of the urethra is dilated or divided. The best course is to treat the stricture in the ordinary way ; and, when a catheter can be passed into the bladder, to retain it there, and freely lay open the fistulous canals, if in the scrotum or thickened perineum ; subsequently encouraging granulation from the bottom of the wound. Or, if the stricture be impervious, its division may be

undertaken when the fistulæ are laid open. In some instances a point of caustic or cautery will suffice to close a small superficial fistula. Where the opening is in front of the scrotum it is very difficult to heal, and will probably require a plastic operation to close it.* For this reason the urethra should never be opened in this situation, if it can possibly be avoided.

SCROTUM.—The superficial fascia descending from the abdominal parietes includes each testicle in an envelope, and adheres to the rami of the ischium and pubes of either side, thus limiting and determining the direction of extravasated urine. *Wounds* of the delicate skin may be followed by active inflammation. Blows frequently produce extensive *ecchymosis* or extravasation of blood into the loose subcutaneous areolar tissue ; the speedy discoloration and diffusion of the swelling distinguish this from hæmatocele ; evaporating lotions aid in dispersing it. Inflammatory *œdema* may follow injury or occur spontaneously ; rest, warm applications, and a few punctures afford relief. *Elephantiasis*, except to a very limited extent, is rare in this country ; but in warm climates the scrotum sometimes attains an enormous size from this hypertrophic condition ; excision is then the only remedy. Simple œdema of the scrotum, aecompanying general anasarca, may be relieved by occasional punctures. *Prurigo* usually occurs in old people, and is accompanied by distressing itching and irritation, very difficult to relieve : scratching the part excoriates it, and not infrequently lays the foundation for ulceration. The parts should be frequently bathed with warm water ; and moistened with lead or yellow wash ; flour to the surface allays irritation. Sweeps are subject to *epithelial cancer* of the scrotum, from the irritation, apparently, of the soot : if removed early, it may not recur.

Hydrocele is a collection of serum in the vaginal tunic of the testicle, over the front of which the fluid accumulates. It is known by its pyriform shape and transparency ; but it may be opaque if the tunic be thick or the contents mixed with blood : further, it may be complicated with hernia ; or the testicle may

* See case narrated by author, in twenty-eighth volume of ' Med.-Chir. Trans.'

be in front. In young children it is not very uncommon, and may be treated by repeated puncturing and evaporating lotions. In adults, the radical cure is effected by drawing off the fluid, and injecting one drachm of tincture of iodine in two or three of water, and leaving it in, subsequently poulticing the scrotum. *Hydrocele of the cord* may occupy the unobliterated tunic above the testicle, or the areolar tissue of the cord ; if puncture do not relieve, the swelling must be incised, and tbe wound should be dressed from the bottom. It is liable to be mistaken for a hernia occupying the inguinal canal, but can be distinguished from it by traction upon the cord.

Hæmatocele, or bloody extravasation into the tunica vaginalis, is usually the result of injury, such as a blow or a strain. Its history, rapid or sudden formation, and its opacity, distinguish it from hydrocele. If absorption do not take place after rest, support, and evaporating lotions, it may be desirable to draw off the fluid portion of the blood ; or even to make a larger opening should inflammation be excited : sometimes the tunic becomes excessively thickened in hæmatocele.

Varicocele is a varicose state of the veins of the spermatic cord; they feel like a bunch of worms beneath the skin. This swelling will disappear in the horizontal posture and under pressure, like hernia; but will reappear on change of posture, though the ring be closed by the fingers. It is more common on the left side than on the right. The scrotum should be supported by an elastic bag-truss, or a radical cure may be attempted, as in other cases of varicosity, by obliteration of the veins. But this is attended with some risk. A metallic spring or leaden clamp will sometimes accomplish the same result more slowly but safely.

TESTICLE.—This organ may be *hypertrophied* from being over-fed with blood ; or *atrophied* from pressure, or as a sequence of that *neuralgic* affection which seems closely allied to irritable breast in the female : also from varicocele, or from not having descended into the scrotum. *Inflammation* may result from injury, or it may be secondary, as in gonorrhœa, or metastatic, as in mumps. An acute attack requires active antiphlogistic treatment and local bloodletting. Induration of the epididymis

is a common and persistent consequence; suppuration is more rare. *Tubercle* in the testis is not uncommon, and is often followed by suppuration, terminating in tedious sinuses, or succeeded by fungating granulations. In this condition the testicle is often spoiled and useless; and being merely a source of irritation had better be removed. *Sinuses* may be healed by injection, though rarely: pressure may keep down the fungating granulations; but the most certain method of dealing with them is to shave them off; and then, paring the edges of the opening, to bring the adjoining borders of it together with a pin or suture. *Fibroid* growths in the testicle are rare; but fibro-cystic or fibro-cellular are less uncommon. *Cancer* is seen in all its forms, though the medullary is by far the most frequent.

In the operation of castration, care must be taken to secure the cord, before dividing it, lest it should retract; and the silk guard, with which it is transfixed, should not be removed until the risk of secondary hæmorrhage is passed. This operation may be needed for the above diseases, or for tubercular testicle where the gland structure is destroyed.

FEMALE ORGANS. BREAST.—This gland is occasionally the seat of *hypertrophy* from hyperæmia; and also of *atrophy* from various causes. **Irritable breast** is a neuralgic affection, accompanied by unnatural fulness, which may affect some particular part of the gland, suggesting the existence of a tumour. It occurs in young women, and is generally attended with defective menstruation, leucorrhœa, pain in the back, and probably other hysterical symptoms. It is to be treated chiefly by attention to the general health, and the exhibition of steel and other suitable tonics: fomentation and the local employment of belladonna may afford relief in this troublesome affection.

Tender or *fissured nipples* cause great suffering in nursing. An astringent lotion will harden the tender, excoriated part; and immunity may often be secured by diligent employment of such a remedy for some time before confinement. When unrequired milk accumulates, it should be drawn off; the application of belladonna is efficient in restraining the secretion. Sometimes the milk will accumulate, forming a

fluctuating tumour, and excite ulceration for its evacuation, without suppuration ; it should be relieved by puncture.

Acute **inflammation** of the breast may be the consequence of a blow, or occur without any apparent cause ; but it is most commonly occasioned by retained or obstructed secretion, and usually terminates in abscess. Pus will sometimes find its way through the nipple, and milk and pus are not infrequently mingled. These abscesses may be superficial, but are oftener deep-seated ; and diffused in some instances, so as to occupy a large space before approaching the surface. Warmth and moisture should be diligently employed until fluctuation is distinct ; by thus waiting there is less probability of subsequent sinuses forming, which are often very troublesome to heal, and require free incision.

Chronic inflammation, accompanied by induration, and in some instances terminating in suppuration, may occur at any period of life. The similarity of feel and symptoms may sometimes render the diagnosis between this condition and scirrhus perplexing ; but the history and development of the disease can rarely leave room for doubt : the treatment should be by general support, local soothing, and, if it can be borne, graduated pressure.

Cysts, with various contents, are met with in the breast ; they may contain serum, albumen, fatty matter, or fluid coloured with blood. These may be numerous, small and scattered, or may attain a large size : their texture is fibro-cellular and vascular ; and they are usually developed in the gland-tissue, though apparently in some instances they are originally dilated ducts. Fresh cysts and glandular growths, springing from the interior of a parent-cyst, will burst through the containing cyst and ulcerated skin, and present a protruding vascular mass, which then grows apace. These cystic productions are not necessarily malignant, though they are often recurrent and associated with cancer.

Fibrous tumours, as well as *myeloid*, are rare in the breast ; and *tubercle* is never found in it.

The **mammary glandular tumour** (adenocele) is an independent growth, though presenting similarity to the struc-

ture of the true gland : the morbid deposit is contained in a capsule, and gradually encroaches upon and replaces the absorbed gland. It may commence on the surface or within the body of the true gland, and is often, though not always, rapid in growth. This tumour is movable, firm and elastic, and attended with but little pain ; its removal is usually successful, if none of the diseased texture be left.

Though the medullary and colloid forms of **cancer** are occasionally met with in the breast, they are rare compared with the fibroid form. The medullary is more often secondary than primary ; but it is not unusual to find that a cancer, originally scirrhus, is medullary in those portions which fungate or which are growing rapidly. *Scirrhus*, or hard cancer, is frequent in the breast, and almost always commences as an infiltration in the gland tissue itself, which it displaces as it grows. It is usually of slow growth, and rigid, irregular and cartilaginous to the touch : but these characters are less marked when the growth is rapid. The nipple is often retracted, and the pain is of a sharp, lancinating, or plunging character and not constant. This disease is most frequent at or soon after the middle period of life, and is often hereditary. As it advances the general health becomes more involved ; but in many instances these tumours remain comparatively inert for a considerable time. On section of a scirrhus breast, the surface assumes a hollow appearance moistened with exudation, and presents radiating fibrous bands or limbs ; and the gland-ducts may be seen traversing the hard surface. (For microscopical appearances, see Tumours, page 54.) The question of operating must be determined by various circumstances ; such as the age and health of the patient, the history of the case, its progress, the condition of the neighbouring lymph-glands, &c. ; and especially the presence or absence of disease in other parts. The statistics of this operation are not of a character to justify indiscriminate interference, or to encourage sanguine hopes of non-recurrence of the disease, except in rare and favorable cases.

The LABIA PUDENDI are occasionally the seat of hypertrophic enlargement or elephantiasis, similar to that affecting the scrotum, and must be dealt with in the same way, by excision

of the redundant portion : this is rarely needed. If the seat of warty growth, the morbid mass must be destroyed by escharotics, or excised with a knife. Encysted or other tumours of this part must be excised. Extensive ecchymosis of one or both of the labia may result from contusion. Usually this will disperse spontaneously ; but, if persistent, a small puncture will allow of the blood being squeezed out ; and though some suppuration may follow, the part will heal under soothing applications. Abscess of the labium must be treated as in other parts. Adhesion of the labia in children is sometimes a source of anxiety to mothers and nurses : usually a small opening is visible, and a director will readily separate the edges.

NYMPHÆ AND CLITORIS.—Hypertrophic growth of either of these parts can be remedied by excision. The clitoris organ is occasionally the seat of epithelioma, and may then be safely removed by the écraseur.

Contraction of the external opening of the vagina, the consequence of sloughing after protracted labour is difficult to deal with ; gradual dilatation is the best treatment : the knife is rarely available, unless (which is very rare) there be complete occlusion of the vagina.

UTERUS.—*Polypus* of the os or interior of the uterus must be treated with ligature ; the risk of hæmorrhage forbids the use of the knife. For hæmorrhage use the solution of the perchloride of iron. A vascular and very sensitive growth sometimes makes its appearance at the orifice of the urethra. Cautious application of nitric acid may destroy it ; otherwise it must be excised. It has been proposed to relieve prolapsus of the uterus by excision of a portion of the vagina ; this requires great caution ; the instruments now adapted to support the womb are generally preferable.

Vesico-vaginal and **recto-vaginal fistulæ** are distressing conditions. If small, the application of a heated wire, at intervals, may suffice to close the aperture. Larger openings must be closed by paring the edges and bringing them together with metallic sutures, as presently to be described.

Carcinoma uteri unhappily admits only of palliative treatment.

This organ has been partially—it is said entirely—removed ; but this proceeding is scarcely admitted now into the category of the justifiable operations of surgery.

Large **ovarian cysts** admit of being tapped in the same manner as that operation is performed for ascites; but sometimes the contents are too thick for removal in that way : this cannot be ascertained beforehand. The radical cure consists in entire removal of the cyst in suitable cases by the operation termed ovariotomy.

Ovariotomy.—The patient being recumbent, with the legs depending, or reclining in an easy chair, the linea alba is divided between the umbilicus and pubes, so as to admit the hand of the operator ; this opening is subsequently extended upwards and downwards, as occasion may require. The cyst is then opened with a large trochar and canula low down, and is retained at the surface by an assistant armed with a hook, or forceps, or by a suitable adaptation attached to the canula for that purpose. The emptying of the sac is favoured by lateral pressure. The cyst if single is then gradually drawn out of the abdomen, any adhesions being carefully separated, and fine ligatures applied to bleeding vessels, and cut close. The pedicle should be included in a clamp ; and the edges of the wound are then to be adjusted with uninterrupted suture.

The **Cæsarean section** may be required for removal of a fœtus, where the outlet of the pelvis is so obstructed by deformity or the presence of a pelvic tumour, as to prevent a natural birth. For this purpose the length of the linea alba is incised, and the anterior wall of the uterus opened cautiously, to a sufficient extent to admit of the removal of its contents. The umbilicus must be avoided by a deviation of the incision to one side. The uterus contracts when it is emptied ; and the edges of the wound should be then adjusted with suture.

Perineal rupture may occur in difficult labour, the rectum and vagina being thrown into one outlet. This cannot be dealt with till the patient is in good health : sometimes this condition is accompanied by prolapse of the posterior wall of the vagina or of the uterus. The points of importance to be attended to in this operation, are a free but accurate section of the entire

edges of the rupture, so as to present a broad surface for adaptation; and the application of metal sutures at a sufficient distance—say half an inch—from the margins, to prevent the risk of their yielding by ulceration at the points transfixed : the movable shot splint, or even a simple twist of the wire, answers the desired purpose of fixing them. The sutures should be left in six, or eight, or ten days, according to circumstances ; and two or three must be applied, according to the extent of the fissure. An elastic catheter should be fixed into the bladder ; and the bowels must be kept quiet with opium.

In *vesico-vaginal fistula*, the same precautions are to be exercised in the performance of a similar operation. Paring the edges of the fissure in this deeper operation is facilitated by transfixing them successively with a two or three-pronged director, beyond which the knife has to be carried in making the requisite section for paring the edges : by passing the prongs of this director between the tissues, and not through the mucous membrane of the bladder, a larger raw surface is obtained.

Catheterism in the female is to be performed by passing the right hand, with the instrument, beneath the lifted right thigh of the patient ; whilst the tip of the forefinger of the left hand rests between the nymphæ, immediately above the depression which marks the position of the urethra. If this precaution be not taken, the catheter may be passed into the vagina, or between the nympha and labium.

SECTION VI.

OPERATIVE SURGERY; INCLUDING OPERATIONS OMITTED IN THE PRECEDING PAGES, AND DEFORMITIES ADMITTING OF SURGICAL RELIEF.

General remarks.—Although the natural qualifications of good sight, a steady hand and self-possession are necessary in an operating surgeon, an accurate acquaintance with anatomy acquired by actual dissection, and familiarity with the use of the knife, derived from the same source and from operating on the dead subject, are imperative. It is when in the presence of a serious and complicated operation, that the book-anatomist or library-surgeon experiences the fatal error he has committed; and is compelled to make his election between assuming a responsibility to which he is utterly unequal, and thereby incurring the fearful risk of destroying his patient; or that of shrinking from the responsibility, and leaving his patient to die for lack of the assistance which he dares not attempt to afford.

Before an operation is undertaken, every step of it should be carefully considered, and every anticipated contingency should be prepared for. All the necessary preparations should be superintended by the operator himself, and his directions should be clearly given to his assistants as to the part each is to take. Having divided his operation, if a complicated one, into its different stages, the operator's attention should be fixed exclusively on that with which he is occupied: this will prevent confusion and too great eagerness to reach the conclusion: and whilst he appreciates the duty of avoiding unnecessary delay, he must never lose sight of the ultimate welfare of his patient as the paramount obligation under which he should

act, and to which no mere personal consideration should blind him.

In using the bistoury or scalpel, it may be held as a pen or as a table-knife, according to the taste or habit of the operator. Incisions through unimportant soft parts should be freely made ; and, as a general rule, where the ultimate object of the operation is deeply placed, the external excision should be long, as the succeeding steps are thus facilitated, and the subsequent discharge finds a more ready exit.

In **administering chloroform,** the condition of the patient's heart and lungs should be first ascertained, for, although certain forms of heart disease (valvular disease with or without intermittent action) do not contra-indicate the use of chloroform, yet others do (fatty degeneration with feeble irregular action) ; and it is advisable to know beforehand the condition of the heart in the event of accidents occurring during the administration of chloroform.   The vapour should be allowed to mix freely with the air : it should be inhaled slowly and gradually at first, and the quantity supplied should be limited to the object of rendering the patient insensible to suffering.   There is probably no better nor safer method of ascertaining this, than by making a compact with the patient that he shall, at request, give some token that he is still conscious.   Thus, by directing him to press an assistant's hand, or to raise his own whenever bidden to do so, the operator is enabled to judge of the precise moment when volition, and with it sensibility, ceases.   This condition may be prolonged as consciousness returns, by a few fresh inhalations.   In case of accidental suspension of respiration, water should be dashed smartly on the face ; and, if requisite, the tongue must be drawn forwards from the mouth, and artificial respiration practised, and galvanism employed.

Bleeding arteries may be twisted, and this is to be done by separating the vessel from the tissues, and twisting it three or four or half a dozen times.   In the case of large arteries the middle coat is felt to give way, when the twisting is to be immediately stopped.   Where the tissues are infiltrated and the vessels softened it is safer to ligature.   When the surgeon prefers to trust to the ligature the thread must be proportioned

to the size of the vessel. Acupressure needles are preferred by some.

Before closing a wound it should be carefully cleansed from all blood and clots ; and, as a general rule, it is better to leave a wound open and exposed, till serous exudation replaces true bleeding, *i. e.*, by admixture with the oozing which may still continue. Either metallic or silk sutures may be used in bringing the edges of a wound together ; and where lengthened support is required the sutures should be inserted at some distance from the margin of the wound ; in which case the metallic suture is preferable. The same remark applies to pins, and the twisted suture ; the points of such pins should always be cut off, after their insertion. The subsequent dressing of wounds, if any, should always be simple and cleanly ; beyond this attention the less interference there is the better ; a few strips of plaster, an evaporating lotion or a water dressing, are nearly all that is needed : bandages are rarely required except to afford support. Incised wounds very often heal more readily without any dressing at all.

Venesection.—In selecting a vein at the bend of the arm for bleeding, it is desirable to avoid the proximity of the brachial artery, which usually lies immediately beneath the median basilic vein. A broad tape being applied firmly a little above the elbow, the vein must be steadied with the thumb of the left hand, whilst the lancet is carried obliquely into it. When a sufficient quantity of blood is obtained, the bandage is removed, and re-applied, with a pledget of lint, over the wound, and tied below the elbow.

Tenotomy.—This operation is performed subcutaneously. A very narrow knife is used, and this must be passed across the tendon before the edge is turned towards it ; and the section is to be made from within outwards as it is withdrawn, or by a sawing motion until it gives way. The division is facilitated by first putting the tendon on the stretch. A few days should be allowed to elapse before any extending apparatus is applied.

Removal of tumours.—In excising solid or encysted tumours, it is rarely necessary to remove integument, unless the

tumour be of very large size ; healthy integument retracts when liberated from abnormal pressure. With the breast the case is different, as there is, so to speak, a normal redundance of integument corresponding to the gland. A sufficiently large knife should be selected where the tumour is large and solid ; the incision should be free, and shaped according to circumstances : a single incision rarely need deviate from a straight line. It is usually better to dissect up both sides of a tumour : some may be readily raised and isolated, as fatty tumours ; others, as cysts, require long and often tedious dissection. Unless the bleeding be excessive and the operation protracted, it is unnecessary to suspend its completion to apply a ligature ; an assistant's finger or miniature forceps will supply the requisite pressure until the operation is finished.

Excision of joints.—Any joint in either limb may be made the subject of excision. Before subjecting a patient to the risk of the operation on one of the large joints, it behoves the surgeon carefully to consider, on the one hand, whether he may not recover without it ; and on the other, whether he have a fair prospect of rallying from the effects of it. Limbs are, no doubt, now saved, which formerly would have been sacrificed ; but probably also joints are sometimes unnecessarily destroyed or life risked, by want of discrimination in the selection of suitable cases. In excision, it must be remembered that the joint itself and the surrounding soft parts are usually so far modified by disease, as to require special deviations from the described method of operating to meet the requirements of the particular case.

Shoulder-joint.—The head of *the humerus* may be removed by a simple perpendicular incision over it ; or by raising a flap of the deltoid, which is to be preferred if much room be required. The capsular muscles will require careful division if not already loosened by disease, and the head of the bone, being turned out from its articulating cavity, is to be cut through with a chain or bow saw from within, or with a common saw from without, the vessels and nerves being carefully protected. The glenoid cavity must be also examined, and dealt with according to circumstances. The elbow should be afterwards supported.

Elbow-joint.—A single longitudinal incision over the back of the joint is sufficient for exposing a diseased elbow; or a T-shaped or crucial incision may be employed. The olecranon is then to be sawn through or cut with bone-forceps, and the disarticulation completed by dividing the lateral attachments of the bones, so that the saw may be used in separating their diseased extremities. Care must be taken to secure the ulnar nerve from injury; it must be sought for behind the inner condyle of the humerus: the olecranon should be saved if possible. Recently an endeavour has been made to preserve the periosteum by careful dissection with a strong knife, or Langenbeck's "raspatory." The arm should be secured in a semiflexed position, the wound being left free for dressing. Passive motion may be begun when the progress of the case is sufficiently advanced; for considerable motion is sometimes restored after this operation.

Excision of the *wrist-joint* is sometimes justifiable, but care must be taken not to sacrifice the tendons in reaching it, owing to the consequent uselessness of the hand. It may be effected by a longitudinal incision on each side of the wrist, and the tendons are to be separated from the bones; care must be taken to avoid the radial artery. Portions of dead bone may be removed, as occasion may require.

Hip-joint.—If an attempt be made to remove the diseased head of the femur, the incision must be determined by its normal or dislocated position: a similar operation will enable the surgeon to remove the necrosed head of the bone, if left in the acetabulum. Rotation of the limb by an assistant will guide the operator to the upper extremity of the femur; the acetabulum must also be examined.

Knee-joint.—Excision of this joint has proved very encouraging. A large incision and free opening are required, and a semilunar flap, with its convexity directed downwards, is the best. The horns of this incision should extend well above the condyles of the femur, and sufficiently far back to secure a broad flap: the convexity should cut across the ligament of the patella. This bone being turned up, the lateral and crucial ligaments, if still undestroyed, must be successively divided quite

to the back of the joint, the leg being forcibly flexed by an assistant. The diseased surfaces of bone must be sawn through with a bow saw from behind forwards, either horizontally, or in a wedge-shape, so that the opposing surfaces shall fit into each other; and the patella is to be treated, if necessary, in the same way, by paring its surface, or it may be entirely removed. Every particle of accessible disorganized tissue should be dissected away; and the flap afterwards carefully adjusted with metal sutures. The subsequent position of the limb is to be on a long, well-fitting splint, very slightly flexed, with an extending screw for use, as needed. The dressing in this, as indeed in all these cases, should be plain water, or the surface may be left exposed.

Excision of the *ankle-joint* is a difficult operation, and one it is rarely advisable to undertake. It is preferable to sacrifice the foot in most cases, by removal at the ankle-joint, and resection of the extremities of the tibia and fibula.

Excision of bones.—*The Clavicle* may be removed by an incision along its entire length, and division through its centre, so that either extremity may be separately raised and dissected from its attachments. The important subjacent textures must be carefully guarded.

The Scapula may be removed, the arm being retained. For this purpose free incisions are required, to expose the diseased structure; and considerable hæmorrhage must be expected from the division of large arteries.

The Maxillæ.—The upper jaw may be removed in part or entire: when practicable, it is desirable to save its orbitar plate. One long incision may be made from the outer part of the orbit to the angle of the mouth, and a shorter one, joining the first at an angle, must be carried along the zygoma. The flap thus marked out must be raised; and this will be facilitated by division of the lip in the median line. The alar cartilage is then to be separated from its bony attachment. The zygoma, the fronto-malar junction, and the nasal process of the superior maxilla have next each to be divided with bone-forceps; the palatine plate is then similarly treated to the exclusion of the velum, and of the palate-bone if possible. The bone, with the

tumour occupying it, may then be drawn out, and the operation completed. The adjusted flaps are to be supported by wet lint in the cavity thus left.

Another mode of proceeding is to carry the incision through the lip, along the side of the nose and below the orbit to opposite its outer angle ; if necessary, another incision may be extended from the angle of the mouth towards the ear and the flap thrown outwards.

In excising half of the *lower jaw*, a long incision must be made from the condyle to the angle, and then, along its lower border, to the symphysis of the bone. The flap must be dissected up, and the membrane of the mouth divided. The symphysis has then to be cut through ; and the bone, being everted, has to be cautiously cleared of its deep connections before the condyle is disarticulated. The hæmorrhage attending this operation is often, but not always, abundant. The whole jaw, or a portion only of one side, or the symphysis, may be likewise removed ; but by operations modified acccording to circumstances.

AMPUTATIONS.

General remarks.—In all amputations, the primary object of the surgeon should be to secure a sufficiency of flap or flaps to close the wound : for this purpose a single or double flap, or one made by a circular incision, may be employed according to circumstances. If muscle be included in the flap, there must be security for the skin extending well beyond it ; and it is well to remember that, in amputations for recent injuries, the retraction of the skin is much greater than in amputation for long-standing disease. Practically this is the case, though the explanation probably is that the healthy, well-exercised muscle contracts much more during incision than that which has been long disused ; and that, therefore, after division, its subsequent relaxation leaves it, relatively, much longer than the skin. Attention to this hint will obviate much disappoint-ment, especially in flap operations. In amputations of the lower

extremity the patient should be recumbent : in those of the upper, a sitting posture, if practicable, is generally more convenient.

Assistants are required for commanding the bleeding, for tying ligatures, and for sponging. Where dependence can be placed on the assistant, the best mode of commanding an arterial trunk is by compression with the thumb or fingers ; but in this case great care is required to steady the limb when the bone is sawn through, or all command may be lost over the artery, as at the groin : otherwise a spring clamp, or screw tourniquet with a suitable pad, may be employed. Where it is important to save blood, the limb may be raised for a few moments, to favour the unloading of the vessels, before pressure is applied, and this should immediately precede the incision.

Flaps may be made either by perforating the soft parts and cutting from within outwards, or in the reverse way ; in the latter case, as in the circular operation, the skin should be made tense by drawing it from the extremity of the limb. It should be remembered that in flap operations, especially those made by perforating, vessels are often cut obliquely. In general skin-flaps make better stumps than those which include muscle.

In securing an artery of any size, two pairs of forceps are required ; one for seizing the vessel, and the other for clearing away the surrounding textures ; and the ligature should be firmly tied high up. A tenaculum is often very useful in seizing and drawing out smaller arteries, when it is less important to exclude other textures : one end of the ligature should be cut off. Veins should not be tied if it can be avoided ; but sometimes it is necessary to secure them ; and sponging the surface with equal parts of spirit and water assists in arresting oozing, and in preparing the wound for adhesion by coagulation of the albumen.

The knives used should be proportioned in size to the bulk of the part to be removed : in all operations on the hands and feet a long and very narrow bistoury is the most convenient. In dividing a bone the saw should be first drawn from heel to point, and used lightly without pressure, and with a free sweep

backwards and forwards ; the holding assistant being directed to avoid raising the limb, by which the saw is nipped, or depressing it, by which the bone is splintered. During this part of the operation the soft parts must be carefully protected with the hand or a linen retractor. A stump should not be closed until all bleeding has ceased : and tight bandages must be carefully avoided, if any be employed. A piece of lint dipped in water is all that is needed, over the sutures or strips of adhesive plaster : but it is still better to leave the wound exposed.

UPPER EXTREMITY.—In removing either of the **phalanges,** a palmar flap is to be preferred, when practicable. The phalanx must be bent, and the knife carried across the joint, which, it must be remembered, is not at the angle formed by the conjunction of the two bones, but anterior to it. When the joint is laid open, each lateral ligament is to be divided ; and then the flap is formed, by measurement, from the front.

Fingers.—In removing the *ring* or *middle* finger at the *meta-carpo-phalangeal* articulation, the intervening web, connecting it with its lateral neighbours, is to be divided by incisions which meet at an acute angle opposite the joint : the tendons in front and behind must then be cut through, and the disarticulation completed by dividing the lateral attachments of the bones. If a strong hand be required the head of the metacarpal bone should be left : but more symmetry is secured by removing it with a small saw or bone forceps. In removing either the *fore* or *little* finger at the same articulation, the flap should be taken from the free border ; and caution must be observed in securing a broad piece of skin, by pinching it up before perforating : the flap should be commensurate, or nearly so, with the length of the first phalanx.

The *thumb* or little finger may be removed, including the metacarpal bone, by an extension of the last operation ; *i. e.*, in either case by carrying the incision down to the carpus ; and after disarticulating and turning out the metacarpal bone, by separating a broad measured flap from it, cutting from above downwards or towards the phalangeal extremity of the member. A single side-incision along the whole length of the metacarpal bone will enable the surgeon to accomplish the same result.

Wrist-joint.—The hand may be removed at the wrist-joint by either a circular or double-flap operation ; care being taken to secure sufficient integument, which is apt to retract much at this spot, as indeed at any part of the fore-arm. The styloid processes may be left or removed at pleasure. The proximity of the ulnar nerve to the artery should be remembered, in tying the vessels.

Forearm.—Amputation may be performed at any part of the forearm, either by a circular or double flap incision : in the latter case, perforation with a narrow catlin is to be preferred ; but much muscle should not be included.

Upper-arm.—Amputation above the elbow is best performed with a circular flap of the skin only : the profundæ arteries will probably require torsion or ligatures as well as the brachial. Amputation at the elbow-joint is an unadvisable operation.

Shoulder-joint.—Although circumstances may require a variation in this operation, such as the formation of a double flap, in front and behind, the best method of removing the arm at the shoulder-joint is by making a flap from the deltoid to cover the exposed axilla. On the right side the point of a long knife is made to perforate the shoulder a little below the acromion process, and at the anterior margin of the deltoid ; it is then carried over and round the head of the humerus, and pushed out at the posterior fold of the axilla : by cutting outwards and close to the bone a large flap is formed, including the entire deltoid to its insertion. The capsular muscles being next divided, the arm is carried across the chest to facilitate its disarticulation. When this is accomplished, the knife is carried downwards on the inner side of the bone until the separation is completed. The only variation, when the left arm is the seat of operation, is, that the knife is entered at the posterior wall of the axilla, and brought out at the anterior margin of the deltoid. The subclavian artery must be compressed above the clavicle, with the thumb, or the handle of a large key carefully enveloped in lint ; and an assistant should be prepared to seize the artery as soon as it is exposed : if essential, the artery may be secured before division, by arresting the operation at the proper stage :

but this is scarcely needed where assistants are to be depended on. If the tubercles only can be saved the bone should be sawn through, as the attachment of the rotator muscles renders this small fragment of the bone useful.

LOWER EXTREMITY.—Operations on the **toes** are similar to those already described as applicable to the fingers; and it must be borne in mind that the value of the great toe in the foot is scarcely inferior to that of the thumb in the hand : it should therefore be preserved whenever it is practicable; or as little of it as need be sacrificed. Removal of the entire toe, with the metatarsal bone, must be effected by disarticulating it from the inner cuneiform, and making a long and broad flap from its inner side.

In removing the toes with the **metatarsal** bones, the disarticulation is accomplished from above, and the flap is to be made from the sole of the foot. In this amputation (*Hey's*) remember that the line of articulation between the metatarsal bone of the great toe and the internal cuneiform bone is directed towards the head of the fifth metatarsal bone, while that between the cuboid and outer metatarsal bones is directed towards the head of the first metatarsal bone.

In the operation known as *Chopart's*, the calx and astragalus alone are left. In this operation, also, the disarticulation is effected from above, the incision being guided by the navicular bone on the inner side and the cuboid on the outer. The flap is made from the plantar integument.

Ankle-joint.—This very satisfactory operation (*Syme's*) is thus performed :—The anterior incision should extend in an oval direction from the point of the outer malleolus to just behind the inner, securing just sufficient front flap to extend well beyond the base of the tibia : more is undesirable, as the cicatrix must be anterior to the seat of pressure. The lower incision, *i. e.,* the anterior margin of the posterior flap, should be directly beneath the malleoli, and extend transversely across from one to the other; and this incision should be carried freely and at once down to the bone. The skin and fat should be peeled carefully from the heel-bone, until the great tendon is reached; and this requires both time and caution to accomplish. Then

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the ankle-joint may be dislocated from the front ; and the tendo Achillis is the last part to be divided. The malleoli must be sawn off, and also, if diseased, the articular surface of the tibia. Care should be taken to divide the plantar arteries, if possible, *after* the bifurcation of the posterior tibial. *Pirrie* has introduced another mode of performing the operation, by sawing through the lower end of the tibia and fibula at once and dissecting out the heel afterwards. Sloughing of the cellular tissue and of a portion of the posterior flap is an occasional occurrence ; and therefore the latter should be of ample dimensions. After clearing away diseased tissue, and when the bleeding has ceased, the flaps are to be adjusted with wire sutures. The steps of the operation are sometimes reversed, and the proceedings hastened, by first disarticulating, then dividing the tendo Achillis, and subsequently dissecting the flap from behind forwards.

A modification (*Pirogoff's*) of this operation consists in leaving the tuberosity of the os calcis, by sawing through the bone in its centre, and adapting it to the sawn base of the tibia. This method is less tedious, but the success, as it depends on the union of the two bones, is not so certain as in the operation at the ankle-joint.

Leg.—In amputating below the knee, either a single flap of muscle and skin may be obtained from behind, or a double skin or circular flap operation may be performed. The circular is, on the whole, the best. It is undesirable to leave more of the leg than sufficient to form a rest for a wooden substitute, unless it be intended to adapt an artificial limb of more complex make, unsuitable to a working man. The tibia should be cut through immediately below its tubercle, the sharp point of which may be sawn off obliquely.

Amputation at the knee-joint is not to be recommended ; but a good stump is secured by cutting through the femur just above the condyles, after making a single long flap in front, by a crescentic incision extending across the joint just below the patella and terminating, on either side, immediately above and behind either condyle.

Thigh.—Amputation of the thigh should be performed as

low down as convenient. Either the circular skin flap, or double flap with or without muscle, may be practised ; the latter is to be preferred. A long and rather narrow knife is to be used for forming the anterior flap, by cutting from without inwards, and drawing it from heel to point : then, without removing the knife, the point is made to perforate the thigh behind the bone, by carrying it from the terminal extremity of the first incision, till it makes its appearance at the corresponding point on the opposite side : this second section, for the back flap, is made from within outwards : the remaining soft parts are then cleared from the bone before the saw is used. Lateral flaps are sometimes to be preferred.

Hip-joint.—Disarticulation at the hip-joint may be effected by the same operation as the above, higher up : both incisions should be made from within outwards, *i. e.*, by perforation or transfixion, the point of the knife entering midway between the anterior spine of the ilium and the great trochanter, and making its exit, after crossing in front of the bone, on the pubic side high up. The anterior flap, long and full, being completed, the posterior section is made in like manner, after the capsule, round ligament, and capsular muscles have been divided, and the head of the bone has been disarticulated. The abdominal aorta should be compressed.

The Breast.—Small and non-malignant tumours of the mamma may be extirpated without meddling with the gland, or removing more than the neighbouring portion to which such tumour may adhere. But in scirrhus it is rarely justifiable to leave any portion of the gland. In removing the whole breast the patient may be sitting or recumbent. A large and long scalpel should be selected, and the incisions should be deep and free. The amount of integument to be sacrificed must be determined by the size of the breast and tumour ; and the form of the incisions must depend on these and other accidental circumstances. Where it is practicable, a crescentic piece of skin may be included between two incisions meeting at their extremities ; the edges of the wound can thus be afterwards more accurately adapted. The dissection being well carried beneath one side, the mass is turned over and the extirpation

completed.   Great care should be exercised in leaving no portion of disease behind ; and this caution is especially requisite when there are deep adhesions, and the diseased tissue has to be dissected up from the pectoral muscles.   If there be indurated glands they must be removed : but an operation would scarcely be undertaken, unless under exceptional circumstances, where such lymphatic contamination was known to exist.   When the bleeding vessels are secured, and the hæmorrhage has ceased, the edges are to be kept in contact with sutures and light strips of plaster, the arm being kept by the side : or sutures alone may be used and the wound left exposed.

The Penis.—In cancer of the penis, before the lymphatic glands are involved, this organ may be amputated, care being taken to get well behind the disease.   The removal may be accomplished at one sweep of the knife ; and, the remnant of the organ being held firmly by an assistant, the dorsal and the cavernous arteries are then tied.   As the wound heals, care must be taken that the contraction does not close the urethra : on account of this tendency it is desirable not to preserve too much skin.   The bleeding after this operation is sometimes very troublesome.   A catheter is not needed ; but when cicatrisation is advancing a bougie should be frequently introduced into the urethral orifice.   Most contraction takes place after the wound is healed.

LIGATURE OF ARTERIES.

GENERAL REMARKS.—The instruments required for tying an artery are, a scalpel, with the extremity of the handle sharpened, a director, retractors, a pair of forceps, an aneurism needle of firm metal, armed with a strong silk or catgut ligature of size corresponding to that of the vessel.   A needle of the common form is usually the best ; and the extremity of the handle may be notched or perforated, to hold and keep the loose portion of the ligature from falling into the wound.   The

external incision should be free, and longer where the artery is deep : in every respect this is desirable, both as facilitating the operation, and also the after healing of the wound by permitting the ready discharge of pus. In exposing the artery it must be disturbed as little as possible in its cellular bed ; and the needle must be passed around it with the same precaution. When the extremity of the needle presents itself on the opposite side of the vessel, the nail will probably suffice to scratch an aperture for its exit : the ligature is then to be seized with forceps and drawn through, whilst the needle itself is withdrawn. The ligature is not to be tightened till its pressure is proved to be sufficient to arrest bleeding or the admission of blood into an aneurismal tumour : it is then to be tied firmly with a plain double knot. If the ligature be of catgut, the ends are to be cut off close to the knot and the wound closed ; and the embedding or organization of the catgut is hoped for (see page 105). If the ligature be of silk, one of the ends is to remain outside the wound and the other should be cut short : it is advisable to guard the loose ends with a strip of adhesive plaster, near the wound when it is dressed. The edges of a long wound may be held together with one or more sutures, space being left for the escape of discharge. The period which elapses before the separation of a silk ligature—which should be quite spontaneous—varies, according to the size of the vessel and distance from the heart, from a week to a fortnight or three weeks. In ligature of the larger vessels, about the tenth or twelfth day is the most critical period ; though hæmorrhage from ulceration and premature separation of the ligature may take place earlier. If retained beyond a reasonable time, the ligature may be put gently on the stretch, and fixed over a little roll of plaster with a strip of the same, so as to raise it perpendicularly ; but even this must be done cautiously.

In conducting the dissection for laying bare an artery, muscular tissue should never be divided, if it can be avoided by separating the cellular connections of adjoining muscles : great perplexity is occasioned by want of attention to this precaution.

Radial artery.—Ligature of this or of the ulnar artery is

generally required for wound, and the position is therefore determined by the seat of injury. At the wrist and through the greater part of its course, where it is accessible, the radial artery lies between the supinator longus and flexor radialis; here it is to be sought, and will be found beneath the fascia, and overlapped above by the muscles : it is accompanied by two veins, but the nerve leaves the artery at the lower third. The skin should be divided to the extent of two inches.

Ulnar.—This artery is to be sought for beneath the fascia, by separating the flexor ulnaris from the flexor sublimis, under cover of which it lies deeply above ; but it is comparatively superficial below, where it is still overlapped by the flexor ulnaris. It is accompanied by two veins, and has the ulnar nerve on its inner side, throughout its course.

Brachial.—At the bend of the elbow the brachial artery lies beneath the aponeurotic expansion from the biceps tendon, having the tendon itself to its outer side and the median nerve on the same plane and to its inner side. This artery may require one or two ligatures here, for wound, or varix dependent on wound. The superficial veins must be guarded from injury. The superficial position of this artery through the arm renders it easy of access at any point higher up : in cutting down on it the large basilic vein must be avoided ; and care must be taken that a nerve is not mistaken for the vessel, and that a high bifurcation does not frustrate the object of the operation. It is well to remember that the nerve which can be felt to roll under the fingers most easily is the ulnar, and does not accompany the brachial artery in the lower three fourths of the area. A line drawn from the outer angle of the axilla to the middle of the bend of the elbow will indicate the course of the artery.

Axillary.—Ligature of this artery is rarely practised. It may be tied by opening the axilla itself, where it is surrounded by nerves and its large vein is superficial. If an attempt be made to tie the artery higher up, the great pectoral muscle must be divided to a sufficient extent to expose the smaller muscle of the same name, which may be drawn downwards : after the strong fascia in this position is divided the artery will be found,

having the nerve cords above and the vein below and to its inner side.

Subclavian.—The position selected, when practicable, for tying this artery is in the third division of its course, where it lies external to the scalenus muscle. The difficulty of this operation is greatly enhanced by the elevation of the clavicle, where there is aneurism of the axillary artery high up. The subclavian artery in this position will be found in the angular interval between the first rib and the insertion of the scalenus muscle into it, and at this point a small tubercle or ridge can commonly be felt. To seek for the scalenus, and to trace it to its insertion, should therefore be the object of the operator ; all other guides are fallacious. The vein which lies in front of the scalenus need not be exposed, nor offer any obstruction to the exposure of the artery : the nerves lie above and behind the latter, and the lowest of these large cords may be, and has been, mistaken and tied for the artery. To obtain ample space for the deep dissection, two incisions should be made, one horizontally above, or, rather, over the clavicle when the skin is drawn down, and about three inches in extent : from the inner extremity of this incision, which should reach to within an inch of the sterno-clavicular joint, another short incision should extend vertically upwards ; and the flap of skin thus defined can be dissected up ; some fibres of the sterno-mastoid may be divided with advantage. After this the knife is but little required, but the cellular connections are to be separated with a blunt instrument until the scalenus muscle is exposed. When the artery is distinctly felt pulsating, the needle is to be carried round it, by introducing it from before, and directing it backwards and upwards.

Carotid.—The common trunk may be tied low down, or higher up and nearer to its bifurcation. Below, it is more deeply placed, not only under cover of the sterno-mastoid muscle, but also beneath the sterno-hyoid and thyroid. Above the point of divergence of these muscles the artery is comparatively superficial, and may be exposed by an incision extending downwards for two or three inches, from the os hyoides and along the border of the sterno-mastoid muscle ;

the fascia and platysma being divided and the edge of the muscle drawn aside, the sheath of the vessels is exposed, with the descendens lingualis lying upon it ; the jugular vein is behind and external to the artery, and the pneumogastric nerve lies between them : the aneurysm needle should be passed from behind forwards. In tying the artery lower down, an incision of similar length must be made, but reaching to the sternum, along the border of the sterno-mastoid muscle : the sterno-mastoid being drawn outwards, and the sterno-hyoid and thyroid inwards, the artery is exposed, partly overlapped by the jugular vein, and more so on the left side than the right. In these operations the superficial veins, especially one or two crossing the sheath high up, must be avoided.

In deep, penetrating wounds of the neck high up, attended by arterial hæmorrhage, it is safer to tie the common trunk at once than to search, at great risk and probably in vain, for the bleeding vessel, which may be either the external carotid or its branches, or the internal trunk. The short interval between the origin of the external carotid and the distribution of its branches is a serious, if not insuperable, objection to placing a ligature upon this vessel, except in case of wound. Some of its branches may require ligature under similar circumstances, as in attempted suicide, and in operations on the neck and face.

The **anterior tibial** artery may be tied, as it crosses the tarsus, where it will be found immediately to the outer side of the extensor pollicis tendon : lower down it sinks between the first two metatarsal bones. It is accompanied here, as higher up, by two veins and a nerve, the latter being usually on its outer side. Throughout the leg, the anterior tibial artery lies on the interosseal space, having the tibial muscle to its inner side throughout ; on its outer side the long extensor overlaps it in conjunction with the last-named muscle, and here it is most deeply placed : in the middle of the leg the long extensor of the great toe is interposed between the other two muscles, and here the artery is to be sought between the extensor pollicis and tiabialis anticus. In the lower third of the leg the extensor of the great toe crosses to the inner side of the

artery, which is then found between this muscle and the common extensor. In seeking for the vessel between its muscular coverings, it is requisite to pay particular attention to the caution not to divide the structure, but simply to separate the cellular connections, of the adjoining muscles : care must therefore be taken to mark the line of separation between adjoining muscles, and this is effected by manipulation of the foot, and by the use rather of the handle than of the edge of the knife.

The **posterior tibial** artery occupies a deeper position than the anterior by reason of the extra layer of muscles on the back of the leg ; and the attachment of the soleus to the tibia renders it still more difficult of access : it is accompanied by two veins, and a much larger nerve than the anterior tibial, which lies behind and generally to the outer side of the vessels. *At the inner ankle* the artery is comparatively superficial, and lies between the tendons of the long flexor muscle in front, and the flexor of the great toe, which is at some distance behind it. In this position the artery may be felt pulsating, and may be compressed, or tied, without much difficulty. *In the calf* the artery may be secured by cutting through the centre of the superficial muscles ; but this operation is not admissidble, except in a thin limb, for punctured wound. The better method is to separate the inner head of the soleus, on a director, from its attachment to the tibia. The external incision parallel with the posterior edge of the tibia and about an inch behind it, should be free for this purpose, as the vessel will be found at a considerable depth. No other muscle should be meddled with ; but the dense intermuscular fascia which binds down the deep muscles and vessels must be divided freely, in a longitudinal direction, on a director ; and the artery will be found, immediately beyond the outer or more distant edge of the tibia.

In cutting through the soleus the strong tendinous origin of the muscle lies deeply, and often in the midst of its fleshy fibres : this must not be mistaken for the intermuscular fascia, which is more pearly than white in appearance. In this operation it is possible, if the incision be made too near to the

edge of the tibia, to get into the substance of the deep muscles, and so in front of the artery.

The **popliteal artery** is rarely made the subject of ligature. It occupies a deep position as it traverses the space of that name, after entering its inner side from Hunter's canal. To find it, a long incision through the centre of the ham is required, and after the fascia is divided, the artery is to be sought to the inner side of, and nearer to the joint than, the internal popliteal nerve and the vein.

The **femoral artery** may be tied at any point between Poupart's ligament and the upper part of Hunter's canal : but, unless any special circumstance determine the spot, the lower part of Scarpa's triangle is to be preferred, where the artery is overlapped by the sartorius muscle. The superficial incision should be free and parallel to and *over* the sartorius, to avoid the saphena vein which lies over its inner border : the risk of cutting on the long adductor instead of the sartorius will be thus avoided, and the wound will be directly over the sheath of the vessels. The last-named muscle, being exposed to a sufficient extent, is to be turned aside outwards, and its dense aponeurotic sheath brought into view : this must be carefully slit open, and the vessels will then be seen in their cellular bed.

The tendinous fibres of the vastus internus must not be mistaken for the aponeurosis of the femoral sheath ; nor the nerve to the vastus for the long saphenous nerve. The vein lies to the inner and back part of the artery, and the saphenous nerve to its outer side ; another nerve, more superficial, must not be mistaken for that within the sheath. The best direction in which to pass the needle is from without inwards, as its point can thus be inserted between the two vessels ; but this is not important. In this operation the limb should be flexed and laid on its outer side.

The **external iliac** artery must be reached by an incision a little above Poupart's ligament, which should commence to the outer side of the external ring, and be carried upwards and outwards for about three inches towards the spine of the ilium. The cord must be cared for, whilst the aponeurosis of the external oblique, as well as the internal oblique and transversalis

muscles and the fascia, are divided on a director. The peritoneum is then to be carefully separated from its cellular connections, and the aneurism needle introduced around the artery from within outwards, *i. e.* between it and the vein.

Internal and **common iliac** arteries.—To reach these vessels a longer incision is required, which should extend from the middle of Poupart's ligament, upwards and a little outwards in a curved direction—the convexity of the curve being towards the iliac spine: the remaining steps of the operation are similar to those of the last: the ureter crosses the bifurcation of the common trunk; but it follows the peritoneum, when that membrane is separated and lifted from the vessels.

The **abdominal aorta** may be reached by the same operation or a modification of it, by which the incision is carried somewhat farther upwards and backwards, on the left side.

TORSION OF ARTERIES.

GENERAL REMARKS.—Torsion or twisting of arteries has now been so commonly adopted for arresting hæmorrhage after amputation that the use of the ligature is much diminished. Torsion is equally applicable to large and small vessels, and has the especial merit of not requiring the surgeon to leave a foreign body in the wound, and of being useful in controlling hæmorrhage from veins as well as arteries. However, the danger of using the ligature upon veins has probably been much exaggerated.

For the purpose of torsion a pair of special forceps is advisable. These should work easily, and hold firmly by rather broad points. The artery should first be well separated from surrounding tissues by means of a pair of ordinary dissecting forceps, and then be seized by the torsion forceps. Should the artery be large, it is well to pass one blade of the forceps into the interior of the vessel, and to steady the artery by holding it firmly above in

the blades of another pair of forceps; this will prevent the twisting of the vessel from extending too far upwards, and ensure a more ready rupture of the middle coat. Smaller vessels may be seized with or without previous isolation.

The number of turns which must be given will depend upon circumstances, and no absolute rule can be made, but it is usually sufficient to give from three to six or seven. In larger vessels the middle coat can be felt to give way and then it is unnecessary to twist further: in fact further torsion is dangerous, as the end of the vessel may be entirely twisted off, and the plug formed by the retracted middle coat may be insufficient to prevent hæmorrhage from the now shortened vessel. A slight untwisting of the artery follows the removal of the forceps, but this should not be sufficient to reopen it.

The effect of torsion is to twist the outer coat completely, and by that means to form a bar to the flow of blood: at the same time the middle coat, being softer, thicker, and more readily torn, is ruptured, and when ruptured retracts and closes; and a peculiar feature of this part of the process is, that in retracting the torn edges become inverted, thus offering an additional obstruction to further hæmorrhage. As in the case of ligature, there is formed in the vessel a clot gradually extending from the point of rupture to the next branch above, and before long the twisted vessel is kept in its new position by the exudation of plastic matter around it.

There are some cases in which torsion is not applicable, or in which great care must be exercised. These are, where recent or long standing inflammation has caused infiltration of the tissues, and where consequently the bleeding vessels cannot be isolated; in such cases it is advisable to ligature, making use sometimes of a tenaculum for passing under the vessel: moreover, where the arteries are softened by disease, as after inflammation of neighbouring tissues, in malignant growths, soft atheroma, &c., or where they are rendered brittle by cancerous deposit, in hard atheroma; in such cases torsion must be practised with caution.

ACUPRESSURE.

The term *acupressure* has been applied to the compression of vessels by means of needles. Such compression may be made by passing the needles under the vessel, and twisting a wire or silk ligature round the free ends of the needle, as after operation for hare lip. Or the vessel may be compressed against subjacent bone by passing the needle through a fold of skin on one side of the artery and then through another on the opposite side of it.

Another modification of acupressure is obtained by passing the needle through a fold of skin over the vessel and then twisting this more or less completely ; the point of the needle is then fixed into the skin over the side of the vessel.

Acupressure is made use of in the operations for the cure of varicose veins ; it has been used extensively in Scotland in almost all operations, but in the majority of instances torsion or ligature is preferable.

MALFORMATIONS ADMITTING OF SURGICAL RELIEF.

HEAD AND NECK.

Hare lip may be single or double, and accompanied by partial or complete cleft of the palate. An operation may be performed at a very early period if the child cannot suck ; but it is better to wait until about the fourth month : if deferred beyond that period or the fifth month, it should not be done until the teething has ceased to be a source of irritation. In single fissure, the cleft is always on one side of the median line. In double fissure, one or both incisor bones frequently project, and require to be depressed by frequent or continuous pressure, or to be excised before operation.

The most important points to be attended to in these opera-

tions are, the liberation of the lip, if tied down by the reflected mucous membrane : a sufficiently free incision to secure adaptation of a *broad* surface of the adjoining margins : extension of the incisions well round each angle, so that no notch be left at the border : union of the two incisions at the upper angle, so that no orifice of communication be left between the mouth and nostril : accurate adaptation of the pared edges with the pins passed well through the entire substance of the lip, excepting the mucous membrane : security against the risk of subsequent interference by the patient. Where a wide palatal fissure exists, much good may be effected by the infant's nurse frequently pressing together the sides of the face with the fingers and thumb, or with Hainsby's compress, so as to approximate the borders, before an operation is undertaken.

In single fissure, each angle should be successively perforated with a hook, and thus kept on the stretch, whilst the necessary incisions are made with a thin and narrow blade ; the lip being compressed, meanwhile, by an assistant. Two pins should be used ; and a single fine suture may be added, if needed, at the margin : a light spring, with a pad at each extremity to compress the cheeks, forms an admirable support.

In double fissure, the lateral edges being pared, the central pendant portion may be used, by converting it into a triangular flap to occupy the higher part of the gap, the upper pin being passed through it to fix it in its position. In these operations the little patient must be secured in the lap of an assistant. The pins may be safely removed at the end of forty-eight hours ; but support should be continued for a few days, with strips of adhesive plaster carried from cheek to cheek.

Cleft-palate.—When the soft palate is the subject of fissure, it may be united by paring the edges and adapting them. Under any circumstances this is a difficult and precarious operation, and should rarely be undertaken until the patient is of an age to endure the necessary pain inflicted, and cheerfully to submit to the self-denial afterwards required. Division of the muscles forming the pillars of the fauces, and subsequently of the levator and tensor palati on both sides, facilitates the approximation and adaptation of the pared edges. As perfect

rest as possible must be subsequently enjoined. Especial knife, scissors, forceps, and needle are required for this operation. The palatal muscles are divided with a straight or curved knife, immediately internal to the hamular process of the pterygoid plate; traction should be made upon the palate, and the muscles when divided are felt to give.

When the hard palate also is cleft a further operation may be performed. The tissues are to be separated from the hard palate by means of a raspatory, commencing the separation at an incision some distance from the edge of the cleft and working inwards; when the edges are brought together a wound is left where the first incision was made, and this granulates. Much improvement in voice is not usually obtained, but there is much relief to the patient's discomfort in swallowing food.

Ptosis, or depression of the upper eyelid, may be a natural defect, and seriously impede vision. This may be corrected in a measure by cautious removal of a portion of the redundant integument from the lid, and the subsequent use of sutures. Other defects in the interpalpebral aperture may be rectified by division of contractions, or by excision of integument to change the position of the commissures. These defects are not common.

Strabismus or squinting arises from undue balance of action between the recti muscles. It is the inner one which usually requires division. This is effected by pinching up a fold of conjunctiva, which is to be divided with suitable scissors; and, a small hook being then introduced, the muscle is caught and brought forward for division. (*See diseases, &c., of the Eye.*)

In **wry neck,** division of the origin of the sterno-mastoid muscle at its origin, in part or entirely, may be occasionally admissible; but the cases in which it is so are few.

TRUNK.

Imperforate anus.—This congenital defect may be merely skin-deep, or comparatively superficial occlusion : in such case, the straining of the infant will indicate the point for a crucial incision, by the prominence of the contents of the bowel. If deeper, the scalpel must be directed by the finger or a director. In the latter case a bougie must be frequently introduced to keep the opening free. When very deep, the point of the knife must be directed backwards and upwards along the concavity of the sacrum. Under these circumstances the bowel may terminate in a bulging cul-de-sac ; and long-continued attention may be requisite. The sphincter is generally perfect. When the bowel cannot be reached it may be necessary to prolong life by opening the colon in the left lumbar region. When this has been done a catheter passed into the colon may be felt sometimes in the perineum and cut upon.

Hypospadias is a deficiency of the inferior wall of the urethra, near to its orifice. If trifling, it is comparatively unimportant, and does not require surgical interference : but if the exposure of the mucous surface produce irritation, relief may be afforded by making use of the prepuce, in a plastic operation, for covering the fissure.

Epispadias, or deficiency of the upper wall of the urethra, is rare, and accompanies the more serious arrest of development, in which the abdominal parietes and anterior wall of the bladder are deficient (*ectopia vesicæ*.) When the effect is limited to the urethra, the tegumentary edges may be pared and brought together, or a flap may be raised on either side, and the surfaces of the two adapted and kept in position by quill or bead suture, as in closing accidental openings of the passage in front of the scrotum.

In **Ectopia vesicæ**, the constant unrestrained discharge of water upon the surface is a source of great annoyance to the patient and his friends, and an attempt to remedy this has been made by forming a communication between the ureters and the

rectum, subsequently closing the orifices of the ureters upon the surface, and then covering the everted bladder by a plastic operation. The rectum is thus made to take the place of the bladder.

In congenital **phimosis,** circumcision is the proper remedy where the prepuce is redundant; but if otherwise, the prepuce must be slit up by the side of the frænum. This operation ought not to be performed in childhood, unless the orifice be so small as to obstruct the free passage of the urine.

If the scrotum be divided, which is very rarely the case, this simple and unimportant defect may be corrected by paring the adjoining edges and adapting them with sutures.

Imperforate vagina may be of a very simple kind, merely consisting of a thin membranous septum at its orifice: this may be split up with a probe in most instances; or a knife may be required. If the *hymen* be imperforate, this defect, being further back, does not attract attention, until accumulation of the catamenial discharge creates discomfort and suffering. A crucial incision at once remedies this malformation, and no after-treatment is required. In abnormal enlargement of the *nymphæ,* their sensitiveness, when thus exposed beyond the labia, may be a source of much discomfort; and removal of the redundant portion is then justified.

EXTREMITIES.

Supplementary or **bifid thumb, fingers** or **toes,** require removal. If possible, the joint, which is usually common to both, should not be opened, as the integrity of the spared member would thereby be risked. Other congenital malformations of the humerus and forearm rarely admit of any relief, except by mechanical appliances. The same remark applies to congenital dislocation of the ossa femoris.

In **club-foot** and similar deformities, much may be done by mechanism without operation; but in many cases tenotomy

is an essential preliminary to mechanical assistance. The tendo
Achillis is the most frequent subject of operation for these
defects ; and is, fortunately, most amenable under this treat-
ment, uniting more readily than any other tendon. The divi-
sion of other tendons must be undertaken with a knowledge of
the possibility of their not again uniting ; but even this sacrifice
is required in some cases of deformity.

The operation of tenotomy is performed subcutaneously, a
narrow and pointed knife being introduced, and carried past
the tendon to be divided : its edge is then directed towards
the tendon, which is divided outwards as the knife is withdrawn.
During the section, the tendon should be put on the stretch,
and the completion of its division is thus readily ascertained.
As regards the after-treatment of these cases, it is better
to wait for a few days before any extending apparatus is applied :
in the interval, the limb should be kept at perfect rest.

The hamstring muscles may occasionally require division in
contraction of the knee ; but this is usually the consequence of
disease. Caution is requisite in this operation to avoid injury
to the nerves, especially the external popliteal.

The usual varieties of the club-foot are three : *equinus*, in
which the patient walks on the toes only ; *varus*, in which the
foot is inverted and thrown over on its dorsal aspect ; *valgus*,
in which the foot is everted, so that the patient walks on its
inner border.

In talipes *equinus*, the deformity may be the consequence of
the whole length of the limb being shortened : in such cases an
operation for letting down the foot is useless. But where the
fault is in the shortening of the muscle, division and subsequent
elongation of the tendo Achillis is the remedy.

Talipes *varus* is the most common deformity ; and, in extreme
cases, is attended with displacement and distortion of the tarsal
bones, probably the consequence, though congenital, of irregular
muscular action. The bones of the leg rest partly on the short-
ened os calcis, and the astragalus is consequently pressed
forwards : the other tarsal bones are influenced in a minor
degree, and the ligaments and fasciæ are either contracted or
stretched according to their position. An abnormal bursa is

usually developed on the back of the tarsus, on which the foot rests when placed on the ground. As a general rule, it is desirable not to interfere by operation until the child is two or three years old, or even later. In many, if not most cases, division of the tendo Achillis, with subsequent prolonged and continuous use of a suitable apparatus, is all that is needed. This tendon should be divided at its narrowest part, above its insertion. The small wound should be immediately closed with a strip of adhesive plaster. If, in this form of talipes, other tendons are involved, they are the tibialis posticus and flexor pollicis : should these require division behind the tibia, great care must be exercised not to implicate the tibial vessels and nerves : the shortened plantar fascia is more likely to require division ; and this may be also done subcutaneously.

In talipes *valgus*, which rarely occurs until the foot has been used for some time, and is often the consequence of relaxed and elongated internal lateral ligament as a primary condition, the long extensor and peronei muscles take advantage of the loss of resistance and aggravate the deformity. If tenotomy be necessary, it is these tendons which require division. The peronei may be readily cut through, where they lie together immediately above the outer malleolus, or lower down ; but the former is the preferable position. The extensor tendon should be divided in front of the ankle-joint, just before it breaks up on the tarsus : the most prominent part is the best guide to the operator, who must be careful to keep his narrow knife close to the back of the tendon.

In the very rare form of talipes *calcaneus*, which is exactly the reverse of the pes equinus, and in which the patient walks on the heel, all of the three anterior muscles are most likely to be implicated in determining the deformity.

After any of these operations, the patient may be encouraged to put the foot to the ground with the apparatus on, after it has been worn for a few days ; and subsequently, when it is thought prudent to throw aside this mechanical assistance, a properly constructed boot, with a supporting iron, should be supplied.

SECTION VII.

METHOD OF OBSERVATION.

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I. CASE-TAKING.

Rough notes should, if possible, be made when a case is first seen, for if delayed until other cases have also been seen it is difficult to ensure the accuracy or completeness of the record. The very act of taking notes impresses the case more strongly upon the mind, and in this way note-taking is most important to the student or surgeon, besides being, perhaps, of use to others. Above all things, in note-taking avoid putting down as a fact what has not been verified by yourself. Let notes be short and to the point ; if long and wordy, it is probable that neither yourself nor any one else will read them. Let them be method-ical, and they will enable the reader to understand more rapidly what is meant. Much time and long description may be avoided by roughly sketching the locality of an affection, and, poor as the drawing may be at first, it will indicate often more than mere description ; and the power of sketching fairly may be gained by practice.

Some definite order of observation and note-taking should be adopted, and the following may serve as a guide.

1. **Diagnosis**......... *Result.*
2. **Name,** *address (or ward and No. of bed*).* **(Surgeon.*)**
3. **Age,** *occupation, habits.*

* These headings are intended for hospital practice only.

4. **Date** *of first observation (or of admission*).*

5. **Previous history** *of the case.*

6. **Present condition.**

        (*a*) *Local symptoms.*

        (*b*) *General symptoms.*

7. **Remarks** (*of surgeon**).

8. **Treatment.**

9. **Progress.**

10. **Result.**

With reference to the **previous history,** note such facts as bear upon the case, particularly the origin and course of the disease or injury, and, where necessary, record the family history and peculiarities.

In noting the **present condition** (6) observe (*a*) the *local signs.* What can be seen, or felt, or heard, or (sometimes) smelled ? Describe first the most prominent local sign and add other observations afterwards.

Thus, in the case of a simple fracture of the leg, " fracture of tibia and fibula ; tibia, between middle and lower thirds, obliquely downwards and inwards, point of upper fragment nearly through skin ; fibula, two inches above malleolus ; very little bruising or swelling. Hardly any shock on admission ; temp. 98·1°. No other injury."

Or, in the case of a tumour, " tumour of right breast, above and to the outer side of the nipple, about the size of a walnut, hard, not nodulated, neither tender nor painful, skin not adherent, nipple not retracted ; no glandular enlargement."

Or, in a case of necrosis, thus :—" Sinus over head of right tibia on inner side, with sprouting granulations and purulent discharge, bone enlarged on inner side. Circumference of limb in this position one inch greater than that of left. Probe passes to exposed bone, which is felt to be loose. Aching pain in head of tibia after walking. No affection of knee-joint."

(*b*) With regard to general symptoms, it is best to examine and note the different organs systematically. Thus, after observing the aspect of the patient, his position, and manner, it is well to note the condition of his—

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* These headings are intended for hospital practice only.

(*a*) *Circulatory organs*, including pulse, heart, fulness of veins, and temperature.

(*β*) *Respiratory organs*, including rapidity and fulness of breathing, condition of lungs as determined by auscultation and percussion.

(*γ*) *Organs of digestion*, including tongue, teeth, mouth, fauces and abdominal viscera, together with power of swallowing, symptoms of dyspepsia, state of bowels, appetite.

(*δ*) *Genito-urinary organs*, including character of urine, frequency of micturition, fulness of bladder, catamenia, displacements of uterus, pregnancy.

(*ε*) *Glandular system*, including evidences of glandular abscesses, hardness and increase in size or number of glands.

(*ζ*) *Nervous system*, including headache, general pains, alterations in sensibility, loss of power, starting of limbs, twitching of muscles, peculiar sensations, fits, state of intellect.

(*η*) *Special sense organs*, including condition of pupils, impairment of vision, state of optic disc, deafness, impairment of taste and smell.

II. RULES TO BE OBSERVED IN THE EXAMINATION OF PATIENTS.

If the patient be capable of answering sensibly, the first questions naturally to be asked are—*What is the matter ? Where do you feel pain ? Has the present illness come on suddenly* (acute affection) *or slowly* (chronic) ? *How did the illness begin ?* If the result of an injury, *how did it happen ?*

Get the patient to adhere as closely as possible to the questions. Do not, however, lose temper, and lose no time in long answers, but aim steadily at getting facts, allowing the patient, as far as can be, to tell his own story without putting to him leading questions.

Next observe for yourself, and make sure that your observa-

tions are correct. Follow the same course as suggested for note-taking, by examining first the local signs, and afterwards the general symptoms, methodically.

Probably a mental diagnosis will occur early during the examination, but be careful not to jump to conclusions which are not strictly warranted by facts, and be prepared to give reasons for what you believe.

When examining patients avoid unnecessary exposure and anything which may wound their feelings. In manipulating a part, examine carefully so as to satisfy yourself, but avoid giving unnecessary pain by going over your work twice. Do not, however, allow a false feeling of delicacy or nervousness to lead you to make an incomplete examination.

When a patient has received an injury of so severe a character as to necessitate operation, avoid putting him to the pain of a complete examination until chloroform has been administered. A further rule to be observed for the patient's protection is to take great care that no infection or source of irritation is conveyed by the hands of the surgeon; and for this purpose cleanliness is most important, and disinfection by means of Condy's fluid or chloride of soda, &c., after handling putrid or poisonous or offensive matter.

The surgeon should also use care in protecting himself when examining wounds or contagious diseases. An acutely suppurating part may give rise to much trouble if the pus be carried either to a broken surface or to the delicate mucous membrane of the eye or nose. Extreme care should therefore be used in handling a part which is the seat of erysipelatous inflammation, a gonorrhœa, soft or hard chancre, purulent ophthalmia; and the secretions from such affections should be carefully kept from coming in contact with the eye, or nose, or any scratch. In a case of hydrophobia it is also well to avoid exposing a wound to the blood or secretions. If such animal poisons happen to come into contact with a broken surface, wash well with cold water or suck the wound; afterwards use special means for destroying the poison, such as Condy's fluid, perchloride of iron, nitrate of silver, nitric acid, the actual cautery, &c. Before operating or handling poisonous wounds it is advisable to

cover a scratch or broken surface with collodion or perchloride of iron.

In cases which may give rise to legal actions, or in doubtful cases, it is wise to examine female patients in the presence of a nurse or female friend.

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III. IN POST-MORTEM EXAMINATIONS.

Where possible, the examination should be made systematically and thoroughly, and not only a single organ observed ; short notes should be taken at the time, otherwise facts are certain to be overlooked, and descriptions likely to be inaccurate ; and from the rough notes a fuller entry may be made in a proper record-book, after the microscopical examination of diseased tissues. Avoid looseness of description, state dimensions in inches or tenths of inches, give actual weights if possible, and actual quantities.

The appliances which it is advisable for the operator to take with him are a strong knife, a dissecting-knife and forceps, large scissors, chisel, mallet, Hey's saw, sponge, measures, grease, sheep's bladder for containing preparations, packing-needle and twine, wire and steel pins for the skull, and paper for rough notes. Other things may be required for special cases, as a coronet and a spine-chisel.

The following may be taken as an outline for a system of observation :

I. TO BE OBSERVED BEFORE OPENING THE BODY.

Date, time. Number of hours after death. Character of weather at time of examination.

Name, age, sex.

External appearances, colour of hair, peculiarities, putrefaction, œdema, features.

II. THORACIC AND ABDOMINAL VISCERA.

Cut in middle line from below chin to pubes, open peritoneal cavity, dissect back skin and muscles from surface of thorax to beyond costal cartilages; cut through cartilages near to their junction with ribs, using only a strong knife for the purpose unless the cartilages be much ossified; disarticulate at sterno-clavicular joint. It is not necessary to cut the abdominal walls transversely, but sometimes a few transverse incisions into the muscles only will give more space. Be careful to avoid injuring abdominal or thoracic viscera.

Fluid in peritoneum. Measure the quantity, character of fluid, adhesions, new growths.

Fluid in pericardium. Observe as in peritoneum.

Fluid in pleuræ. Ditto.

Observe the relative size, position, engorgement, &c., of different viscera, also the relations of new growths to fixed anatomical points.

Cut firmly down by the side of the larynx, carrying the knife at length through the large vessels which run across the root of the neck on each side. Pass the point of the knife then upwards behind the chin, and cut round the root of the tongue; when the finger of the other hand is passed into the cavity of the mouth from below it can hook down the tongue and assist greatly in freeing the larynx and pharynx. These are to be pulled down together, and with the lungs and heart carefully torn away from the thorax. If the chief disease be in the thorax, remove the central portion of the diaphragm with the thoracic viscera. If the chief disease be in the abdomen, the pericardium should be cut through and the diaphragm left untouched. Divide the œsophagus and large vessels by cutting through them upon the edges of the ribs after the lungs, &c., have been pulled over them outside the body. There will now be together tongue, larynx, pharynx, trachea, œsophagus, lungs, and heart.

Tongue. Epiglottis, fauces, tonsils; notice œdema, ulceration.

Larynx. Trachea.

Pharynx. Œsophagus.

Open œsophagus from behind and examine, after which open trachea and larynx in same manner with long scissors.

Notice congestion, ulceration, new growths; wash freely with stream of water.

Lungs.   Colour, density, emphysema, result of squeezing a cut surface; does any part sink in water? cavities, character of tissue around, points of extravasation, appearance of large vessels and their contents, appearance of bronchi and their contents.

Separate the heart by dividing the large vessels close to the root of the lung.

Heart.   Size, weight, character of apex, amount of fat.

Open the ventricles by a vertical cut through the middle of their walls, keeping clear of the septum, which can be easily felt from the outside.   This incision may be extended afterwards so as to make a flap.   Examine the semilunar valves of aorta and pulmonary artery as to competency, by pouring a stream of water in from above.

Notice quantity and kind of clot on each side, adhesion of clot as distinguished from entanglement, thickness of walls, size of venous and arterial orifices (tested roughly by the number of fingers which can be admitted), state of mitral and tricuspid valves and of aortic and pulmonary valves, particularly as to rigidity, roughness, obstruction and incompetency; state of coronary arteries.

Aorta.   Observe atheroma, dilatations.

Bronchial glands.

Examine the liver in sitû, after which remove it by cutting through the diaphragm freely on each side until the viscus can be brought over the edges of the ribs; then divide the structures which remain by cutting upon the ribs.

Liver.   Weight, size, hardness, colour, appearance of capsule, character of liver substance on section, congestion, greasiness, transparency, toughness, consistency, colour, peculiarities in portal canals.

Gall-bladder.   Bile, gall-stones.

Remove the spleen by passing the hand round the organ, drawing it forward, and dividing the vessels which enter it.

Spleen. Size, weight, colour, consistence.

Where there is no obvious reason for extraordinary care in dissecting out the stomach and intestines, this may be done by making a hole with the fingers through the great omentum above the transverse colon and gradually separating the intestines, an assistant drawing them out as the operator is dividing the mesentery, mesocolon, &c., close to their attachment to the bowels. The stomach and duodenum must be removed with care, and the pancreas requires careful dissection if it is to be separated. Take care that the intestinal canal is tied above and below where it is cut through.

Stomach. Notice size, contents, condition of mucous membrane, muscular coat, pylorus.

Duodenum. Valvulæ conniventes, Brunner's glands, seen by removal of the serous and muscular coats.

Jejunum, ileum. Notice Peyer's patches, solitary glands, valvulæ conniventes, vascularity.

Cæcum. Valve, appendix ; notice vascularity and ulceration.

Colon. Look for ulcers and deposits in submucous glands.

Mesenteric glands. Notice enlargements, new growths.

Examine the bladder in situ, unless there is reason for suspecting disease in it or the prostate. Open the bladder from above. In the female remove the uterus, ovaries and vagina, with, if necessary, the rectum and bladder together, by dissecting from the brim of the pelvis. The kidneys are to be removed after cutting through the areolar tissue and fat which encloses them ; with them the supra-renal capsules should be taken away, but not infrequently the right supra-renal body is closely connected with the liver.

Supra-renal bodies. Size, weight, relation of cortical to medullary portion, appearance.

Kidneys. Size, weight, capsule, appearance of surface when capsule removed, appearance on section, relation of cortex to medulla, contents pelvis, ureters.

Bladder. Character of interior, contents, appearance of prostate, condition of veins in neighbourhood.

Urethra, penis, testes.

Uterus. Shape, contents.

Ovaries. True and false corpora lutea, cysts.

Vagina.   Hymen.

Breasts.   Evidences of lactation.

Muscular structures.   Condition of psoas and iliacus.

Bony structures.   In cases of injury search for evidences of fracture of ribs or pelvis, or dislocation in pelvis, examining for possible injuries to neighbouring viscera.

III. HEAD AND SPINE.

Cut down to bone from ear to ear across top of skull, preserving the hair. Reflect the scalp simply backwards and forwards until the calvarium is exposed. Saw through the calvarium an inch above the level of the eyebrow in front and through occiput behind. A special instrument (the " coronet") is of great assistance in this otherwise troublesome operation. Use a sharp saw, and for leverage a **T**-*shaped chisel; and when calvarium is felt to be thoroughly freed, use the end of the lever for separating the first part of the dura mater in front.*

Skin.   Notice bruises, cysts, wounds, observe subcutaneous bruises.

Fluid in subarachnoid space.

Dura mater.   Fulness of vessels, character of membrane, Pacchionian bodies, adhesions of dura mater, extravasations, ossifications in membrane.

Remove the brain by separating it from before backwards, successively dividing the nerves at the base, preserving, if possible, the pituitary body. When the tentorium is reached divide the structure along the margin of its attachment to the skull; pass the point of the knife well into the spinal canal and divide the cord.

Brain.   Vascularity of surface, firmness, weight, amount of water it displaces, evidences of extravasation on the surface, patches on pia mater or arachnoid, thickness of these membranes, deposits at base or in fissure of Sylvius, state of vessels.

Remove upper part of hemispheres by a horizontal section.

Notice amount of vascularity, distinctness of white and grey matter.

Open the lateral ventricles by cutting a little on one side of the

middle line rather forward, lay open the cavities with the handle of a scalpel, after which slice the brain carefully, cutting from before backwards and slanting the knife outwards.

Ventricles. Amount and kind of fluid, consistence of walls, choroid plexuses.

Corpora striata. Optic thalami, pons, medulla, cerebellum.

Fourth ventricle. Choroid plexuses, character of walls.

Search carefully for extravasations in any part of the brain, but particularly in the corpus striatum and in the neighbourhood of the middle cerebral artery. If suspecting aneurysms or tubercle, wash away the brain substance from the membranes under a rather strong stream of water. When an area of softening or extravasation is found trace its relation to large vessels.

Bones of the skull. Examine for fracture or fissure by stripping off dura mater from the interior of the base.

The temporal bone may be removed for examination by separating the external ear with the scalp and sawing in front and behind the petrous bone. A sharp tap with the mallet will assist.

Care should be taken to fix the calvarium carefully afterwards by running steel pins into the diploe, or by wiring the bones together.

The spinal cord *is removed after the arches of the vertebræ have been taken away, and for this purpose the muscles have to be removed by carrying the knife along the sides of the spinous processes. A special hook-ended chisel is made to cut its way through the laminæ on each side by the assistance of a steel mallet.*

The cord is then to be removed in its membranes, by cutting through the nerves as they are passing into the vertebral foramina.

Membranes of the cord. Notice vascularity, patches of extravasation, tubercle, grittiness.

Sections of cord. Notice consistence, vascularity; if necessary, put aside pieces for hardening in spirit, or Muller's fluid, or chromic acid, &c.

IV. THE LIMBS.

Examine for fracture, dislocation, bruises, wounds ; notice condition of veins leading from injured or diseased parts, relation of nerves and vessels to tumours or injuries, condition of joints in pyæmia.

V. MICROSCOPICAL EXAMINATION OF TISSUES.

As a rule, examine as soon as possible ; for morbid tissues undergo alterations often very rapidly. Use as few reagents as possible, but rather examine in the natural fluids of the part. Iodized serum forms one of the best fluids for examining tissues in, but the character of such media will depend greatly upon the nature of the tissue and the fancy of the examiner. In making these sections use a sharp knife after dipping the blade in fluid. Scrapings of morbid tissues will often yield valuable information under the microscope. Pieces of tissue taken away for further examination should be wrapped in oiled skin or other impermeable medium.

SECTION VIII.

SUGGESTIONS IN EMERGENCIES AND DOUBTFUL CASES.

SHOCK.

Collapse from injury may be the consequence of simple shock to the nervous system, of wound of some important organ, or of the hæmorrhage. These various causes may coexist. Many cases occur in which it is not, at first, manifest to which the symptoms are to be assigned. Thus, a patient has been struck or kicked on the abdomen, or he has fallen from a height, or has been run over by a heavy vehicle. No external lesion is apparent : the surgeon ascertains that there are no broken bones, and that there is no external wound of importance. What is to be done ? The patient should be removed with great caution, and enveloped in hot blankets, and heat should be applied to the feet. Stimulants should be avoided, if possible, or given very moderately and cautiously. Soon a catheter should be passed, to ascertain that the bladder and urethra are uninjured. Light nutriment and drink may be given in moderation : at first entire abstinence is preferable ; fragments of ice may be sucked to moisten the mouth. As reaction comes on, small doses of opium will tranquillise, and will also quiet the peristaltic movement, in case any portion of the intestine be wounded. These cases terminate according to circumstances. Reaction may be very gradual and slow, leaving the surgeon

long in doubt as to the issue ; and yet the case may terminate favorably, without proof of organic lesion. He must not conclude, from the presence of abdominal pain and tenderness, that peritonitis from such lesion is imminent : for local and even diffused tenderness over the abdomen may subside, without leaving any trace of mischief. Depletion is rarely admissible in such cases ; but warm fomentations afford relief. Reaction may, however, be followed by acute peritonitis ; or inflammation may ensue, with scarcely any reaction. In either case, it is probable that some fatal lesion has been inflicted on some one or other of the abdominal viscera. Again, a patient may die speedily, or after the lapse of one or two days, without any effort at reaction. Sickness is a distressing, and, if protracted, an unfavorable, symptom in these injuries : mustard to the epigastrium, and cool acidulated drink or ice may relieve it. Blood in the urine may appear and continue for some days, without other evidence of serious mischief to the kidney. Escape of the intestinal contents into the peritoneal cavity entails fatal peritonitis. Persistent rest of a wounded intestine is the only chance of security against this result, by giving time for plastic effusion to close the wound. The same remark applies in wounded or ruptured bladder : a flexible catheter should be worn, and kept in communication with a receptacle by means of a small indian-rubber tube. The prognosis in all these cases should be very guarded,—even when the symptoms are favorable : and the strictest rest should be enjoined for some time.

HÆMORRHAGE.

Bleeding from an *incised* or *lacerated wound* usually (but with certain exceptions) admits of treatment by position, cold, pressure, torsion, or the application of a ligature on the bleeding vessel, if an artery. Under any circumstances the surgeon should thoroughly clear away all clots from a bleeding wound, before he employs any measure to stop the bleeding. In *punctured* wounds, however, the case is different, as arterial

hæmorrhage demands the prompt interference of the surgeon, generally by operation, to arrest it.

Suppose such wound to be in the **Neck**, below the hyoid bone, and attended by copious arterial hæmorrhage. The proper course to pursue would be to extend an incision upwards and downwards from the wound, and to expose the bleeding point of the carotid trunk, and tie it above and below the injury. An assistant should, meanwhile, compress the artery lower down : and the introduction of a probe or director will help to guide the operator to the wound in the vessel.

If the wound be higher up, *i. e.*, under the angle of the jaw, the arterial bleeding may proceed from either internal or external carotid, or from some branches of the latter. The safest practice, in a case of penetrating wound in this position, is to tie the common carotid a little before its bifurcation : the bleeding should be controlled, meanwhile, by pressure, with a compress or the fingers of an assistant, in the wound.

In hæmorrhage from incised wounds of the **Throat**, the open orifices of the bleeding arteries must be sought for and twisted or tied.

The radial or ulnar artery is not infrequently cut near the **Wrist**, by the hand being thrust through a pane of glass, or by the breaking of a glass bottle in the hand. The bleeding orifice must be sought for, and a ligature placed above and below it, if the vessel is only partially divided ; if quite severed, two bleeding orifices must be sought for till found, and twisted or tied. The wound may be extended for this purpose, if requisite. There is a nerve in company with the ulnar artery at the wrist, but not with the radial. Care should be taken to include only the artery in the noose. The wound may be subsequently closed.

In lacerated or cut **Palm**, the bleeding is often very troublesome, and difficult to arrest. The wound should be thoroughly cleansed from coagulum, and if a bleeding artery be seen, it may be twisted or tied. Further incisions, however, to search for the vessel, would prove abortive, and probably lead to further mischief by opening fresh branches. What, then, should be done ? The wound being cleansed and the brachial artery

temporarily compressed, a piece of sponge of suitable size must be wrapped in thin muslin, or gauze, and pressed firmly into the wound : a bandage is then to be applied over it, around the hand and extending up the arm : the limb should be placed with the hand elevated and resting on a pillow. The advantage of wrapping the sponge in muslin is to prevent the blood from coagulating in the pores of the former, which would involve the forced separation of the clot when the compress is removed : the use of the bandage and position is to moderate the circulation. Should bleeding still persist, after this plan, with the aid of cold and other styptics, has been fairly tried, the proper treatment is to tie the brachial artery in the middle of the upper arm : ligature of the radial or ulnar, or even of both, is likely to prove ineffectual, on account of the free anastomosis between them and the interosseal arteries : for the same reason compression of these vessels near the wrist fails : continuous compression of the brachial artery for any time could not be borne, on account of the proximity of the nerves. (*See " Ligature of Brachial."*)

Suppose the hæmorrhage to proceed from a penetrating wound on the inner part of the **Thigh**, and that it is arterial in character, and sufficiently abundant to leave no doubt that the femoral artery is wounded. The first step is to direct that pressure be made on the artery as it crosses over the pubes : even an uninitiated assistant may do this with his thumb or a large key wrapped in a piece of linen, if properly instructed. Then cleanse the wound of blood, and pass a director gently as far as it will reach. This should be held firmly by an assistant, as it serves to guide the operator to the bleeding point. A free incision should then be made, in the course of the artery and having the wound for its centre. When the vessel is exposed the perforated part is to be included between two ligatures, with as little disturbance as possible : the edges of the wound are to be approximated, and the ligatures, if silk, brought outside in the usual way : if the catgut ligature be used the ends should be cut short and the wound completely closed. (*See " Ligature of Femoral."*) It is very possible, if the external wound have been plugged before the surgeon's arrival,

that extravasation of blood may have taken place into the thigh ; but this must not deter him from pursuing the same course, turning out the clot as he proceeds. Nor must he be misled by the temporary arrest of bleeding from this cause or from faintness : if the artery is wounded, it must be tied as described.

But this same tense and swollen condition of the thigh may occur, accompanied by faintness, but without external wound. The history of such a case would probably be, that the patient felt something give way in the thigh, and that swelling rapidly ensued. If many hours have elapsed, and the tension is great, the surgeon probably finds the leg already œdematous and deficient in temperature : the tibials pulsate but feebly, or not at all. The probability is, that this is a case of ruptured femoral artery; and of diffused false aneurism as the consequence. It is evident that the same course of proceeding as that just described is not strictly applicable here : inasmuch as there is no external wound to guide the operator to the seat of injury. Therefore the surgeon has at once to select between two alternatives ; either to tie the artery at the seat of injury, if that can be found, above it if it cannot ; or else to employ palliative measures, and wait. A third alternative, of amputating, may present itself at a later period. The palliative means referred to are, compression of the artery at or below the groin ; general support of the limb by bandaging, and elevation of the feet. If there is evidence that hæmorrhage is still going on, or the tension of the limb threatens its vitality, palliative measures are out of the question. Unless the condition of the limb is hopeless, and thus demands amputation, ligature of the artery is then the proper cause. But the question is, where is it to be applied ? If the swelling is limited, that may serve as a sufficient guide to the operator. But if the extravasated blood is diffused through the thigh, he must make his incision freely over the course of the artery, as in an ordinary operation. He must then clear away the clots, and examine the vessel, which he will probably find he is able to do without much dissection. If he find the seat of laceration, he will place a ligature above

and below it : if not, he must apply a single ligature high enough to command the bleeding.

It may be that a penetrating wound in the **Leg** involves the anterior or posterior tibial artery. In such case, there can be no hesitation as to the propriety of cutting down upon, and tying the bleeding vessel above and below the seat of injury. This is facilitated by introducing a probe or director to the bottom of the wound, and cutting upon it ; a precaution which will be found of assistance, even when the posterior tibial artery is taken up in the way already described (vide *ante*, p. 201). These accidents occur occasionally in reaping or mowing.

Bleeding from a **scalp** wound is generally controlled by the application of a compress ; but a partially divided artery will sometimes give great trouble ; in which case, its complete division with a knife, and subsequent compression, is preferable to ligature.

In all cases of severe hæmorrhage the greatest watchfulness should be exercised, after spontaneous cessation of the bleeding : for, in such cases, hæmorrhage recurring with reaction may be speedily fatal.

POPLITEAL ANEURYSM.

The **treatment of popliteal aneurysm** by pressure requires much care, and unflagging attention ; and it is useless to undertake it unless these can be bestowed. The surgeon should always bear in mind that the pressure is designed only to *moderate the flow of blood* through the artery, and thus permit the accumulation of fibrinous deposit on the interior of the sac, with a view to its ultimate obliteration. The best instrument to use is one which, partly encircling the limb, makes circumscribed pressure, through the medium of an oval pad, on the artery, and possesses a larger pad at its opposite extremity for counter-pressure. The patient should never be left without the super-

intendence of a competent and well-instructed attendant. The
pressure should first be very moderate, and increased only as it
can be borne : it may be varied in amount, though it is unde-
sirable to intermit it entirely. The position of the pad should be
changed from time to time; but during this moving upwards
or downwards, as the case may be, it is desirable to control the
circulation at the groin : on reapplication of the pad, its effect
should be tested by placing the hand on the sac, whilst the
screw is adjusted. The sac itself should be carefully examined
day by day, to notice whether there be any tenderness or heat,
indicating inflammation. If so, it will be unsafe to continue
the pressure, as suppuration and hæmorrhage are likely to occur,
and the artery should, therefore, be tied in the usual way.
Irritable persons are bad subjects for this method of treatment.

Digital pressure and pressure by forced flexion of the knee
have been employed in many instances with marked success ;
and ice applied to the surface has sometimes proved useful.

TREATMENT OF CONTUSIONS AND WOUNDS.

The **treatment of contusions and wounds** is neces-
sarily determined by their nature and extent. All wounds
inflicted with a sharp cutting instrument should be closed by
adjustment of the opposed edges or surfaces, where the mecha-
nical conditions of the parts involved permit it. Thus, the
dexterity of the surgeon is manifested in securing these con-
ditions in amputation and in the removal of tumours. Re-
dundance of skin, especially in the latter class of operations, is a
good fault; for its elasticity should be borne in mind, and its
tendency to contract after being subjected to distension for even
a lengthened period. In contemplating the natural process by
which union of an incised wound is effected, it is apparent that
the great desiderata are to secure accurate and actual contact of
surface and exclusion of air. The surgeon is able to render

efficient aid in the former, but his interference very often mars the latter object. Dressings of all sorts to an accurately adapted incised wound are to be deprecated, at any rate for the first forty-eight hours. By exposure the margin of the wound, of whatever size, has the opportunity of becoming hermetically sealed by the same process as the surfaces are rendered adherent, viz. the deposit of fibrin from the serous exudation. This should not be disturbed unless the inflamed condition of the wound suggest the imminence or commencement of suppuration; a light evaporating lotion or water dressing may then be employed. But amputation of the thigh or breast or excision of the knee may be treated without any dressing if the case be favorable, and so long as the adjoining edges of the wound are carefully maintained in position by metallic suture. Unquestionably the glazing of a large cut surface may be facilitated and hastened by a local application before the wound is closed; and this first step is certainly an important one, as adhesion, which is the first step in actual union, is thus at once and permanently secured. Simple spirit and water in equal proportions seems to effect this object very well; but a weak solution of chloride of zinc, of sulphurous acid, or of carbolic acid, may be employed. Entirely undisturbed rest of the wound is essential, and the sutures should not be meddled with so long as they produce no irritation and are required to keep the injured parts in relation.

In *smaller* wounds, with or without loss of texture, the old-fashioned Friar's balsam, or the simple tincture of benzoin with some tannin dissolved in it, is an excellent application. It arrests bleeding, and acts in coagulating the fibrin, and also in assisting to seal the wound and thus exclude the air. Simple irrigation with cold water is both agreeable and beneficial when a wound is inflamed and raised in temperature.

When an *incised* wound is prone to suppurate, the amount of suppuration may be materially limited by uniform pressure, whereby the surfaces are kept closer together, but the outlet for the discharge must be left free. The appearance of œdematous granulations at the margin of a wound may be controlled by pressure applied directly over them. If the discharge (from a stump, for example) be profuse, the suppu-

rating surface may be syringed, or even sponged, advantageously with an astringent or detergent lotion ; the flaps should then be again accurately adapted and kept in relation.

The obstacle to the healing of a *penetrating* wound is mechanical, viz. the retention of the exudation from the vessels primarily, and (as in a sinus) of the purulent discharge subsequently. If such injury be inflicted in a part which admits of the treatment, an accurate adaptation by pressure of the sides of the wound so as to obliterate the space should be tried, and may prove successful. But if the injury be of a nature and extent to involve disintegration and loss of texture, it is better to enlarge the mouth of the wound, and favour the escape of the discharge by the application of warmth and moisture.

Actual loss of texture, with a breach which cannot be closed, must heal by production of new material, and this is accomplished by granulation. When this process is healthily active, simple protection of the surface and cleanliness constitute all the treatment requisite. Medicated lotions to stimulate the deposit of fibrin may be required when the healing process is sluggish ; but the best stimulant is carefully and evenly applied pressure by strips of wet linen, or by a bandage over wet lint. Daily irrigation with cold water is also very useful. When granulation is established the healing of such a wound is identical with that of an ulcerated surface, and must be aided by the same treatment, including skin-grafting if requisite. It is scarcely necessary to remark that in a lacerated or contused wound it is important to preserve every portion of skin that is likely to retain its vitality. It is surprising how much may be done in this way by careful management. Scrupulous attention to the cleanliness of such a wound by the removal of any extraneous matter, or of hopelessly disintegrated tissue, should not be neglected.

Where the breach of surface is extensive, whether from mechanical injury, ulceration, or burn, skin-grafting is an important adjunct in hastening the closing of a wound. Many and small grafts are to be preferred ; indeed, the size of a graft does not appear to influence the result, but subdivision offers the advantage of economy in material.

Several methods may be adopted in skin-grafting, but the simplest plan is that already described (page 24). The small pieces may be placed within half an inch or an inch of one another and form so many focuses for skin formation. The success of the grafting should be manifest in from two to four or five days, but the pieces may be slower in taking. The first indication is a bluish depression at the point of insertion, and with a glass the cuticular formation can be seen to have begun.

The advocates of the **antiseptic treatment** of wounds claim for it a success which has not been uniform in the hands of all who have tried it. The principle of excluding air from a wound with the view of limiting putrefaction has been long recognised; but the agency of the disinfectant is directed to the protection of a wound from infected air, and it is assumed that all atmospheric air is more or less infected, or capable of generating decomposition, unless disinfected. When transmitted through a disinfecting medium its capability of generating infection or putrefaction is annulled; and air thus treated may have access to a wound without producing any deleterious results. Carbolic acid is the agent to which preference is usually given. Thus, a wound is washed with a weak solution of the acid; it is dressed under the protection of the spray; and a strong solution, a mixture with oil or in the form of a paste, about one part in four, is laid over the wound, a gauze protective being introduced between this dressing and the wound, to preserve the raw surface from the stimulating action of the acid. Certainly it is requisite to protect any part to which a strong solution of the acid is applied, as its direct contact with the skin is competent to produce even sloughing. Its poisonous effects have also been recorded by some surgeons who have used the solution to wounds. The solution employed varies from one in forty to sixty, or even one hundred; and the carbolised muslin dressing is prepared with resin and paraffin, from which the carbolic vapour passes off slowly, and the egress of watery vapour or of perspiration is permitted by reason of its porous texture. This dressing also adapts itself readily to the inequalities of the surface to which it is applied; and its successive layers absorb any exudation there may be from the surface.
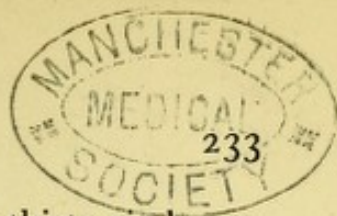
Oiled silk is placed over it after twenty-four or thirty-six hours, and afterwards the dressing is changed at intervals of forty-eight hours.

The avoidance of putrefaction of the excretions from a wound at an early period is considered very important; and the employment of the antiseptic is believed to limit inflammation and cell-growth. It is also supposed that the same agency, by restricting fibrinous deposit in a wound, renders its cicatrix more elastic and pliable. It is maintained that, by its action, the organization of blood-clot is facilitated; contused textures, as in fracture, which would otherwise slough, are restored; compound fractures are treated more readily and with less risk, and with the prospect of early healing of the wound; the necrosis of exposed bone is prevented; large abscesses, as lumbar or psoas, may be freely opened without risk of constitutional disturbance, as by hectic or irritative fever; the treatment of caries is curtailed; operative treatment of joints is deprived of much of its attendant risk; loose cartilages are removed with impunity, and the consequences of burns and scalds are mitigated. In the deligation of arteries the catgut ligature, steeped in a solution of carbolic acid in water with olive oil, has been employed; and the ends being cut off close to the knot and the wound closed, the knot itself has become absorbed or organized.

Finally, the alliance between pyæmia, hospital gangrene and erysipelas, seems to be indicated or confirmed by the fact that they have disappeared simultaneously where the antiseptic treatment has been employed and rigidly enforced.*

* A paper in the 'Edinburgh Medical Journal' for May, 1872, "On Antiseptic Surgery," may be consulted on this subject. The foregoing account has been obtained chiefly from this source.

BURNS AND SCALDS.

Severe burns or scalds require prompt attention and careful *treatment*. In stripping off the clothes of a burnt patient, great care should be exercised that the skin is not stripped off at the same time : and this is especially necessary in removing a tight garment, such as the stockings, which should be cut in their length instead of being drawn off. An examination must then be instituted over the whole of the burnt surface, to ascertain whether any, and what part, of the cutis has perished. The charred or ash-colour of the destroyed skin, usually with a de-fined margin, indicates the line of demarcation between the dead and the living skin.

In extensive burn, even without destruction of skin, the general condition of the patient demands immediate attention, for death may speedily result from the shock attending even a scald over a large surface. The patient must be treated in the same way as if suffering from collapse from other causes, viz. : by being warmly covered, and having warmth applied to the feet : and, in addition, stimulants are generally requisite to assist in restoring the heart's action : and when warmth is restored, a few drops of laudanum (according to the age of the patient) may be given at intervals, to allay pain and nervous irritation. Milk, beef tea, jelly, &c., should be administered. The condition of the mucous membranes requires careful watching, as the suspended function of a large surface of skin excites a vicarious effort in them.

Where vesication only has occurred, the surface must be protected ; and the best application is a mixture of chalk or whitening with vinegar and a little oil. This should be applied to the surface with a brush or feather, and renewed when dry, without disturbing the previous layer : speedy relief to pain is thus obtained.

As regards the local treatment of a part in which the cutis has perished, there is nothing preferable to a warm poultice, aided, subsequently, by a stimulating lotion, until the slough

has separated. The treatment is, in short, to be that of sloughing from any local cause. The healing of the granulating surface is hastened, and advantageously so, by transplanting skin in grafts, and sometimes by plastic operation.

Whenever the burn or scald involves a large surface, the prognosis should be guarded, even though the injury is superficial, and however favorable the early symptoms may be.

THE DIAGNOSIS OF TUMOURS.

In forming an opinion on the nature of a tumour, the surgeon is guided by a variety of circumstances : yet, even long familiarity with disease, and trained delicacy of touch and discrimination of eye, are not always sufficient to guide the most experienced to a certain diagnosis : therefore, the young practitioner must expect to meet with perplexing and doubtful cases in this branch of surgery. The circumstances referred to are the following :—The hereditary tendencies, and past and present health, of the patient. The history of the disease, as to the tissues primarily attacked or secondarily involved ; and as to the duration, appearance at different times, varying rapidity of growth, suffering, and any special tendency exhibited during its development. The existing position, mobility, attachments, form, size, consistency, vascularity, and sensibility of the tumour. Its interference with health, and with functions of other parts or organs. Its tendency to induration, softening, inflammation, ulceration, or suppuration. The application of these remarks will be found in the following analysis of the special characteristics of the more common forms of tumour.

Nævus, or vascular tumour, is generally congenital : when accompanied by swelling, constituting it, in fact, a tumour, its primary seat is in the areolar tissue, and the skin is frequently

involved secondarily : its growth is generally uniform and un-attended by pain. When the skin is not marked by the characteristic scarlet blot, which shows that the disease has extended to it, the subcutaneous nævus is a soft doughy swelling, often presenting a blue tinge on the surface, generally adherent to the skin, painless, varying in size, according to its duration and other circumstances ; and becoming distended when the subject of it cries or strains. These tumours usually exhibit no tendency to become inflamed, except under irritation. They frequently remain stationary for a considerable period, but generally grow uniformly by extension in superficial diameter and thickness. With the exception of the aneurism by anastomosis, these vascular swellings do not pulsate ; but they may be partially emptied of their blood by pressure, refilling when the pressure is removed : they bleed freely when punctured or cut ; and sometimes under ulceration, resulting from pressure or friction. No part of the surface of the body has immunity from vascular tumours ; but they are more frequent on the face, scalp, and back of the trunk, than on the abdomen and extremities.

Simple cysts are generally of slow growth ; though frequently, after long quiescence, they suddenly begin to expand rapidly. There seems to exist in some individuals a tendency to the production of these cysts, and very often there are several in the same individual. They may occur at any period of life ; and present themselves usually either under the form of dilated natural ducts, as in the sebaceous or lactiferous cysts ; or of the expansion of the areolar spaces of a tissue, in which fluid accumulates, and thus forms, in time, a circumscribed sac. These cysts are limited to the tissues in which they originate, and encroach, by their expansion, on surrounding textures. In their origin they are generally firmer in texture than when the accumulation of their contents expands and thins their walls. Those which are accessible for operation are found chiefly about the head, neck, and breast ; but they likewise occur, in connection with tendons and over parts subjected to pressure ; as ganglions and bursæ. Cysts are generally movable as regards their deep connections, though often adherent to the superjacent skin ; they vary in form, but single cysts are generally uniform

and oval or round in figure, unless modified by the pressure of surrounding textures. Their consistence depends on the character of their contents, which may be solid, thick or thin fluid; and on the density of their walls: they sometimes fluctuate on pressure. They are not very vascular nor endowed with much sensibility. Cysts have a disposition to suppurate, if irritated; and sometimes ulceration of the surface will allow of the escape of their contents, and of a spontaneous but tedious cure.

Sebaceous cysts occur chiefly in the scalp, and sometimes attain a large size.

Cysts which are found in the *neck*, and in the *thyroid body* in particular, are either single or multilocular, or in clusters, and usually contain serum in a limpid state, or discoloured with blood or other colouring matter. Some of those occurring in the neck contain so much blood, and have occasionally such indications of spongy structure, as to ally them closely with nævus growths.

Cysts of different kinds, and with various contents, are found in the *breast*; they may contain serum, or milk, or discoloured fluid, and sometimes attain a large size, and are then readily distinguishable by their history and physical characters.

Cystic tumours, the product of friction or pressure, are found over the patella, on the dorsal aspect of the clubbed foot, and in other localities which are subjected to irritation by certain occupations; also in connection with single tendons or muscles, or with bundles of tendons, as in the hand. They usually contain serum or synovial fluid; but sometimes opaque matter of thicker consistence, or granular matter.

Fatty tumours are generally of slow growth, and entirely unattended by pain. They are chiefly found on the surface of the body, and present either a circumscribed prominence, or, though more rarely, exist as an undefined redundance of fat at some particular part. They affect the trunk more than the extremities, and are found most frequently on the back of the neck, the shoulders and loins; rarely below the knees or elbows: occasionally two or more coexist. They are readily, though not loosely, moveable; for, though the defined form of fatty tumour is surrounded by a thin capsule, it is not otherwise

detached from the surrounding subcutaneous fat. These tumours have no regularity in form, but extend in circumference as well as thickness, if not interfered with; sometimes they become pedunculated. To the touch they present the consistence and feel of fat, being more or less irregular, elastic, and yielding; occasionally they attain a very large size. Their vascularity is trifling, and they are not the cause of pain, unless indirectly by pressure on sensitive parts. They show no tendency to inflammation; though troublesome ulceration sometimes occurs in a pedunculated fatty growth. Fatty tumours may be distinguished from fibrous or fibro-cellular tumours by the greater firmness and elasticity of the latter, which are also usually found where the former are rare, especially about the organs of generation.

Cartilaginous tumours, or *Enchondromata*, are more frequent in early than late life. They vary much as to rapidity of growth; and are met with chiefly, though by no means exclusively, in connection with long bones, near to joints, and on the fingers. They are usually painless themselves, though sometimes the source of pain from tension and pressure on surrounding parts. They are firmly attached, generally by a broad base, and immovable. They are, in some instances, uniform and smooth, in others nodulated on the surface; generally firm, with a certain amount of elasticity; but occasionally yielding readily under pressure, though as readily regaining their former shape. They attain, in some cases, a very large size; and interfere seriously with the functions of parts and organs near or to which they are attached. Occasionally they become ossified; and in some instances manifest a tendency to softening and degeneration.

Osseous tumours are connected with the same parts, usually, as the cartilaginous growth, and possess many characteristics in common with them. They are distinguishable by their unyielding hardness: they are of slow growth.

Myeloid tumours also occur chiefly in connection with bones, growing either in their structure and expanding them, or, though more rarely, from their surface. They are met with chiefly in early life, and are of slow growth; their consistence

varies, being sometimes firm, in other cases softer and more yielding; their surface is generally uniform. They are usually painless, and show no tendency to ulcerate, nor to return when removed.

The various forms in which **Cancerous** tumours present themselves, their almost universal diffusion, their extension from one tissue to another, their varying characteristics in rapidity of growth, the suffering entailed, their destructive interference with neighbouring organs, and the varying tendency of their later stages, render it difficult to define briefly how to distinguish these from all other tumours. The subject will be best illustrated by example, and by comparing cancer with other tumours in bones, the testicle, and the breast.

Long Bones in the neighbourhood of joints, as the tibia and femur, near to the knee, are the subject of *osseous* and *cartilaginous* tumours, as well as of *myeloid* disease, the characters of each of which have been described. These parts are likewise obnoxious to *cancer*, in the medullary, or colloid form. Soft cancer invades the interior, and grows from the exterior, of bones; and generally the surface, texture, and medullary canal are simultaneously attacked. In this way the outer walls and cancellous structure of the articular ends of a bone may become expanded and thinned, containing deposits of cancerous matter; or these parts may be the seat of osteoid cancer. In the diagnosis of these malignant growths, the hereditary tendency, past and present health of the patient, the history of the disease, its primary development, its duration, rapidity of growth, and the suffering it has entailed, all have an important bearing. Whether on the surface, or in the interior, of the bone, the disease forms an integral part of it. Its form varies; but the expansion of bone is generally more uniform than the external growth; it varies also in consistence, being, however, generally firm, though unequally so; softened at some parts, at others hard, nodulated, and even crackling under pressure, from the partial resistance offered by the thin wall of bone around it. This disease is usually attended by much suffering to the patient, and the health becomes seriously involved; if the skin yield at any point, fungating growth follows, in some instances

accompanied by much bleeding. Its ultimate tendency is certainly fatal. This disease attacks the jaws and pelvis as well as the extremities.

The foregoing tumours are to be distinguished from *scrofulous* disease or tubercular deposit in the cancellous structure of the extremities of long bones. Such infiltrations run the course of similar disease in the vertebræ or tarsal bones, terminating in caries and suppuration.

The TESTICLE is the seat of many forms of tumour, such as *tubercular*, *cancerous*, *fibro-cystic*, and *cartilaginous*; besides being liable to changes and enlargement, consequent on injury or inflammation of its structure or coverings.

The physical characters of these various swellings are so much modified, or rather assimilated, in many instances, by the dense fibrous investment and interstitial tissue of the organ, that the surgeon is compelled to depend very much on the history of the disease and the condition of health of the patient to throw light on the case. Without such assistance, for instance, it would not be always easy to distinguish between medullary cancer of the testicle and hæmatocele; for, generally, the cancerous deposit is bounded, as is the effused blood, by the coverings of the organ; the dense fibrous coat giving a uniform resisting surface in the former, as the thickened vaginal tunic does in the latter. Medullary cancer of the testicle may have cartilage or even bone combined with it, by which its external characters are modified.

Scrofulous disease of the testicle may attain a considerable size, and soften at various points, before it suppurates. Where there are cysts, they may generally be distinguished (apart from other characteristics) by the absence of inflammation or special tenderness, where there is fluctuation.

In the BREAST, again, many different tumours grow, and require careful discrimination. The *mammary glandular* (*adeno-cele*) tumour and *scirrhus* may be selected for comparison. The former of these occur either on the surface of, or within, the true gland-tissue. They are but loosely connected, and are therefore readily moveable, even when partly imbedded in the gland. They grow with varying rapidity, displacing the true

gland, and attaining, sometimes, a large size. In consistence they are firm and elastic, but generally irregular on the surface. *Scirrhus* is very hard and heavy, and not elastic, which is especially remarkable where the growth is slow; and it rarely attains a very large size. The development of these tumours is usually slow; but there is considerable variety in this respect. They are not so moveable as the mammary tumour, but seem to be adherent to the surrounding gland; and further, they contract adhesions to surrounding textures, especially the skin, which is often puckered; and the nipple is drawn in. These conditions, together with the history of the disease, the probably inherited tendency to it, the peculiar, sharp, lancinating pain which accompanies it, and the deteriorated health of the patient, are generally sufficient to characterise and distinguish scirrhus of the breast. This organ is rarely the seat of any other form of cancer; as rarely as the testicle is the seat of scirrhus.

Chronic inflammation, with circumscribed induration of the mammary gland, is sometimes accompanied by shooting pain through the affected part, probably indicative of central suppuration; and under these circumstances it might be mistaken for scirrhus tumour, unless attention is paid to the characteristics which have been referred to.

It should be remarked that, though the mammary glandular tumour is usually attended with but little or no pain, small, circumscribed growths, of the same or a similar texture, are sometimes highly sensitive.

ON THE DETECTION AND EARLY TREATMENT OF CERTAIN FRACTURES.

The detection of some fractures requires no skill; the injury is self-evident: but much tact, as well as knowledge, is required for the discovery of some obscure fractures, especially

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where they occur near joints, and may, therefore, be confounded with dislocation. Injuries to the shoulder and hip are chiefly obnoxious to this obscurity, for there the muscles cluster thickly around the joints. But in other situations also there may be some difficulty in eliciting the signs of fracture, and this is much enhanced by a want of acquaintance with the proper method of conducting the investigation.

There are certain **general rules** *in making an examination* for fracture, which are applicable to all cases. Thus, all unne-cesary violence must be avoided, as not only distressing to the patient, but mischievous in its consequences. If fracture is suspected, but no positive or satisfactory proof of its existence can be elicited, it is expedient to treat the case as if a fracture was ascertained, and to make a further examination after the lapse of two or three days. When there is much swelling about the seat of a suspected fracture, so as to render a satisfactory examination impracticable, it is desirable to wait until the effusion has been absorbed : in consequence of the obscurity arising from this cause, the examination should be made as soon after the receipt of the injury as possible. These remarks apply with varied force in different instances : *e. g.* careless violence used in attempting to determine the existence of fracture of the spine might be productive of fatal consequence by compression and laceration of the spinal cord. Again, fractures near to joints, as at the shoulder, are much more masked by effusion than in most other situations.

When examining a patient for suspected fracture, the surgeon must not expect to find all the ordinary signs of such injury always present : indeed, it may be said that no one sign is sufficiently constant, to be regarded as essential to the diagnosis. Thus, fractures may occur, without any one, in particular, of the following signs being present ; viz., distortion, unnatural mobility, crepitus, loss of power, pain, swelling or spasm ; and yet some of these are sure to exist, and, in many instances, all. Information to be derived through the sight is first to be sought ; and this includes swelling and distortion. Swelling may, of course, be due to a variety of causes, being often greater in sim-ple contusion than in fracture : but distortion, such as charac-

terises fracture of one of the limbs, can only be due to this cause, or to dislocation. The spasm of a broken limb may often be witnessed; and the deformity it produces is often sufficient to indicate the existence and nature of a fracture. For the presence of pain and loss of power, the patient's testimony must be trusted : and sometimes the acuteness of the surgeon may be tested, in these respects, by patients who have an object in deceiving him. Abnormal mobility and crepitus must be elicited by movement of the bone or limb which is supposed to be broken : and this part of the investigation must be conducted in various ways, according to the part examined, as will be presently exemplified. But distortion, pain, and spasm are all, likewise, capable of being made manifest by manipulation. Thus, irregularity of a broken bone, which is not visible, may be tangible, as, for example, in the tibia, when it is broken alone. It is scarcely necessary to add that both pain and spasm may be caused by moving a fracture. Though, as remarked, all of these signs may be present, it is not necessary that they should be made manifest : the examination should not be prolonged after sufficient proof has accumulated to satisfy the surgeon of the existence, position and nature of the fracture ; for this is all he needs to guide him in his treatment.

Thus, when called to a case of suspected fracture, the surgeon's first care should be to learn the history of the accident ; how the patient fell, was struck, or run over : then he will view the seat of injury, and help himself in this ocular examination, by comparing corresponding parts on the two sides. If requisite, he will next proceed in the investigation by handling the parts, so as to ascertain whether there is unnatural mobility or crepitus, and whether he can produce deformity : and he may again find it useful to call to his assistance a comparison between the corresponding sides of the body. If the fracture is near a joint, and there exists any doubt as to whether it is a dislocation, he must recall all the characteristics of each injury and compare them, severally, with the signs which are manifested in the case he is examining. But, if there is already too much swelling to enable him to prosecute this examination satisfactorily, he will do well to place the patient in an easy and

favorable position, and to resume the inquiry when the swelling has subsided, employing measures in the mean time to accomplish this object.

There are so many features possessed in common by fractures and dislocations, that much caution is necessary, in some instances, in determining the nature of the injury. Thus, there is, usually, deformity, loss of power, pain, swelling and spasm, in both accidents; and even the peculiar rubbing sensation which may be elicited by moving a dislocated bone, and which appears to depend on the effusion and altered condition of the synovia, may be mistaken by an inexperienced hand for the crepitus produced by moving the broken ends of a bone against each other. A severe bruise, likewise, may produce many symptoms which might be mistaken for fracture, especially when there is extravasation immediately around a bone. Inquiry should also be made, in all cases of doubt, whether a patient has been the subject of any previous accident, or was deformed congenitally, or in consequence of any peculiarity in his occupation. Thus, the habit of carrying a weight on one shoulder produces an unequal elevation of the two sides; and the position in which a blacksmith stands, in wielding a heavy hammer, may give a twist to the right leg, by causing eversion of the foot and inversion of the knee.

As in the diagnosis, so in the *treatment*, especially the early treatment, of fractures, there are *general rules* to guide the practitioner, which are applicable alike to all cases. Thus, repose of the injured bone, as nearly absolute as possible, and a position which favours the coaptation of the broken ends, are demanded in every instance. In some cases these objects are readily fulfilled, as where the shaft of the tibia alone is broken; whereas, in others, spasm of the muscles offers a very serious obstacle to the adjustment of the fracture. As regards the period for permanently " putting up " a fracture, there is no fixed rule; for, loose and moveable fractures, as of the thigh, require the support of apparatus at once; but a fractured leg may be generally laid on its outside, and but lightly confined until the swelling from the effusion has somewhat subsided. The period, also, during which it is necessary to persevere in

the use of splints, varies according to the size of the bone, the nature of the fracture, the age and health of the patient, &c. The constitutional treatment must be, in like manner, guided by circumstances. In all cases the surgeon should inspect the fracture from time to time, and re-adjust the apparatus.

A few suggestions on the detection and early treatment of some particular fractures will conclude these remarks.

Spine.—In suspected fracture of the spine, the utmost caution should be exercised in moving the patient, and great gentleness in examining the injured part. Any rough movement of the body, or coarse manipulation at the seat of fracture, is likely to aggravate the mischief seriously. All that is justifiable is to pass the finger along the ridge of spinous processes to detect any deviation in regularity : and to be satisfied as soon as such irregularity is discovered. At the same time it must be remembered that, although no fracture can be detected, one may exist, without displacement of the vertebral arch ; or the symptoms may be due to extravasation of blood, or only to concussion (pp. 76 and 112).

Ribs.—In examining a patient with fracture of the ribs, it should be remembered that the only displacement admitted of is inwards or outwards. The proximity of the pleura renders it very liable to laceration by the broken ends of the bones ; therefore any rough pressure with the fingers at the seat of injury must be avoided : this is not the way to detect crepitus and unnatural mobility. If the open hand be pressed gently over the suspected spot, whilst the patient inspires deeply or coughs, the desired evidence will be elicited. It is very rarely requisite, or even justifiable, to place pads or compresses on the chest to assist in rectifying any displacement of the fractured ends : if perfect repose do not accomplish this, it is not likely that force will. A broad bandage firmly applied fulfils all the indications in ordinary cases of fracture of the ribs (pp. 76 and 144).

Pelvis.—If fracture of the pelvis be suspected, its outline should first be carefully examined, by passing the finger along the crest of the ilium, over the body of the pubes, and down its ramus and that of the ischium, to the tuberosity of the latter :

if necessary, these parts may severally be grasped between the finger and thumb, and their mobility be thus tested. Pressure, with a hand placed on the anterior spine and crest of either ilium, as the patient lies on his back, will be attended with abnormal mobility, if the fracture is extensive or complicated. No further apparatus is needed than a supporting bandage; and this not usually, as displacement is trivial, except in fatal cases; but perfect rest must be maintained, and secured if requisite (pp. 77 and 171).

The **Scapula** may be examined by grasping in succession the internal and inferior angles, and the spine and acromion process: pressure on the coracoid process, whilst the patient breathes deeply, is the way to ascertain whether it is broken (p. 78).

Arm.—Of the fractures below the shoulder, those in the neighbourhood of the elbow and wrist are alone difficult to detect. The olecranon, if broken off, is always more or less separated from the shaft of the ulna, and therefore this fracture is easily detected. The very rare accident of fracture of the coronoid process of the ulna is difficult to detect, except from the loss of resistance and of muscular antagonism, consequent on the injury. When the arm is extended, the triceps, being unopposed by the brachialis anticus and the passive resistance offered by the process, draws the ulna upwards: the arm should, therefore, be kept constantly flexed. Fracture of either condyloid process may be discovered by grasping and moving it: but these injuries and fractures involving the joint, are often rendered very obscure by the effusion which rapidly succeeds the accident: in such case examination should be delayed until the swelling has subsided. The integrity of the head of the radius may be ascertained by its following the rotation of the hand; and this may be felt by grasping it between the finger and thumb. When the base of the radius is broken near the carpus, or the epiphysis separated, the examination must be made by placing a thumb on the suspected seat of fracture, whilst the hand is grasped and adducted: in this way both mobility and crepitus may be elicited, by the lower fragment being drawn down and tilted through the agency of the external lateral ligament;

but the deformity assists very much in the diagnosis of this injury.

Leg.—Fractures near the knee are not generally difficult to detect unless there is much swelling : and the superficial relations of the ankle-joint enable the surgeon, generally, to make an accurate diagnosis of fracture in its proximity. Broken malleoli are sometimes marked by effusion for a time ; but afterwards, inversion or eversion of the foot, whilst the fingers are pressed on these points of bone, is usually accompanied by palpable crepitus or unnatural mobility, or by both : if necessary these processes may be grasped between the fingers and thumb, and moved from side to side ; but generally a fissured interval marks the line of fracture. Fracture of the fibula, where under cover of the peronei muscles, is often difficult to ascertain positively : but it may be inferred from the concurrent testimony of pain and loss of power with the history of the accident. It is a far more serious matter to overlook a fracture of the lower than of the upper part of the fibula, for permanent displacement of the foot may result from neglect of the former, but no lasting ill consequence need ensue from failing to discover the latter. Care must be exercised in handling a loose fracture of the leg on account of the facility with which a simple fracture may be made compound. It is a safe precaution, in moving a patient who has a broken leg, from the scene of the accident, or from one room to another, before any apparatus is applied, to fix both limbs firmly together : the sound limb thus acts as a splint to the injured member.

The **Hip-joint** is deeply buried in muscles ; and therefore fractures in its close neighbourhood cannot be felt, except indirectly : and the diagnosis must be formed from the general signs rather than from direct evidence. When the fracture is through or below the great trochanter, the immobility of this prominence when the limb is rotated, and crepitus, usually indicate the nature and seat of the injury ; but fracture of the neck must be inferred chiefly from the deformity which characterises it (p. 80).

When summoned to a case of injury of the hip, the surgeon's first inquiry should be regarding the mode in which the accident

occurred ; from the information thus obtained, he may generally form a probable conjecture as to whether he has to deal with a fracture or a dislocation.   For, as with the shoulder, fractures about the hip-joint are almost always produced by direct violence ; whereas, in dislocation, the force is almost always indirectly applied (p. 96).

But this is only a preliminary step in the investigation.   It is better, in the first instancc, to examine the patient in the recumbent posture ; afterwards, if there be any obscurity, he may be got up : as, thereby, the characteristics of these injuries become in many instances more strikingly marked. Whilst the patient is lying perfectly straight on a bed or couch, with the legs side by side, a careful comparison should first be made between the anterior spines of the ilia, to see that they are on the same level.   Then a similar comparison is to be made between the limbs as to their length and position ; and a tape or string should be carried from the anterior superior spine of the ilium to the inner malleolus on either side : any difference in length will thus be readily detected ; and it will be noticed whether the foot is inverted or everted.   If the injured limb is shortened and everted, there is only one other accident, besides fracture of or near the cervix, of which this deformity is suggestive, viz., dislocation on to the pubes, in which these signs also occur.   But the other differences are too marked to escape observation.   In fracture of the cervix, the accident usually occurs in the elderly, and by a fall on the trochanter : the limb is moveable in various directions, and capable of elongation to its normal length, though retraction takes place again as soon as the extension is relaxed.   The thigh can also be rotated ; and in performing this manœuvre, crepitus is generally elicited : and notice must be taken, at the same time, whether the trochanter rotates with the shaft of the bone. But, in dislocation on the pubes, the limb, though shortened and everted, cannot be rotated inwards, nor can it be elongated : it is, in fact, fixed in position ; and the head of the bone may be felt on the body of the pubes, beneath Poupart's ligament. In both the backward dislocations of the femur, the limb, though shortened, is inverted : and though it occasionally happens that,

in an impacted fracture of the cervix, there is inversion of the limb, and even a certain amount of support afforded to the superincumbent weight, yet the comparative mobility and trivial deformity of the fracture distinguish it from dislocation. But such impacted fractures, with inversion, are very rare.

The question whether the fracture is within or external to the capsule is not of practical importance : the treatment should be the same in both.

Fracture of the neck of the thigh-bone should be put up at once, by adapting a long outside splint, which must extend some distance above the trochanter, so as to admit of counter-extension. This splint must be fixed firmly to the entire limb, care being taken that the ankle and foot are protected from pressure by the introduction of soft pads. The perineal bandage, by which counter-extension is to be made, must also be softly padded : its two extremities are to be carried through the notched extremity of the splint, and firmly tied, whilst extension of the entire limb is made by an assistant. But it is not requisite, nor desirable, to carry this extension to an extreme during the first two or three days.

Fracture through the base of the trochanter may generally be distinguished by the immobility of this apophysis, when the thigh is rotated ; the treatment is to be conducted on the same principles as that of fractured neck of the thigh-bone. (See also p. 80.)

It may be remarked that, in relation to fractures of the thigh generally in either sex, fracture of the neck is more frequent in the female than in the male; which is probably due to the greater prominence of the trochanter in the former : and though a fall on that apophysis is by far the most rife cause of such fracture, it may also result from a fall on the knee or foot, when the cervix is weak from attenuation. The shortening of the limb varies considerably in accordance with the elevation of the trochanter. The very rare accident, in which the head of the femur is forced through the acetabulum into the pelvis, may occur : and it is possible for dislocation and fracture to coexist.

In all cases of injury near the hip-joint, the relation of the

trochanter to the spine of the pubes and tuberosity of the ischium should be noted, and compared with that on the sound side.

The **Shoulder-joint** and its neighbourhood are subject to many injuries, which have certain features more or less in common; and thus a correct diagnosis is not infrequently perplexing to those who are unfamiliar with these injuries, and who are unacquainted with characteristics by which they may be distinguished from each other. Thus, flattening or hollowing of the shoulder, in a varying degree, will be found in fracture of the acromion process or glenoid cavity of the scapula, dislocation of the head of the humerus, fracture of the neck of the humerus : and in any injury or disease which paralyses the deltoid, and especially the small rotator muscles of the shoulder-joint, whereby stretching of its capsule is permitted ; for this effect occurs as a necessary consequence of the loss of the support afforded by their tonic action. Therefore, it must not be concluded, because there is loss of rotundity of the shoulder, that there is necessarily either fracture or dislocation. In such cases as those last referred to, the deformity may be very marked in long-standing disease accompanied by disuse of the arm : but, in cases of recent injury, it would be comparatively trifling, and simply attended by loss of power in the affected muscles, without the characteristics of the other injuries.

When the surgeon is required to examine a case of injury of the shoulder, he should first inquire how the accident happened ; whether by a fall on the hand or elbow, with the arm extended ; or on the shoulder, with the arm by the side. It is also well, if there be any doubt, to verify the patient's statement by examining the palm of the hand, or the coat worn at the time. As in accidents to the hip, a shrewd surmise may be formed as to the nature of the injury from this information : for, if the momentum of the fall has been received on the outstretched hand or elbow, the consequence is probably either a fracture of the clavicle, or a dislocation of the humerus : but if the fall was directly on the shoulder, it is more likely to be either a fracture of the glenoid cavity or acromion process of

the scapula, or of the neck of the humerus. The patient should then be stripped to the waist, and bidden to stand upright, with the arms depending by the side. In this way any difference between the two sides is readily observed. If, in addition to hollowing or flattening of the shoulder, with prominence of the acromion, the injured arm hangs loosely and helplessly, without any effort on the part of the patient to support it, the case is more probably one of fracture than of dislocation ; for the latter accident is characterised by fixedness of the arm and its separation from the side, the elbow being usually supported by the sufferer, to mitigate the effect of pressure on the axillary nerves.

But it is only by a careful manual examination of the joint and its neighbourhood that a satisfactory diagnosis of many of the injuries of the shoulder can be arrived at. The following is the proper way of conducting this examination :—The patient is placed in the upright posture, with his arms hanging by his sides, or supported by an assistant symmetrically in front of the chest. The surgeon, standing behind his patient, places the forefinger of either hand on the corresponding sterno-clavicular articulation, and carries them simultaneously outwards, along the clavicle, and then around the acromion and along the spine of the scapula : the slightest difference between the normal and injured side will thus be readily detected. It may chance that, in sweeping the fingers over this irregular arch, he may meet with dislocation or fracture of the sternal end of the clavicle, fracture of the shaft of that bone, or of its scapular extremity (p. 78), or fracture of the acromion itself, or of the spine of the scapula (p. 78). Most of these injuries are readily recognisable from the superficial position of the bones : fracture near to, or dislocation of, the acromio-clavicular articulation may be confounded ; but if so, the practical importance is not very serious, as the treatment of these accidents is essentially the same ; though that of the dislocation is generally more tedious than of either of the fractures, in consequence of the laceration of ligament by which it is attended.

But neither of the above injuries may be discovered, and

thus the question becomes much circumscribed ; for, if there is any accident to joint or bone, it must be either a fracture of the glenoid cavity or neck of the humerus, or a dislocation of the head of the latter. As regards splitting of the glenoid cavity, it may be remarked that it is a very rare accident, that the attendant swelling is great, and that the signs of its presence are the same as those of fracture of the neck of the humerus, except that the head of the bone, in the latter accident, is immoveable when the shaft is rotated. For practical purposes, however, the rarity of fractured glenoid cavity limits the doubt usually to the alternative of fractured neck of the humerus and dislocation. The presence of the head of the humerus beneath the pectoral muscle, or in the infra-spinous fossa (p. 93), together with the position of the arm, generally suffices at once to distinguish these accidents : therefore, the diagnosis lies really between dislocation into the axilla and fracture of the neck, where any doubt exists.

It cannot be denied that, although the distinguishing signs of these injuries are generally well marked, there are occasions when some doubt may reasonably exist ; and, perhaps, others in which, from want of experience and proper information, there is perplexity where there ought to be none. When the swelling from effusion is very great, and the accident occurs in an aged and fat person, in whom the muscles are feeble and lax, and where no satisfactory account can be obtained of the mode in which the accident happened, some hesitation is excusable. Under such circumstances, it is better to wait until the swelling has subsided, than hastily and recklessly to apply force in attempting to treat a case, which may be fracture, as if it were a dislocation : though it should be remembered that the earliest period is the best to reduce a dislocated bone. The diagnostic signs of each of these injuries have been already described (p. 94) : it may here be repeated that the indications most to be depended upon, apart from the way in which the accident occurred, are, the passive mobility of the humerus in fracture, the shortening, or absence of elongation of the limb, the presence of bony crepitus, and, beyond all, the practicability of restoring the rotundity of the shoulder. For the purpose of

testing the presence of these and other signs, the surgeon should bend the elbow to a right angle and press it upwards, whilst he fixes the scapula : no striking change of configuration of the shoulder, no obliteration of the hollowing of the deltoid, are thereby produced in dislocation. Retaining the arm in the same position, he will then rotate the humerus, by acting on it through the forearm, whilst with the other hand he grasps the shoulder, and endeavours to feel whether the head of the bone moves in concert with the shaft ; likewise, by transferring his hand to the axilla, he will seek to ascertain the same fact, and judge also whether it is really the head or fractured extremity of the shaft which he feels there, when the arm is separated from the side. Lastly, he should carefully measure each arm from the point of the acromion process to the outer condyloid process of the humerus, as perceptible lengthening belongs to axillary dislocation, and not to fracture. The possible complication of the two injuries existing simultaneously need not trouble him, for it is of very rare occurrence.

Finally, if the signs of both dislocation and fracture are absent, with the exception of disability of the patient to raise his arm, of some falling of the humerus and consequent prominence of the acromion, and limited flattening of the shoulder, which can be obliterated by raising the humerus perpendicularly, the scapula being fixed, he may conclude that the case is one of contused and disabled muscles, involving probable injury to the supplying nerves, and requiring the same treatment as fractured neck of the humerus. It may be remarked that the disability and pain from such contusion is often of long duration and succeeded by shrinking of the muscles of the shoulder.

Injury to the humerus, in the neighbourhood of the shoulder-joint, may be a *separation of the epiphysis* in the young, or a *fracture above or through or below the tubercles* in the adult. The treatment consists in placing a soft but firm pad in the axilla, which must be fixed there by a bandage or handkerchief carried over the opposite shoulder ; the application of a short splint on the inside of the arm, and of a long outside shoulder-splint of leather or wood, which should envelope the shoulder and extend to the elbow. The arm must then be confined

to the side by a belt or bandage, and the elbow supported. Previous careful bandaging of the entire arm prevents or limits the œdema consequent on interruption of the circulation from pressure in the axilla.

ON THE DIAGNOSIS OF JOINT DISEASES.

It is of the greatest importance to the surgeon to be able to diagnose joint diseases, and particularly in their early stages, for the good which can be done to them is best done early, while the mischief which may follow the neglect of them is often irreparable. An outline of the different forms of disease affecting joints has already been given (page 83), and it may be useful to examine the cases now from a different point of view—to take them as they are likely to present themselves to the surgeon. It may be remarked, before proceeding further, that the condition of the interior of the joint may be pretty accurately diagnosed, and the situation of disease also determined, but that, for this, the examination must be made methodically and with great care. The knee-joint is most commonly affected, and the following remarks apply directly to that joint, but indirectly more or less to all joints.

When a case presents itself with some affection of the joint, the **history of its commencement and progress** will sometimes be of great assistance towards a diagnosis. *Did the present disease follow an injury, or did it begin of itself?* Caries and chronic synovial disease are commonly constitutional, and therefore are not usually the consequences of injury ; necrosis, on the other hand, is more commonly the result of injury or exposure to cold. Synovitis may, of course, follow an injury, and frequently does, but then it is acute and is not usually permanent ; and the symptoms of traumatic synovitis are so distinct as not to be liable to be confounded with other and more serious affections of joints.

If it followed an injury it is important to learn *what time has*

elapsed since the receipt of it, and *whether the disease has been progressive, whether there have been exacerbations,* and *whether these have resulted from fresh, but slight injuries,* such as catching the foot against anything, &c. If the accident has been recent the probability is in favour of traumatic synovitis ; and whether this be the only injury or not, the treatment has to be directed to this condition. If the accident be of old date, and there is a history of the patient having been laid up some time at first, and of frequent relapses having occurred from slight injury or from unknown causes, or from slight exertion, the probability is in favour of necrosis. But repeated attacks of chronic or subacute synovitis may occur without a sequestrum being the starting point of the mischief, when the patient's health is poor, or when the joint has not been properly rested in the first instance. The history thus far can only point to probabilities, and the joint must now be submitted to examination for present facts.

If the mischief is not traceable to injury, did it follow exposure? Necrosis appears sometimes to follow a sudden chill or exposure in a debilitated constitution. *Did it follow rheumatic affection of other joints?* or *did it follow fever of any kind?* or *was it spontaneous?* Rheumatism affecting several joints is not generally followed by persistent disease in any one, but it occasionally happens that one remains chiefly affected, and the patient's attention is directed to this alone. Enormous enlargement of the joint and of the ends of the bones, with bony or calcareous deposits in the surrounding tissues, will sometimes follow rheumatism, but in such cases other joints are usually affected, though to a less degree. The character of the disease here is of the chronic type, and the structures diseased are chiefly the synovial and ligamentous, but the bones are not exempt. Patients often refer the origin of their disease to rheumatism or rheumatic fever, when a further inquiry will prove it to have been acute osteitis, and the symptoms of the two diseases are very closely allied, as remarked elsewhere, and very similar in some cases to those of typhoid fever. However, it is not uncommon to find that, during convalescence from severe eruptive fevers, one or more joints become diseased ; and in such cases the character of the disease differs from that following rheuma-

tism in being frequently of the suppurative type, the same process going on in the joints as occurs in the loose areolar tissues, by the formation of abscesses in such cases.

If it was spontaneous, is there any evidence of strumous taint? By far the larger number of cases of joint disease are traceable to this cause, and there appears to be a difference·in the pre-disposition to joint diseases in the two types which are commonly recognised in scrofulous patients. Joint diseases appear to be more common in those of dark, muddy complexion and dull intellect, and the disease usually affects the synovial mem-brane or takes the form of caries in the bone. Again, *if it were spontaneous, how did it commence? Was swelling the first symp-tom,* or *did pain precede the swelling?* If swelling was the first symptom, and was not attended with pain for some appreciable time, the synovial membrane is pointed to as the tissue first affected. But if the patient suffered pain for some time before the swelling appeared, and this pain was constant, aching, and especially troublesome at night, the bone is indicated as the original seat of the disease, and the nature of the mischief is probably necrosis, or possibly subarticular caries. The patient is often able to localise the seat of pain, and indicate in that way where the disease will be found. Caries more often follows or accompanies synovial disease, while necrosis frequently is inde-pendent of synovitis for a longer or shorter time, and varies greatly in the intensity of its symptoms.

The history of the case having been obtained, and a clue thus given to the nature of the disease, the joint must be submitted to examination, and first it is advisable to observe facts—to take the **objective symptoms** before the subjective.

(*a*) *Alterations in form.*—The joint may be swollen. If the swelling project above the patella, and on each side of the ligamentum patellæ, this is an indication of synovial effusion. Of course this may not be all the disease existing, but so much is determinable by the character of the swelling. The effusion may so fully distend the capsule of the joint that little or no fluctuation can be obtained, but such a condition only occurs in recent cases, and as a result of injury ; fluctuation through the joint can generally be obtained.

Swelling may be general, around the joint as well as in it, and this is usually an evidence of the acuteness of the mischief, and under such circumstances is of serious import. But swelling, with the other signs of inflammation in the tissues around the joint, without distension of the joint itself, is of much less importance, and would lead to the examination of the bursa patellæ as the source of the apparent disease of the knee, or to some surface injury. Simple œdema of the tissues in this position may also be a chronic result of disease in the bursa, if unattended by œdema of the limb below.

Swelling, again, may be local and yet the result of disease in the joint, as when, after long-standing disease, the joint becomes partly obliterated, and a collection of fluid, usually pus, remains at one point, or a recent attack of inflammation has caused the formation of an abscess in one part of the half-closed joint.

But the swelling may be of bone ; the ends of the bones may appear to be enlarged, and this occurs very commonly in strumous diseases of joints. However, enlargements of bone are often more apparent than real, and are more frequently due to the infiltration of periosteum and surrounding tissues by inflammatory material.

The swelling may be, also, nearly altogether popliteal, and this is often glandular ; but such glandular enlargement is frequently indicative of mischief in the bones or joint.

Other alterations in form which must be taken notice of are those due to displacement of the bones ; and when this is real, as evidenced by measurement and comparison with the sound limb, it is certain that the disease must at some time have been extensive enough to destroy or soften the ligaments.

(b) *Alterations in temperature. Is the joint hotter to the feel than the other?* If so, there is evidence of active changes going on. This is a useful assistance in diagnosis and should not be neglected. The absence of heat is indicative of a chronic form of disease.

(c) *Alterations in colour.* The skin over a joint may be *red. Is the redness diffused or circumscribed?* If diffused, this may be an indication of participation of the tissues in the inflamma-

tion going on in the joint, as occasionally in traumatic synovitis, or commonly in rheumatic or gouty inflammation ; or it may be an indication of inflammation external to the joint, and independent of it ; or of erysipelas, and in this case the redness will usually be well defined, and constitutional symptoms, furred tongue, shivering, and high temperature, accompany it. If it be localised, the surgeon will be led to examine the spot as the focus of disease. The surface, however, may be *whiter* than normal, and this condition is present in chronic forms of joint disease, as, for instance, in the so-called white swelling of the knee.

Again, the surface may be *mottled* and the veins unusually prominent, and this condition occurs sometimes after long-standing disease where the vessels have not recovered their tone, or where obstruction to the return of blood has resulted from the pressure of inflammatory effusion. Venous congestion over a joint will often lead the surgeon to examine it carefully when little else at first indicates the existence of disease.

(*d*) *Alterations in power of movement.* The limb may be fixed, entirely or partially. If *entirely fixed*, the cause of the immobility may be bony or fibrous ankylosis, and, if fibrous, it may be partially from ligamentous thickening and partially from fibrous union of the ends of the bones. In either case there is evidence of long standing disease, but this does not exclude the presence of recent disease in one or more spots. In many cases, however, it allows of more interference being made use of, for there is no longer any synovial cavity in which inflammation can spread rapidly after operation. If the joint be fixed in an inconvenient position it may be necessary to resort to excision.

If the union be *incomplete*, and the movements only limited, *can the deformity be partially or entirely removed under chloroform?* If so, the disease may be hysteria, or the contraction due to reflex action from an acutely diseased joint ; in the former case the constitutional symptoms will be absent, in the latter they may be severe.

Are the movements impaired only in certain directions? This may be due to fibrous thickening of certain ligaments, to

localised swellings about the joint, as exostosis, glandular enlargements, displacements of interarticular cartilages, loose cartilages, &c. A patient comes with inability to straighten his knee, and with a history of this condition occurring suddenly after a slip or sprain, and he may or may not have subsequent swelling of the joint. Examine carefully for dislocated semilunar cartilage, or for loose cartilage. It is well to notice the position into which a limb is thrown when a joint is distended with fluid, as it will afford an indication of the direction in which displacement will gradually take place if the disease continues, and it will also indicate the position in which the limb should be placed to give the greatest ease to the patient in acute cases.

(e) *Varieties in the results of manipulation. What can be elicited by direct pressure ? Is the joint tender on pressure over all parts, or is the tenderness more particularly marked at one spot ?* Press firmly over separate parts of the joint, and take care now and then to distract the patient's attention. In general synovial disease the tenderness is universal ; in caries and necrosis it is more often localised to the seat of disease.

What is the effect of putting the different ligaments on the stretch ? and what is the effect of pressing bone-surfaces together ? Examine this methodically. In the case of the knee abduct the limb, and if pain is thereby produced on the inner side of the joint, this is the result of disease in the internal ligament ; if on the outer side, it is due to pressure of two surfaces of diseased bone together. Adduct the limb, and pain on the outer side will be ligamentous in origin, while pain on the inner side will be bony. Similarly, flex and extend and rotate, and observe the spots at which pain is most marked. Such an examination, combined with that of direct pressure, will usually indicate the character and extent of the disease.

Is the joint fluctuating to the feel ? This may be due to serum or pus ? In the latter case the constitutional symptoms will be marked if the whole joint be affected ; but if the swelling be of pus localised, such a swelling may be chronic, and the constitutional symptoms proportionately lessened.

Is there any bogginess to the feel ? This may be due to gelatinous infiltration around the joint, or to deep-seated mis-

chief. Pulpy degeneration of the synovial membrane of the knee may be detected by pressure on each side of the ligamentum patellæ.

Can the bones be felt to grate when moved? This symptom exists in advanced disease of the joint when carious surfaces are exposed ; but a dry, rubbing sensation is also sometimes obtained when the joint is deficient in fluid, or when the surfaces of cartilage are eburnated, as in gouty and rheumatic affections of long standing.

Next, with regard to **subjective symptoms.**

Where does the patient complain of pain? What kind of pain? Is it constant, or is it worse at any particular time? Is it aggravated by movement? Pain in one particular spot will indicate usually the seat of the disease, but it must be borne in mind that pain may be referred to another part, as to the knee in hip-joint disease. A constant aching pain is usually indicative of slow disease in bone, and this pain is generally worse at night time. Simple synovial disease is not commonly attended with much pain : in caries the pain is pretty constant : in necrosis it may be severe at first, but usually remits afterwards, and only becomes troublesome after the joint has been used. Frequent remissions in the disease of the joint are peculiarly characteristic of necrosis in the neighbouring bone. In chronic rheumatic arthritis the pain is diminished after using the joint. In hysteria it is not consistent.

Does the limb start during sleep and at other times, and is the jumping attended with severe pain? This symptom is generally indicative of advanced disease, and of a peculiar character. Either the subarticular bone is congested, and the pressure of opposing bone-surfaces by spasmodically contracted muscles is felt, or the cartilage has softened down and the articular lamella become partially or entirely removed, exposing the carious and inflamed bone to the pressure of the opposite bone.

WOUNDS OF THE THROAT.

In a case of attempted suicide, by cutting the throat, the first point which demands attention is *the bleeding*. The wound should be carefully sponged and cleared of clots, and the condition of the large vessels ascertained ; and it may be remarked that injury to these—the carotid artery and jugular vein—is very rare, in consequence of the hollow in which they lie, and the prevalent popular conviction, that the speediest method of terminating life in this way is, by opening the windpipe. If the large trunks are cut, the surgeon has rarely any opportunity of exercising his skill. Search should then be made whether any of the branches of the external carotid have been divided ; and, if so, they must be tied ; and it must be remembered that the existence of one bleeding mouth of an artery implies the presence of another, which either does or may bleed, unless the division be only partial. Yet even the thyroid, lingual and facial branches are not frequently implicated in these wounds. Smart hæmorrhage being checked, the oozing may be controlled by exposure for a time, and cold. But it should not be forgotten that recurrent hæmorrhage, even to a limited extent, may produce fatal collapse. Meanwhile, facility must be given to the patient to expectorate blood or mucus by the wound, supposing the air-passage to be opened. Then, if the wound is long, either extremity of it may be held together with a suture ; but the centre must be left open, or suffocation may ensue. The patient should then be placed recumbent, with the head supported so as to facilitate the adjustment, by position only, of the severed air-tube and central portion of the wound. If necessary, the patient's hands must be confined ; and, under any circumstances, he must be carefully watched. The only *dressing* required is some porous material laid over the wound, and of sufficient thickness to protect the exposed trachea from the ingress of foreign particles, and also to act as a respirator in

warming the inspired air ; indeed, an ordinary respirator may, in some instances, be conveniently adopted, for there is a great tendency to lung complications, especially bronchitis, in these cases.   Then, as regards *nourishment;* if the patient can, and will, swallow, no artificial assistance is required, care being taken that the food is imbibed slowly, lest choking fits be produced.   But, if requisite, liquid food and drink must be introduced through a tube.   For this purpose a full-sized elastic gum catheter may be used ; being passed through the mouth into the pharynx, well beyond the wound.   A bottle or syringe is then employed to inject the food.   Whenever the patient has a severe fit of coughing, it is desirable that the wound should be uncovered and cleansed of the expectoration.

These wounds must heal by granulation : to attempt to close them is not only useless but prejudicial.   At a later period of the cure it may be expedient, provided the patient can breathe freely through the glottis, to approximate the granulating edges, lest the skinning process anticipate their coalition, and thus a permanent fistula remain.   (See also " Diagnosis of Visceral Lesions," Lect. IX.)

FOREIGN BODIES IN THE PHARYNX AND TRACHEA.

Foreign bodies of various kinds occasionally stick in the **pharynx** or **œsophagus;** and prompt treatment is required for their removal.   Such bodies may lodge in consequence of their size, as a lump of meat ; or from their form, as pins, fish-bones, or such like objects.   In the case of a piece of meat or similar soft body plugging the tube, it may be withdrawn with a pair of long, narrow, curved and dentated forceps ; polypus forceps may answer the purpose ; and this is the proper method of proceeding where the object is high up : but if low down, in the œsophagus, it may be quite out of reach, and then

a probang, or œsophagus bougie or tube, must be passed, so as
to press the object onwards to the stomach.   In this way frag-
ments of bone, which have become impacted low down, may
be dislodged.   If the object is small, and entangled in the
fauces or pharynx, it must be extracted, if possible.   For this
purpose, the patient must be placed in a strong light, and the
mouth thrown widely open.   The finger should then be carried
behind the root of the tongue, and the foreign body sought for.
If seen, it may be seized with a pair of forceps ; if only felt,
the finger must serve as a guide to the forceps, unless the body
can be removed with the finger-nail.   The laryngoscope is
rarely of use in these cases.   In some instances, an emetic,
if it can be taken, or tickling the fauces, will aid in the
expulsion of a mass of food, if lodged high up.   It is very rarely
that œsophagotomy is demanded ; only, indeed, in cases where
the impaction of a foreign body resists every other attempt to
remove it.

It should be remembered that the irritation, occasioned by
the presence of a foreign body, often survives for some time the
removal of the irritant, and misleads the patient into the con-
viction that it is not removed.

The intrusion of a foreign body into the **air-passages** is
fraught with great, though usually not imminent, danger ;
patients rarely die of suffocation, though often threatened by
it ; usually, it is the secondary mischief consequent on the pre-
sence of an irritating body in the lung which is fatal.   It is,
however, important that immediate assistance should be afforded ;
and for this purpose the first step requisite is to ascertain the
fact that a foreign body has entered the air-tube, and, if pos-
sible, its position.   It rarely happens that a larger body than
can enter one of the bronchi passes through the chink of the
glottis : a foreign body, therefore, may be expected, if lodged,
to be in one of the bronchi, and more often in the right on
account of its larger size, and its being a more direct continua-
tion of the trachea.   Fits of coughing will, of course, throw it
forcibly against the glottis at times : and it may thus be acci-
dentally ejected ; or it may be so firmly impacted as to be
immoveable.   In the latter case, the absence of respiratory

murmur, whilst the resonance of the lung thus blocked is undiminished, is sufficient to indicate which bronchus holds the intruder.

Where a foreign body of small size is loose, the surgeon should not be hasty to interfere. It is true that the irritation of the object, when it strikes the rima glottidis, produces alarming symptoms ; but, as already remarked, these fits are not often fatal. Under these circumstances it may happen that the body is ejected. But this is not to be waited for, if it do not occur within the first two or three days ; after that interval the same steps should be taken as where the body is fixed. The proper course is to open the trachea in the usual way ; and then to give the patient a chance of coughing the foreign body through the glottis, which more readily allows its passage when the trachea is opened, in consequence, apparently, of diminished irritability of the rima, and of the freedom with which air enters the artificial opening : or, with a long and slender pair of forceps, introduced through the artificial opening, to sound for and seize the body. The experiment under these circumstances, of inverting the patient, has been successfully tried. When the condition of the patient will permit the laryngoscope may be used, but unless the foreign body be above or in the vocal cords there is small probability of being able to detect it, and there is much difficulty in allaying the irritability of the patient. (See also Lect. IX in " Diagnosis of Visceral Lesions.")
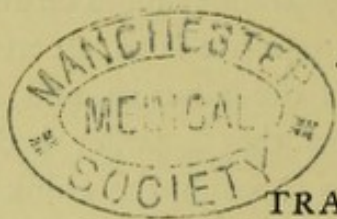
TRACHEOTOMY.

The **operation of tracheotomy** is not difficult, but requires care, and attention to certain rules, to secure its efficient completion, and the subsequent well-being of the patient. The following observations may be added to the brief description of this operation elsewhere. (See p. 142.)

If possible the operator should avoid cutting through mus-

cular fibre ; and he must not mistake the middle lobe of the thyroid body for muscle, but, if it be in the way, he must press it upwards. Broad and bent spatulæ or blunt hooks may be used to separate the edges of the wound ; and, when the tracheal rings are fairly exposed, the tube may be fixed by inserting a sharp hook into it ; but this is not always practicable, nor is it necessary. In some instances, from the spasm of the muscles, and consequent depth of the trachea, combined with profuse venous oozing, the operator is compelled to trust to his finger alone to guide him ; in which case he must satisfy himself that he has exposed the tracheal rings before he ventures to puncture them; for if there be cellular tissue still covering them, it will become emphysematous, and obscure the subsequent proceeding. In passing the knife into the trachea, it is desirable, if possible, to select the membranous interval between two rings, and to hold the knife, which should be narrow, horizontally ; and then turn it, with its edge upwards, and cut in that direction through two rings of the tube : it is unnecessary to cut a piece out. During the progress of the operation, it is desirable, from time to time, to pass a finger down towards the upper outlet of the chest, to feel for the pulsation of any artery which may be within reach ; remembering that there are arterial varieties in this region ; and that an aortic aneurism, by pressing on the bifurcation of the trachea, may give rise to the symptoms for which the operation has been undertaken. Although it is desirable as a rule to wait, before completing the operation, until bleeding has subsided, yet it must be remembered that *venous* congestion is the consequence of an insufficient supply of air, and will be relieved by its admission into the lungs. It is scarcely necessary to insist on the importance of not disturbing the trachea lower down or on either side more than is necessary; yet lamentable injuries to the pleura and lung have occurred in consequence of inattention to this precaution. If a child be the subject of the operation, it is essential to be very careful to prevent any interruption from the resistance of the patient. This operation is, in itself, a serious one, and not to be lightly undertaken, especially in children. Broncho-pneumonia is a frequent cause of its fatality.

Then, as regards the *introduction of the tube* and the *subsequent treatment.* A tube of sufficient length and proper curve must be used; and it should be provided with a shield, and tapes to secure it round the neck. It is well also that the tube should be double, that it may be thus readily cleansed. The patient should be constantly watched, that the tube may be cleared from time to time, by the cautious introduction of a feather; and the utmost attention should be paid to its security within the trachea; for dyspnœa will necessarily ensue if the tube be ejected by violent cough; and an attempt to give relief by introducing a feather may then be productive of most serious consequences, by the displaced tube conducting it to the pleura and lung. If the tube be displaced, it must immediately be re-inserted. The period during which it must be worn will of course depend on the circumstances of each particular case.

Ulceration of the trachea may result from the irritation produced by the lower extremity of a badly-fitting tube. In this way the innominate artery has been laid open. (See also Lect. IX in " Diagnosis of Visceral Lesions.")

INJURIES OF THE HEAD.

Injuries of the head present so much variety that nearly every serious case is a study by itself, and requires to be specially considered in all its bearings, rather than to be treated in accordance with particular formulas or precedent. Nevertheless certain axioms may be enunciated in reference to such cases, which may assist in guiding the practitioner in his treatment, though they may fail, in consequence of the complications referred to, in exactly meeting every case. All comprehensive directions must, therefore, be regarded as subservient to modifications, according to the particular features of each individual case.

The vitality of the scalp renders it justifiable to attempt to

save it, when isolated and otherwise injured to an extent which would render reunion of skin almost hopeless at other parts. Such torn or contused scalp should be cleansed from all extraneous matter, and then be carefully replaced, and held in position by some simple adhesive plaster. Sutures are both unnecessary and mischievous. Arteries must be twisted or tied, if necessary. And these proceedings are not to be set aside because the skull happens to be denuded of its periosteum. The loss of periosteum does not necessarily or even commonly involve death of the bone. However, superficial exfoliation may ensue, and yet the scalp may retain its vitality.

The effects of a blow on the head, without evidence of fracture or other organic lesion, may sometimes endure for a long time : weeks may pass without the patient recovering more than temporary or partial consciousness. It is impossible to say whether such condition may be due to any organic lesion, or merely to commotion of the brain, unless death permit of an examination of the head : but it is certain that patients recover from this condition of protracted concussion, though very slowly, and perhaps, in some instances, never entirely. The symptoms may, at an early period, be suggestive of compression, from the profound unconsciousness of the patient ; but afterwards may have the characters of commotion of the brain, the drowsy stupor in which the patient lies being partially dispelled when he is roused, but a relapse occurring immediately afterwards. Under such exceptional circumstances, the head should be shaved as in ordinary severe concussion, and cold applied if the scalp be hot. Light nutriment must be given and the bowels kept open, whilst attention is paid to the bladder, which, however, is likely to relieve itself spontaneously. Stimulus should be withheld or cautiously administered if the pulse is rapid ; but the circulation must be sustained if feeble. The prognosis in these cases should always be doubtful, because the nature and extent of the mischief are uncertain. Returning consciousness and natural sleep are the most favorable indications.

The **trephine** should never be used, unless absolutely necessary ; but there are certain conditions and circumstances

which admit of no hesitation. 1. When a circumscribed portion of the skull is driven in, and there are persistent symptoms of compression, the trephine must be used, if the elevator and small saw will not effect what is required. 2. When a larger fragment of the skull is driven in, and impacted beneath an overhanging angle of bone, symptoms of compression being present, the trephine, or small saw, may be used to facilitate the subsequent use of the elevator. 3. If a foreign body is lodged beneath, or impacted in, the skull, and pressing on the brain, the trephine may be required to remove it. 4. Symptoms of abscess between the bone and dura mater demand similar treatment. This occurs usually after an interval of some days or even longer, from the receipt of the injury. Fever succeeding rigor, and followed by coma more or less profound ; together with a puffy state of the contused scalp, or a foul discharge from a wound, if there be one, and a denuded condition of the subjacent bone, are pretty sure indications of the formation of matter beneath it. In such a case, the escape of pus from an aperture in the skull should not deter the surgeon from giving it more free vent.

But it is rarely justifiable to trephine for the purpose of discovering supposed extravasation of blood, whether primary or reactionary ;—a condition which the symptoms of coma may indicate ; though it may remain in the highest degree doubtful where such extravasation is ; and whether relief will be given if it be found : for blood may be effused between the skull and dura mater, or into the sac of the arachnoid, or into the substance of the brain. Moreover, such cases may recover without operation ; though this is more rare in reactionary than in primary hæmorrhage. But if coma supervened on the occurrence of reaction, and the seat of injury to the skull is clearly indicated, the trephine should be applied, in the hope that blood there extravasated from the torn meningeal artery, between the bone and dura mater, may be liberated.

Extensive fracture, with depression of a large fragment of bone and laceration of the brain, is not necessarily accompanied by symptoms of compression, and should not be meddled with, unless the depressed bone can be raised without risk of

aggravating the mischief. The frontal sinus may be broken in, without injury of the internal table of the skull.

Perforation, with the trephine, should be conducted deliberately, for the dura mater ought not to be lacerated; and a light dressing should be applied over the replaced skin, after the parts have been carefully cleansed. If it be necessary previously to divide the scalp, a T-shaped or crucial incision answers the purpose. In using the elevator, it is scarcely necessary to say that the fulcrum should be well selected, lest mischief should be done by further depression of bone. (See also p. 111.)

The indenting of young bones of the skull, which may occur without fracture or compression of the brain, requires no treatment. The normal form is usually recovered in a few days or weeks.

In illustration of the above principles, some typical cases may be adduced.

a. A man is knocked down by a blow on the head from a brick: he is stunned for a time, but shortly recovers consciousness. On examination, a scalp wound is found on the forehead; and within it a fracture is discovered, a fragment of bone being driven in and depressed below the level of the surrounding skull. The patient is conscious and uncomplaining; the pupils act, and the pulse is quiet. Still, there is depressed bone: ought it to be raised? Certainly not. Suppress bleeding: apply a cold lotion: keep the patient quiet and on a low diet, and act on the bowels. He may recover without a bad symptom: or, after a few days, coma may gradually supervene, after shivering and an excited circulation, attended by headache and perhaps convulsion. Then it will be necessary to open the wound, and probably to use the trephine, to set free matter between the dura mater and the skull. To proceed further and puncture the dura mater is not desirable, unless it appear discoloured, softened, and bulging. It must be added that these cases generally terminate fatally; and that some surgeons advocate the practice of trephining in all cases of depressed fracture, whether symptoms are present or not.

(b) The case, however, may be of a different character.

The patient may be the subject of an extensive fracture of the skull, and a large fragment may be loosened, and driven through the dura mater into the substance of the brain, which is probably protruding from the wound. Yet the sufferer may be perfectly conscious, and capable of answering questions. What should be done? If there are any loose spicula of bone they should be removed; and if, without much force, the depressed fragment can be raised, it is well to do so: and even an overhanging angle may be removed for the purpose of facilitating this step. But no violence should be used: and this is not a case for the use of the trephine. Such cases may recover: but generally coma supervenes from extension of inflammatory softening into the neighbouring part of the hemisphere, or from extravasation of blood. All that can be done further in these cases is, to suppress bleeding with a compress, if necessary; to enjoin perfect rest, and a light diet, keeping the bowels open: water dressing is the best application to the wound.

(c) If a patient has fallen from a height on the vertex, and becomes the subject of profound coma, without evidence of serious injury to the part struck, it may be inferred that there is fracture, the consequence of contre-coup, of the base of the skull; and that extravasated blood is pressing on the brain. This diagnosis would be confirmed by the exudation of blood and serum from one or both ears: but this symptom is not necessary unless the petrous bones are broken across, which they usually are: nor is oozing from the ear necessarily indicative of fracture. Again, a patient with such an injury is not always the subject of insensibility: this symptom may not be present at first, but may supervene, when reaction comes on, from extravasation of blood. Or, there may be restless delirium and convulsion, attending laceration of the brain, with extravasation into its substance. Patients rarely recover from this condition. Under all these circumstances, the surgeon must patiently watch the symptoms, though the opportunity is rarely afforded him of doing anything to relieve them by active interference.

(d) Or, lastly, a patient may be stunned by a blow on the head, and recover consciousness and voluntary power, though faint; with returning reaction, coma supervenes: in such case,

as already remarked, the trephine may be applied, if the probable seat of extravasation is indicated by the injury ; though it should be borne in mind that the blood may be effused at a distance from, perhaps, on the side of the skull opposite to, the seat of injury.

It may be remarked that the front and upper parts of the brain are susceptible of injury with more impunity than the lower and back parts. The loss of a considerable piece of the front of one hemisphere does not seem to entail, *per se*, serious consequences. (For more detailed information see Lects. IV and V in " Diagnosis of Visceral Lesions.")

WOUNDS OF THE CHEST.

In penetrating wounds of the chest or abdomen, involving the contained viscera, prompt attention is generally demanded, though little can be done for a patient under these circumstances : it is wiser, in most instances, to leave the charge of such injuries to nature, watching and assisting, as symptoms calling for interference may arise.

A wound of the pleura, and even of the lung, may be unattended by serious consequences, if the patient be kept entirely quiet : or the same injury may be followed by emphysema, or extravasation of blood or air into the pleura, and hæmoptosis. A wound of an intercostal or the internal mammary artery may be followed by hæmorrhage. It is better to close such wounds at once, unless steps are necessary to arrest hæmorrhage. Air will almost certainly find its way into the pleural cavity, and partial collapse of the lung result : even blood may be extravasated into the same space, and afterwards become absorbed. But if the lung be so compressed by fluid or air as to threaten suffocation, free vent must be given to it by dilating the wound, or by paracentesis. This operation, under these circumstances, is however rarely required. In pneumo-thorax, when the lung is so compressed that air ceases to enter it, the stage of rest allows

of the agglutination of the wound in its texture, and thus permits it soon to resume its function without risk.

Pneumonia or pleurisy require treatment according to circumstances. A light diet, of unstimulating character, should be ordered ; and pefect rest and avoidance of all sources of excitement enjoined. Cough must be allayed by some simple demulcent ; and the chest must be supported as soon as practicable with a flannel or other bandage.

Some remarkable instances of extensive wounds of the lung, and even of wounds of the heart, are recorded, from which the patients have recovered. (See also Lect. VIII in " Diagnosis of Visceral Lesion.")

WOUNDS OF THE ABDOMEN.

Wounds of the abdomen, *which do not penetrate the peritoneum*, may give rise to inflammation and suppuration : they should, therefore, be carefully closed, and the patient kept quiet : interstitial abscess, if such form, should be opened early.

If the peritoneum is penetrated, severe, and even fatal peritonitis may follow, though no viscus be implicated. Such wounds, whatever their size, should be closed at once, and the patient must be kept quiet, and on a light diet. It is desirable, in these wounds, to ascertain whether the serous cavity is open ; and this may be done, without complicating the mischief, by carefully introducing a finger or a probe, if other manifest indications are wanting. In closing these wounds, regard must be had to their size, as to whether sutures should be used : if employed, care must be taken not to include the peritoneum. When such wounds are large, the intestine or omentum may protrude ; in which case they should be returned ; and, if necessary, the opening must be enlarged for that purpose. Of course, in wounds of this description, it is often doubtful whether the bowel itself is penetrated ; and *it is no business of the surgeon to meddle with the wound for the purpose of ascertaining this*. He

must patiently wait the efforts of nature to repair the mischief, and treat symptoms as they arise. But, in some cases, this fact is not left in doubt, when the wounded intestine presents itself externally. Such wound may be either large or small : and the question which arises refers to the expediency of closing it by suture. The best practice is to close the opening in a wounded intestine with fine sutures, cutting them off close, and leaving the injured part as near the external wound as may be ; and then to close the external wound : but if the suspected wound is not readily accessible without enlarging the external opening and drawing the intestine out, then it should be left alone, and space should be left for the contents of the bowel, if injured, to escape by the wound in the parietes. Sutures thus applied become surrounded with fibrinous deposit, and subsequently find their way into the bowel.

If, therefore, a case of penetrating or incised wound in the abdomen present itself, the surgeon will first ascertain whether any portion of intestine is protruding : if so, he will return it, enlarging the external wound if the strangulation interfere with this proceeding. If there is no protrusion, he will satisfy himself, by the cautious introduction of a finger or probe, whether the peritoneum is penetrated : not because this would influence his immediate treatment ; for, in either case, he must close the wound : but it may guide him in his diagnosis of the future symptoms, as regards external abscess, or local or general peritonitis, and thus assist him in the treatment. If, however, a portion of protruding intestine, or of intestine near to, and readily accessible from, the external opening, is wounded, he will then apply a suture or sutures as described : but he will not explore to ascertain whether such wound exists ; nor ought he to disturb the parts to gain access to a wound, if he suspects that there is one. A wounded artery, as the epigastric or one of its branches, may require a ligature.

As regards the after treatment : under all circumstances, absolute rest and an abstemious diet are demanded. If wounded intestine is known to exist or is suspected, abstinence should be more rigid ; and opium should be given to quiet the peristaltic movement of the bowels. If requisite, an injection may be

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given to clear the lower bowel ; but aperients must be eschewed, at any rate for some days, till the adhesive process has advanced. If peritonitis ensue, it must be treated by fomentation, and local or general antiphlogistic measures, as the circumstances of the case and condition of the patient dictate.   Under any circumstances, the prognosis must be a cautious one ; as fatal peritonitis may be the consequence of a simple puncture of the parietal peritoneum.

Penetrating wounds of the bladder are rare, except in war. Rupture of this organ generally implies two conditions, viz. distension and pressure, as in a fall, when wrestling, and the opponent's knee is thrust violently into the sufferer's abdomen. The symptoms, which are suggestive, but not always conclusive, are confirmed or otherwise by the history of the accident. Collapse more or less pronounced ; constant desire to micturate, with inability to do so ; sometimes tenesmus.   Abdominal pain and tenderness of variable degree ; scanty urine, and mixed with blood.   Restlessness ; an anxious countenance ; rapid pulse and low temperature.   Subsequently tympanites, vomiting (which may occur earlier), prostration, and death.   Urine not infrequently voided naturally after first day.

This injury, though usually fatal, is not necessarily so, and the peritonitis is generally less than might be anticipated.

An elastic catheter should be retained in the bladder, and put in communication with a urinal, so as to give the bladder perfect rest, and the patient must be kept as quiet as possible.

INTESTINAL OBSTRUCTIONS.

Intestinal obstructions arise from various causes, some of which are external, and therefore readily ascertained and dealt with ; as in the different forms of strangulated hernia : others are obscure, both as to their nature and position, and therefore perplexing even to the experienced surgeon.   These hidden

sources of obstruction may be within the bowel, or external to it ; amongst the former are, the accumulation of hardened fæces and other concretions, such as large gall-stones, which have escaped through an ulcerated opening into the duodenum, the growth of a tumour or the existence of a stricture : the latter include pressure, by encroachment, from an external tumour, or constriction by a band or abnormal opening, beneath or in which a portion of the intestine may have become entangled. Further, these obstructions may result from the intestine being twisted, or by its being invaginated, one portion within another.

When summoned to a case of obstruction of the bowels, it is the surgeon's first business to ascertain whether there is any external explanation of the symptoms, by examining all the outlets by which a protrusion may take place. He must not, from any motives of delicacy, or otherwise, omit this essential duty. If he find a hernia in a state of strangulation, he will at once take the necessary steps to reduce it ; or failing this, to operate. But he may find no rupture : and he should then examine the rectum with the finger. Here again he may discover the cause of obstruction, in the form of a large, solid accumulation of fæces. If so, he will take steps to break it up with his finger, or with the handle of a spoon or similar instrument. Some warm water must then be injected ; and, after it has been returned, the operation must be repeated, until the obstructing mass is removed ; further injection of warm water will soon procure the desired relief. But, again, the rectum may be empty, and the explanation of the constipation has to be sought elsewhere and higher up. The right iliac fossa should be examined : it may be tumid from accumulation of fæces within the cæcum ; or the symptoms may indicate inflammation and ulceration of the appendix vermiformis. If there is no indication of the presence of mischief in the iliac fossa, the surgeon should then endeavour to ascertain the seat of obstruction by tracing the distended intestine, as this may assist in the future steps of the treatment.

Under these circumstances of doubt and perplexity, what further indications must the surgeon look for, and what course is he to

pursue ? The history of the case must now be carefully investigated, unless already ascertained. Inquiry must be made whether the patient has ever been the subject of inflammation of the bowels, of an abdominal tumour, of any similar attack previously, or of habitual constipation of the bowels : whether any indigestible food has been taken : whether there was a sudden attack of acute pain ; and if so, in what part of the abdomen.

The *ordinary symptoms* which characterise these cases are : constipation, with distension of the abdomen, more or less pain, tenderness and sickness. The countenance has an anxious, distressed expression, and the circulation is generally quickened and feeble : the secretion of urine is generally high-coloured, but variable in quantity ; and perspiration is often free. But these symptoms vary materially according to circumstances. Thus, the constipation is usually, but not invariably, complete. The pain may be continuous or intermitting, acute or dull, or there may be none at all. Again, sickness is by no means a constant symptom, at any rate as regards its intensity : occasionally it is almost entirely absent. Fæcal vomiting rarely occurs at an early period of the attack. Distension of the abdomen, and that to a distressing degree, is usually a concomitant of these cases of obstruction, from whatever cause ; but in some instances it exists to a very limited extent ; and occasionally there is none. When it is excessive, the pressure on the diaphragm embarrasses respiration. As regards the urine, it has been remarked that it is generally more abundant when the obstruction is low down in the bowel.

Being now acquainted with the previous history and existing symptoms of his patient, is the surgeon in possession of sufficient information to direct him in his diagnosis and treatment ? Unhappily not ; for, the irregularity of these symptoms, both as to existence and intensity, in relation to any particular form or cause of obstruction, is such that they can rarely be depended on as a safe or certain guide : but there are certain points which are deserving of consideration. For instance, if the obstruction occurs in a patient who has been the subject of similar attacks before, it may be inferred that the case is one of obstinate

constipation from impacted fæces. Or if the symptoms have lasted a long time, and have become urgent only at an advanced stage, the same diagnosis is suggested. Again, if the patient's health has been failing, and the difficulty of relieving the bowels has gradually increased from a period more or less remotely antecedent to the complete obstruction, the gradual encroachment of a tumour, perhaps malignant, on the calibre of the bowel is indicated. But if the attack has been sudden, and severe pain, urgent symptoms, and early prostration mark the subsequent progress of the case, internal strangulation has probably occurred ; for these are the symptoms also of a strangulated hernia, where the small intestine is implicated. The resonance, or otherwise, in different parts of the abdomen, and especially along the course of the colon, may assist in defining the seat of obstruction. The introduction of a long tube into the rectum, and the injection of warm water, may aid in the same direction.

But it must be admitted that no reliance can be placed, absolutely, on any diagnostic sign as to the exact seat or nature of the obstruction, if beyond the reach of sight or touch ; and therefore some general principles of treatment must be adopted, as far as the obscure light of each case, and the not very satisfactory experience afforded by statistics indicate them. To take up, therefore, the supposed case where we just now left it, what is the surgeon to do if the source of obstruction and its position still remain in obscurity, after the preliminary investigation mentioned has failed in determining it ? The alternatives presented are, to use injections, to give purgatives or opium, to perform an exploratory operation, with the view of finding the seat of obstruction and of disentangling the intestine, or to make an artificial opening into the bowel above the obstructed part.

Injections are safe and should be fairly tried, a long tube being used, if necessary, and passed as high as practicable. Purgatives ought to have a reasonable trial at an early period, especially where abdominal pain or tenderness and tympanites are not present ; calomel with colocynth, or croton oil having the preference. But it is not only useless, but very mischievous

to persevere in their exhibition, especially if they cause suffering and produce an active peristaltic movement, which always seems to stop short at a certain point ; or if the symptoms have been urgent from the beginning : then they should speedily be relinquished ; or they may be inadmissible from the commencement of the attack. Their use is most promising in long-continued constipation, where the symptoms have not been pressing, and are not acute. Opium affords relief to suffering, but its curative influence is not to be relied on : indeed, one cannot understand how it can be operative, unless the condition is dependent on muscular spasm.

An exploratory operation is a serious undertaking ; but, also, it is, in many instances, the only chance of saving life ; though, it must be admitted, it is not always successful in relieving, or even in discovering, the seat of obstruction. Yet it is a hopeful alternative if resorted to sufficiently early. And here is the difficult problem to solve : *when should other means be relinquished in favour of operation?* It is impossible to give any rule of practice on this point, which is generally applicable, but it may be safely said that an operation is specially indicated where the symptoms resemble those of strangulated hernia or an acute kind ; and that, to be successful, it must, as in hernia, be performed early : the lapse of more than two or three days in this condition will probably place the patient beyond the reach of assistance. An artificial opening in the bowel is admissible, only where an exploratory operation fails of discovering or relieving the seat of obstruction, or where the symptoms indicate that the obstacle is in or below the arch of the colon, and would be relieved by an artificial anus in either loin.

The median line, below the umbilicus, is the best position to open the abdomen for exploring ; and sufficient aperture must be made to enable the operator to do this effectually. If requisite, it would be justifiable to puncture the intestine with a small trochar and canula, to allow some of the gas to escape from the distended bowel, and thus to facilitate the search. Assistants should be at hand to support the intestines with flannels dipped in warm water ; and the incision should be

subsequently closed with sutures. The operation for artificial anus in the loin has been already described. (See p. 155.)

The period at which these cases terminate fatally varies extremely, according to the nature and position of the obstruction. In some instances of acute strangulation, the time may be reckoned by hours rather than days; in others, weeks may elapse without any action from the bowels, before death ensues. The causes of death may be gangrene of the bowel, peritonitis, or exhaustion.

STRANGULATED HERNIA.

Although there is such an infinite variety in the peculiarities of strangulated hernial protrusions, yet there are certain features which are so often met that they may be regarded as the usual characteristics, from which others are deviations. Thus, in the male, an inguinal rupture which has descended into the scrotum is the most frequently strangulated : whereas, in the female, a small femoral hernia is most usually met with in this condition. So rarely, indeed, does strangulated inguinal hernia occur in the latter sex, that the surgeon, who has been in the habit of operating, anticipates almost certainly the femoral form of rupture, when he is called to a case in a female.

The contents of a rupture can rarely be ascertained with certainty, before operating, by the touch only ; but the history may help the surgeon. In small, recent hernia, with acute symptoms, it is most probably intestine alone which is implicated ; but in older ruptures, which have been reducible or partially irreducible, and in which sudden strangulation occurs, it is probable that omentum will be found in the sac, and behind it a small, firmly strictured knuckle of intestine, that has intruded itself into the pouch, which was usually appropriated to the omentum alone. This is so common an occurrence, and it forms the type of so large a class of cases, that the young

operator will do well to search carefully, if he find a mass of omentum in the sac, in a comparatively healthy state ; for the intestinal protrusion may be so limited as to elude a hasty examination.

Umbilical hernia is rarely met with except in the female, and most frequently in fat women ; the abdominal parietes being weakened and the umbilicus enlarged by distension during pregnancy or accumulation of fat. These ruptures almost always contain omentum, and generally also intestine, in smaller or larger quantity. When strangulated they present much uniformity in their configuration, though they vary in their size. Being almost always old ruptures, the skin over the ordinary sac is thin, generally very attenuated, however fat the surrounding parietes may be. Around this central protrusion, and diffused beneath the thicker covering of skin and fat, the fresh descent has forced itself, or the omentum before it ; so that a flattened elevation is found extending for a varying distance, partly or entirely round the umbilicus. The extreme tenuity of the skin and usual thinness of the sac in the centre, render it necessary to exercise great caution in cutting down on these ruptures. A simple incision on the *lower* part of the tumour is sufficient to obtain access to the umbilical opening. The operator should remember that the coverings of this form of hernia are very simple and thin ; that the sac is, in fact, exposed almost immediately the skin and fat are divided. The stricture should be incised below the rupture : this is safer than cutting upwards. A limited incision is generally sufficient ; for strangulation is the consequence of the accumulation of contents in the sac, rather than of the smallness of the aperture. It is better to open the sac, unless the strangulation is very recent.

Respecting this *question of opening the sac* in strangulated hernia generally, great difference of opinion exists. With some operators it is the rule to attempt the relief without opening the sac ; with others it is the exception. If the inexperienced operator elect to act on the former principle, he will do well to bear in mind that he may push back a rupture without relieving the stricture ; that he can have no acquaintance with the actual contents of the sac and their condition ; and that the inflam-

matory products within the sac are returned, together with its other contents, into the abdomen, instead of being allowed an external drainage. Inflamed or congested peritoneum, whether of sac or intestine, are not susceptible of ill consequences from exposure or incision, as the healthy membrane is ; and the assumed analogy between this operation and the taxis is not accurate, inasmuch as the success of the taxis is a measure of the resistant strangulation, which may be estimated as much below that of a hernia in which it is necessary to enlarge the opening before the strictured intestine can be returned. As a rule, the advantages would seem to be decidedly in favour of opening the sac ; in exceptional cases, especially of small and recently strangulated femoral herniæ, the stricture may be divided external to the sac.

The following axioms have reference to the preceding subject :

1. The operation for strangulated hernia, if properly conducted under circumstances which necessitate its adoption, is rarely, if ever, *per se*, fatal.

2. Operate early ; and in all doubtful cases give the patient the advantage of an exploratory operation.

3. Intestinal paralysis, gangrene, and general exhaustion, consequent on the *pre-existing* condition, are the usual causes of death after operation.

4. The urgency of the case is not to be measured by the lapse of time so much as by the tightness of the constriction.

5. Rough and unskilful manipulation in employing the taxis is a rife source of mortality. A careful operation is far less dangerous.

RETENTION OF URINE; ITS VARIOUS CAUSES AND THEIR TREATMENT.

When a surgeon is summoned to a case of **Retention of Urine** in the male, his first business, before attempting to relieve the patient, is to ascertain the cause of the retention by an inquiry into the previous history, as well as the actual condition of the sufferer. This is essential, when practicable, as the treatment must be modified by the circumstances of each case. If the patient is unable to give any account of himself, as from insensibility, the surgeon should at once pass a medium-sized catheter.

Retention of urine may result from a variety of causes, which may be classed under two heads; some obstruction in either the bladder or the urethra, or a paralytic condition of the former, whereby it is unable to expel its contents. Retention may also occur higher up, by obstruction in one or both of the ureters; this, however, is usually partial, being limited to one side, and is, moreover, beyond the reach of surgical interference. Occasionally, under these circumstances, the ureters become enormously distended and hypertrophied.

A *paralytic condition of the bladder* is a very common consequence, indirectly, of obstruction to the passage of the urine: for, the bladder becoming excessively distended, its muscular coat then loses the power of expelling its contents. This is a not uncommon sequence of delayed micturition in cases of enlarged prostate. In other instances, also, where spasmodic is superadded to permanent stricture, paralysis of the bladder, from excessive distension, may survive for some days the subsidence of the spasm. Paralysis is also a consequence of pressure on the brain, of fracture of the spine, and accompanies paraplegia from other causes.

The following may be the *sources of obstruction :* cancer of the bladder; simple hypertrophy, or abscess, or scirrhus of the prostate; stone in the bladder, though rarely; stone in the urethra; organic and spasmodic stricture; abscess in the

perineum ; lacerated urethra ; extravasation of blood in the perineum ; extravasation of urine : and the symptoms of each when associated with the history, are generally sufficiently well marked to be recognisable. Thus, if the comparatively rare disease, *cancer* of the bladder, is the cause, dependence must be placed on the history of the case, especially its negative bearings ; as well as on the absence of any other explanation of the obstruction : add to these sources of information the gradually increasing suffering and difficulty of micturition ; the admixture of blood with the urine ; the deteriorated health of the patient ; and the difficulty, if not impracticability, of drawing off the water, though the catheter can be passed readily into the bladder, or apparently so ; together with the great pain occasioned by this attempt ;—and it is probable the patient is the subject of malignant growth within the bladder.

The condition of the *Prostate*, as a cause of retention of urine, may be surmised from the symptoms, but cannot be satisfactorily ascertained without an examination through the rectum. Its increased prominence, expansion, and its firmness, may be readily ascertained in this way ; its sensitiveness, also, may be tested by pressure. Simple hypertrophy is slow in its development, and is characterised usually by well-marked symptoms (p. 164) ; as is likewise inflammation terminating in abscess (p. 163). In scirrhus the induration is much greater, and the suffering of the patient considerable, and increased towards the close of life ; but the mechanical obstacle to the passage of the urine is the same as in simple hypertrophy.

If a *Stone* is lodged in the urethra, it may cause retention of urine, until it is displaced and forced out by the pressure from behind, or until this pressure is sufficient to force a passage for the water by its side. That the latter consequence sometimes ensues is proved by the occasional occurrence of cases in which the concretion is closely impacted in the canal, but partially grooved or furrowed to allow of the passage of the urine. No doubt such concretions accumulate in this position ; but they must have been sufficiently large, in the first instance, to resist expulsion. Retention of the water may, however, be the climax

of this gradual blocking of the passage, and it may occur at any part between the prostate and urethral orifice; the latter position is not uncommon on account of the contraction at the mouth of the urethra. In the treatment of these cases the stone must be removed, if within reach, either by dilating or incising the lips of the urethra, and seizing the foreign body with a pair of delicate forceps, or by hooking it out with a strong, bent probe. If in the perineum the stone should be at once removed from thence by incision. But if under cover, or in front, of the scrotum, it should, if possible, be dislodged and pushed backwards so that it may be cut out of the perineum; or else pressed forwards to the orifice of the urethra.

In permanent and spasmodic *Stricture*, causing retention, the history of the patient is generally sufficient to determine the character of the obstruction, which is confirmed by an attempt to pass a catheter (p. 172).

Perineal abscess, and *extravasation of urine*, are characterised by unmistakeable signs, as well as indicated by their history. In the former, the tense, and acutely tender swelling behind the scrotum; in the latter, the rapid filling and speedily fatal inflammation of the lax areolar tissue of the scrotum, from the sudden and destructive irruption of the urine, and its spreading devastation around, leave but little excuse for an erroneous diagnosis (p. 174).

Laceration of the urethra may result from violence offered to its interior; but when it causes retention of urine the injury is usually external, and accompanied by extravasation of blood or of urine into the perineum. The urethra is rarely torn completely across; but such an injury may be a consequence of fracture of the pubic portion of the pelvis. The diagnosis of these cases is usually unequivocal; their history and symptoms render it so : and the treatment admits of no doubt, when the circumstances of the case are defined. If there is bleeding from the urethra, the introduction of an instrument is the best method of stopping it : otherwise ice may be applied to the perineum (p. 171).

We will suppose that a surgeon is summoned to a case of retention of urine, without being acquainted with any particulars respecting

the case : how should he proceed ? He must first learn whether the patient has been the subject of permanent stricture ; and if so, in what sized stream his water was passed. He will then inquire particularly into the nature of the present attack ; how it was induced, and how long it has lasted. He will ascertain the degree of distension of the bladder by feeling the hypogastric region. Having satisfied himself of the simple nature of the case, he will proceed to relieve the patient. (For the symptoms and treatment, see pp. 172-3.)

But the patient may be past middle age, and the symptoms may be those of *enlarged prostate* rather than of stricture. If such prove, on examination per anum, to be the case, a suitable instrument must be selected and introduced (p. 164). This operation, if properly conducted, is in many instances very simple. The erect posture is the best. A large catheter with a long curve, made either of gum or silver, will often enter the bladder without difficulty ; care being taken, if a metal instrument be used, not to depress the handle too soon : whereas a smaller and shorter instrument must stop short of its destination, and, if force be employed, it is very likely to perforate the gland, and to be followed by copious bleeding. It is best to try first a gum elastic instrument without the wire, as it is the safest : but if that fail, after firm but gentle pressure has been tried, then the stilet may be introduced, or a silver catheter substituted. Smaller instruments may, if necessary, be subsequently tried : but their shape and length must be the same. The introduction of the finger into the rectum will serve at once as a safeguard and to guide the point of the instrument, as it enters the prostatic portion of the urethra. Unless there be some unlooked-for complication, it rarely occurs that steady and gentle perseverance fails of success. But this may be the case, and the urgency of the symptoms may not admit of temporising even with opium. If admissible, a dose of opium may be given to allay pain ; and then, after an interval, the attempt may be renewed. If still unsuccessful, the case becomes serious and perplexing, for the prostatic enlargement forbids an attempt to puncture the bladder through the rectum : opening the perineum would afford no assistance : and puncturing the bladder above

the pubes is an undesirable proceeding, if there be any other alternative for giving relief. Yet, the only other course open to the surgeon, in this otherwise hopeless dilemma, is to force a passage through the gland, which can be accomplished by firmly pressing a metal instrument outwards, taking care that its point is rightly directed towards the bladder. When introduced either by the natural or through an artificial opening, the catheter must be kept in until the bladder has recovered its tone ; except in those cases, which are numerous, in which there is but little or no difficulty in performing this operation. Then the instrument may be withdrawn after relief has been given, and introduced at intervals, to draw off the water. This is often required for a lengthened period ; and it may be desirable to instruct the patient in the use of the instrument, that he may relieve himself.

If the symptoms indicate the presence of a *stone impacted in the urethra*, the surgeon may satisfy himself on this point, by carrying his finger along that passage, from its orifice to the prostate gland. If he find one, he will proceed to remove it in accordance with the directions and with the precautions already given. If, perchance, it should be impacted far back in the prostate, it must be removed by an incision similar to that for the lateral operation, stopping short of entering the bladder. It is not easy to feel a stone in this position : but it may be struck by a catheter ; or the instrument may be felt grating against it, as it is pressed onwards into the bladder : but this condition, as a cause of retention, is not of frequent occurrence. Still less frequently is a stone within the bladder a source of absolute retention : and if so, it would probably be displaced by the introduction of an instrument.

But the retention may be due to other causes. ' The patient may, indeed, have been the subject of stricture, but he will say that he has always been able to pass his water in a stream, until he felt pain in the perineum, a few days previously ; and this may have succeeded an awkward attempt to introduce an instrument, to relieve the stricture, or it may have been quite spontaneous. He would, possibly, add that he had a shivering fit, and subsequently had felt very hot and feverish. His suffer-

ing from inability to micturate is greatly enhanced by the pain in the perineum, and by his thirst, which he dreads to satisfy, as he will thereby add to the accumulation in the bladder. On examining the perineum, the true state of the case is apparent, and a prompt and deep incision into the inflamed tissues, and the liberation of the *pus*, which may perhaps be but a few drops, will afford relief (p. 173).

The case may, however, have taken on the more serious aspect of diffuse *extravasation of urine* into the scrotum, by the sudden bursting of the urethra, behind an old stricture, in, probably, a disorganized urethra. Sloughing is inevitable in this condition ; but its extent and the chances of the patient's recovery depend on the early period at which free and deep incisions are made. In some instances, not only is the areolar tissue in the hypogastrium implicated, but a large quantity of urine may be found collected in sloughy pouches in the scrotum and perineum. The constitutional disturbance and suffering are proportioned to the intensity of the inflammation and destruction of tissue : and yet, with attention to cleanliness, ventilation, and security for the escape of the urine, together with a liberal diet and suitable stimulus, it is remarkable what a good recovery many of the worst cases make (p. 174).

Lastly, the surgeon may find the cause of obstruction to be purely *accidental*. It may be laceration of the urethra, existing as a complication of fracture of the pelvis, or from a fall across some angular and hard body, or from a kick in the perineum. It is well, in such case, if the patient has either not made an attempt to micturate, or has failed in the effort. The immediate introduction of a catheter is required : for, the longer it is deferred the more difficult it is likely to become, in consequence of the increasing ecchymosis in the perineum and around the urethra. The instrument—an elastic one is preferable—when introduced, must be retained for at least two or three days before it is changed : and then another should be cautiously substituted, and worn until the condition of parts proves that it can be safely dispensed with, which is generally, in simple cases, after the lapse of a week : its presence, when no longer requisite, is likely to excite irritation in the canal (p. 171).

ON THE USE OF THE THERMOMETER IN SURGERY.

TEMPERATURE is a sign of considerable importance as diagnostic of the intensity of shock and of the energy of reaction, as well as of many allied conditions resulting from various causes.

In health the temperature varies between 97° F. and 99°, and is usually somewhat higher in females than in males; it is rather higher in children than in adults; the newly-born child has a temperature averaging 99°·5. The daily variations of a healthy male adult, according to Dr. Ogle, are between 97°·2 about 6 a.m., and 98°·6 about 6 p.m.: the rise or fall between these two extremes is progressive. This is independent of sleep, and the fact of the greatest lowering of temperature occurring in the early morning must be borne in mind with patients who are approaching death. With children the daily variation is greater and the minimum is reached rather earlier. Other conditions, as climate, exercise, and individual peculiarities influence the temperature of the body.

For clinical purposes the temperature should be taken by means of a delicate, self-registering thermometer, and it is most convenient to take the observations in the axilla. Care should be used to insure the instrument being thoroughly in contact with the skin, and this is best effected by pressing the bed-clothes or garments against the bulb of the thermometer and holding it in position for fully five minutes; the time will, however, depend upon the care used, and upon the degree to which the surface has been previously exposed: the thermometer may be watched from time to time until the mercury has ceased to rise.

The temperature of the mouth or rectum usually exceeds that of the axilla by nearly 1°.

In surgical injuries and diseases the thermometer is at times of very great value, and it has been shown that it may indicate the probability of recovery or death. But it is mainly

useful as an *aid* to diagnosis, and must not be relied on to the exclusion of other and more important methods of observation.

In **simple shock** and **reaction** the fall in temperature appears to average about 1° or 2°, as tested at the time of the patient's admission into hospital—generally about half an hour after the accident, and the reaction is marked by a rise in temperature to over 100°, and usually below 103° within the next thirty-six or forty-eight hours.

When the shock is complicated by the occurrence of **hæmorrhage**, even to a moderate extent, the fall in temperature appears to be proportionately far greater. When, in such cases, the thermometer registers below 95° the issue is likely to be grave; but an instance is recorded of recovery after a temperature of 91°·2 with cut-throat.

In **rigor** the temperature rises shortly before the commencement of the attack, and remains high for a varying length of time, generally about half an hour after the termination of the shivering. In the rigor of pyæmia the height to which the temperature may rise appears to vary with the acuteness of the disease, ranging between 100° and 110°.

In **operations** followed by recovery there is usually a fall of about half a degree during or after the operation: but in cases in which the operation proves fatal there is commonly a fall of from 2° to 4°. Chloroform seems to exercise little or no influence on the temperature under these circumstances.

In the **reaction** succeeding an operation, if the temperature exceed 104° the prognosis is decidedly unfavorable: but it is not necessarily so if no rise occurs, provided the general condition of the patient be not otherwise unsatisfactory, as tested by the circulation, respiration, and degree of prostration. Yet, it should be remarked, there is not the same definite relation between temperature and the heart's action and breathing, after the infliction of injury by violence, as there is in medical fevers. The maximum temperature is reached in from twenty-four to forty-eight hours after operation in cases which recover. In falling from the highest point, the descent in simple cases is usually gradual until it reaches the normal standard, but in severe and complicated cases the descent is irregular.

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In **special diseases,** the height to which the temperature rises appears to depend more upon the acuteness of the attack than upon the kind of disease. Thus, in *pyæmia* the maximum in one case was 103°, and in another nearly 110°; in *tetanus* the maximum in one case was 103°, and in another it has been reported as 112°. In severe *erysipelas* it may rise to 106°·5, consistent with recovery, or in milder forms of the same disease to less than 100°.

In **secondary hæmorrhage** the fall in temperature is generally well marked and often excessive.

Before death, in acute sthenic diseases the temperature rises till the time of death, and occasionally for some time after, and it is peculiarly high in cases of inflammation following brain injury.

Where no reaction takes place after head injury, the temperature has been registered as low as 87·6; and in a case of fractured spine it has fallen as low as 81·8 before death.

When a surgical patient, previously in good general health, appears feverish and his temperature is found to exceed 101°, it behoves the surgeon to examine him carefully for some local cause for the general disturbance. This may be found in retained pus, in threatening suppuration, in foul dressings or foul wound, in implication of veins, &c. Should no local cause be found, examine for general diseases most likely to be associated with surgical injuries or diseases, as, for instance, erysipelas, pyæmia, &c. It must also be borne in mind that medical fevers would produce similar increase of temperature, and that their acuteness is generally indicated by the height of temperature; and that certain fevers show moderately constant ranges of temperature.

ON SUSPENDED ANIMATION, AND ITS TREATMENT.

Suspended animation may result from a variety of causes, some of which may occur in the Surgeon's practice, or require surgical interference for their removal or relief: and it may happen in the preparation of his patient for operation, and then demand his presence of mind and utmost promptitude of action to avert a fatal issue.

Suspended animation may be only apparent, as in syncope from loss of blood, or in the exhaustion following convulsive attacks, such as epilepsy or hysteria: this condition is only such a depression of the acts of respiration and circulation as for a time deprives the brain of its normal stimulus. When animation is really suspended, the act of respiration has ceased, though the heart may continue to act for some time afterwards. The term asphyxia has been usually employed to designate this condition, whatever may be the cause of it; and this has led to an indefinite application of the word, which, indeed, its etymology permits. Thus, we speak of a patient being partially asphyxiated, or under circumstances tending to asphyxia; meaning that the state of the patient, if not relieved, will probably terminate in his becoming pulseless, because deprived of the influence of oxygen on the blood. The complete deprivation of respirable air, or incapacity to breathe, is more accurately expressed by the definite word, apnœa. But, as this expression is absolutely privative, as regards respiration, it is convenient also to retain the word asphyxia, as conventionally more generic in its application.

Causes.—Asphyxia may be induced either rapidly or slowly, and results either from

(1) Some mechanical obstacle to the admission of air into the lungs; or

(2) From the pollution of atmospheric air, or the substitution of other gas; or

(3) From a paralysed condition of the respiratory muscles, consequent on obtuse or suspended nervous sensibility.

Under the first head are included such causes as hanging ; drowning ; closure of the mouth and nostrils ; violent compression of the chest and abdomen ; collapse of the lung, from the accumulation of fluid or air in the pleura ; laryngitis, spasm, or œdema of the glottis ; foreign bodies in the larynx, trachea, or pharynx ; the pressure of an aneurysm or other tumour on the air-tube : immersion in carbonic acid gas may be also added to this list, for its effect is to produce spasmodic closure of the glottis.

The second category includes all other gases or mixtures of gas, except the atmospheric air ; for all are either negatively poisonous by being incapable of supporting life, as nitrogen, or positively so by acting as irritants or narcotics.

In the third class are included those cases which are dependent on the influence of narcotic poisons, and injuries directly or indirectly involving the respiratory nervous centre. Atmospheric air may also be polluted, by being made the vehicle of anæsthetic and other vapours.

From the above enumeration it is obvious that many of these cases necessarily come under the notice of the surgeon, and require his manual assistance : thus, obstructions of every kind in the air-tube may demand an operation for their removal ; injuries of the chest come under his care ; and suspended animation, resulting from the poison of chloroform, may tax his knowledge and skill. The proper mode of dealing with obstructions in the air-tube or pharynx has been already adverted to ; as well as the way of remedying compression of the lungs by air or fluid : and it may be here remarked, that œdema of or around the glottis, resulting from a scald, may require the operation of tracheotomy to save life. Where none of the above remedies are available, the condition of apnœa must be treated by artificial respiration, and an attempt to excite a natural respiratory act. Before proceeding briefly to consider how these conditions are to be fulfilled, a few words on the subject of death from chloroform may not be irrelevant.

Whether *Chloroform* produces any actual change in the condition of the blood, or in the physical condition of the blood-corpuscles, and their relation to each other and their containing

vessels, may be an interesting speculation or subject of investigation : but it can scarcely have any bearing on the important inquiry, how to guard against its deleterious influence, and how to recover a patient when in a state of apnœa from an overdose of it. Many of the phenomena attending its inhalation hold a close analogy to those of intoxication : often patients pass through the various stages of exhilaration, depression, and stupor, before becoming entirely insensible. Blunted susceptibility to pain is a characteristic of intoxication : and we often notice that patients, under the influence of chloroform, shrink from the knife, though they have no after-recollection of the suffering ; just as the mutilated drunkard awakes up to a consciousness of present pain, but is forgetful of all the circumstances attending his accident. The appeal is made to the brain through the same nerve, the pneumogastric, and the susceptibility of different individuals to the influence of the vapour varies as much as in the case of alcohol. Further, the attendant symptoms of their fatal imbibition are, in some instances at least, not unlike, allowance being made for the rapid and, at the same time, evanescent quality of the one poison, and the slower, but more substantial and enduring, influence of the other. It is on this evanescent property of chloroform that we ground our hopes of resuscitating a patient in whom animation is suspended from its inhalation : and in measuring its effects and comparing their quality with those of intoxication from alcohol, it must be remembered that the vapour not only pollutes the air, but actually precludes a certain portion from exerting its decarbonising power on the blood. This circumstance, together with the direct influence of the poison on the respiratory centre, and the lowered susceptibility of the sentient extremities of the pneumogastric nerves, seem to offer a satisfactory explanation of the combined state of apnœa and narcotism, which marks the fatal influence of chloroform ;—an explanation which is not inconsistent with the fact that frequently its earlier effect is, as with alcohol, to stimulate the brain.

Be this, however, as it may, the practical questions are, how to keep the action of the anæsthetic within due limit ; and how, in case of necessity, to restore suspended animation. The

condition of the pulse and respiration are, no doubt, important indications to be attended to : and the rapidity, strength, and other qualities of the former should be tested *before* inhalation is commenced, in order to institute a comparison during its exhibition. The healthy state of the heart and lungs should also be ascertained. The most important precaution to attend to during inhalation is to secure a free admixture of atmospheric air with the vapour : probably a neglect to do so is the most rife cause of fatality, if not the only one. But different individuals are variously affected by the anæsthetic ; and it is almost, if not quite, impossible to predicate beforehand what may be the susceptibility of any particular individual. Moreover, the indications of insensibility to pain are, with one exception, so inconstant, that they are not to be relied on : that exceptional sign is, however, a very simple one, and correspondingly safe. It consists, as already noticed (p. 184), in making a compact with the patient to manifest some given sign of consciousness when appealed to : and it is based on the assumption that consciousness, or the exercise of volition, and sensibility to pain are simultaneously suspended.

The *Treatment* of apnœa, from whatever cause except mechanical obstruction, must, with certain modifications, be conducted in the same way. The desideratum is to restore respiration ; and the effort must be to accomplish this, if possible, by exciting acts of natural respiration, or by artificial respiration. The former consists in dashing either cold or hot water on the face and chest of a patient ; it is perhaps better to alternate the high and low temperature ; for if the surface become chilled, cold ceases to stimulate the respiratory effort. Fresh air should be admitted freely to the patient, and the neck and chest should be liberated from all compression. The chest should be alternately compressed and allowed to expand, in imitation of natural respiration : and this may be done either by simple compression of the chest ; by rolling the patient over on his side, as recommended by Dr. Marshall Hall ; or according to the following directions of Dr. Sylvester, which would appear, from a report of a special Committee on the subject, now confirmed by experience, to be the most approved.

Sylvester's method.—The body should be placed supine, on a flat surface or slightly inclined plane, the shoulders being supported. The tongue is to be drawn forwards, so as to secure the glottis from being closed. The operator is then to grasp the arms just above the elbows, and to draw them upwards until they nearly meet above the head; and then immediately to lower and replace them by the side. This is to be directly followed by moderate pressure with both hands on the lower part of the sternum. This process is to be repeated twelve or fourteen times in a minute. From time to time water may be dashed in the face, as described above. The warmth of the surface must be maintained by friction and warm clothing: the warm bath is recommended by many, but its use has been questioned by others.

In case of drowning, the committee referred to recommended that the body should be placed with the face downwards, and hanging a little over the edge of an inclined table or board, with the head lower than the feet. The mouth should be opened, and the tongue drawn forward. The object of this arrangement is to facilitate the escape of water, which the inspiratory efforts have drawn into the lungs. A few seconds are generally sufficient to allow the water to drain out; and this may be aided by pressing once or twice on the back. Then Dr. Sylvester's method is to be adopted.

Dr. Marshall Hall's directions are, to " turn the body gently on the side, and a little beyond, and then briskly on the face, alternately; and to make pressure along the back of the chest each time the body is brought into the prone position." The admission of water into the lungs induces asphyxia more rapidly than simple exclusion of air. A galvanic current may assist in stimulating the muscles of respiration.

The influence of narcotic poisons must be combated by constantly rousing the patient, and exciting the respiratory act; otherwise the somnolency which steals over the senses is fatal, in consequence of the insensibility of the pneumogastric nerves to the accumulation of carbonic acid in the lungs. Of course, if there is poison in the stomach, it must be removed by means of an emetic, or of the stomach-pump.

HINTS ON MINOR SURGERY.

Dressing of Wounds.—This has been treated of already (page 229), but the following hints may be added.

In removing dressings unnecessary violence must be avoided. When a bandage has become saturated or hard, it is often advisable to pass a director underneath it on the sound side of a limb, and cut open with scissors, then soak the bandage with water until it can be removed without difficulty, taking care to work towards and not away from the wound, so as not to tear open the united edges : the fingers of one hand should steady the skin from which the bandage has been taken, while the other hand is employed in separating that part of the dressing which adheres.

Strapping, if employed, should be sufficiently long to have firm hold on each side of the wound, and should be of moderate width, so as to allow of its lying without a pucker; and the appearance of the dressing is improved by attention to uniformity. Where strapping has to be passed over a surface from which discharge is coming, windows may be cut in it to allow the escape of the pus. When strapping is renewed it is best to adjust the fresh strapping between the lines of the old, or over part of the wound, rather than remove the whole before re-applying it, if there be any chance of the edges of the wound gaping; and in removing the old take care to work towards the wound and not away from it. Much pain is often saved to a patient by having the neighbourhood of the wound shaved before applying the strapping. If any of the plaster adhere to the skin it may be removed by means of turpentine, or oil, or a mixture of the two.

Sutures should, in the first place, not be tight in ordinary wounds, for it must be remembered that their object is only to keep parts in apposition. Wire sutures cause less irritation than silk, but are not so easily removed, but if care be taken that the thickness of the wire is suitable to the tissues operated on, there is no danger tearing the wound open in re-

moving it. The wire should be twisted over one of the needle holes and not over the line of the wound, and both ends should be equally twisted, not one continuously round the other. The good which they are likely to do is effected generally in a short time, and unless there is any tendency in the wound to gape, they may be removed after a day or two, or before they have become a source of irritation as indicated by redness and suppuration at the points where they perforate the skin. In removing them cut through one end as close to the skin as possible, so as to avoid catching the skin when the other end is being withdrawn : a little care in this respect will be a great boon to the patient ; it is generally advisable to turn up a little the portion of the suture which remains over the wound before withdrawing it. It is usual to cut the twisted wire short after inserting a suture, but the projecting points frequently catch in the dressing, and the inconvenience of this may be avoided by leaving the ends long and twisting them together, and by passing a piece of strapping over them.

Bandages.—The object of a bandage is to retain parts in position without injuring them, and it is necessary to avoid strangulating a limb by too tight bandaging. Where a limb is likely to swell, as after fracture or other injury, the bandage must commence at the furthest extremity of the limb. Where parts are much bruised avoid carrying the bandage over them, as it will be impossible to see what mischief is going on beneath it, until perhaps too late. Uniformity in bandaging is obtained only by practice and judgment, and is of more importance than at first sight appears ; a limb well bandaged will lie more comfortably, and the splint will remain more steady, than if the bandage be put on awkwardly or irregularly. For convenience a bandage should have been rolled as tight as possible before being used, and it must be remembered that it should be held loosely while making a " turn."

Special bandages, as gum, starch, glue, paraffin, and plaster, are used where a firm splint is required to be adapted to a limb. The skin should be first protected by lint or zinc dressing.

Splints.—It must be borne in mind that the object of splints is usually to afford the means of keeping parts at rest, or

at times to give support to act mechanically upon a limb. If it be necessary to keep a part at rest, it is often quite as good treatment to lay a limb between sandbags, and these can readily be made upon the spot by filling a stocking with earth. Splints are usually made of wood or perforated zinc, but a good impromptu splint may be made with a few sheets of newspaper folded together. Special splints may be moulded in leather or gutta percha, or they may, of course, be made of any workable material. When placed upon a splint a limb must not be in a constrained position, consequently, joints should, if possible, be semiflexed. Notice, again, that a splint should include the next articulation above and below a fracture, for complete rest cannot be obtained unless these joints are kept unmoved. The limb should be protected from the pressure of a splint by padding of cotton wool or tow, or any soft material, but this must not be put over prominences: to protect the heel or ankle do not envelope these points in an abundance of cotton wool, as is often done, but rather pad all round or above and below, just as you would take pressure off a corn.

Torsion.—This means of arresting hæmorrhage is applicable to vessels of any size. Special forceps are advisable for it, though they are not essential. In the case of small vessels it is only necessary to catch the bleeding point and twist it three or four times, and it is not absolutely necessary to isolate the vessel from the tissues, though, where it can be done easily, it is better. In the case of large vessels seize the bleeding point with a pair of ordinary forceps, and separate it fairly from the surrounding tissues, then twist with the torsion forceps; if the artery be very large one blade of the torsion forceps may be passed inside the vessel. The number of twists to be made varies with the size of the vessel and the character of the tissues: generally about half a dozen are made for vessels of any considerable size, but with these it is possible to feel when the middle coat has given way. Do not be alarmed at seeing the vessel untwist itself two or three turns and retract. (For the pathology of torsion, see p. 102.)

Ligature.—It is advisable to become adroit in tying a double knot which shall not slip, and the best form is the " reef

knot." It is bad to see so simple an operation bungled over. The ligature has often to be put on when the hands are wet and slippery, so that it is advisable to always retain the ends of the ligature separate during the process of tying. Take care to carry the forefingers well down to the knot and to pull steadily : the forefingers will guide the direction of the force, and the vessel will not be torn out of the wound. Take care also not to tie the ends of the forceps, and avoid using such violence as to break the ligature.

Acupressure (see p. 205).

A seton is made by passing a broad needle or the blade of knife rapidly through a fold of skin pinched up between the fingers. Several thick silk threads should be left in the track of the wound, their ends tied together ; and they should be occasionally pulled backwards or forwards to prevent the wound healing rapidly.

An issue is made by rubbing potassa fusa or Vienna paste over a spot of skin usually about the size of a fourpenny piece. The surrounding skin must be guarded by two or three layers of plaster in which a hole has been cut. Rub in this hole with the potassa fusa until the cutis is denuded and a dull grayish dirty surface is made : then remove the plaster and place some sweet oil on the surface and around. Use a poultice until the slough separates ; after this the sore may be kept open at will by means of a pea or glass bead.

In **cupping** the chief thing required is rapidity. Holding the cupping glass slightly tilted and near the part where it is to be placed, carry the flame of a spirit lamp (or of some substitute) into the glass, leave it for a second, and withdraw rapidly while bringing the glass down upon a level surface of skin. The skin immediately rises, more or less filling the glass. In " dry cupping " this is the whole operation, and the glasses are left until the surface of the included skin is congested or livid. In " wet cupping " the scarificator is first made to pass through the skin, causing numerous incisions, which bleed freely when the exhausted cupping glass is put over them. The blades of the scarificator should not be set to cut deeply. Where copious

bleeding is required it is better to open a vein. After wet-cupping lay a pad of dry lint over the surface.

The points usually selected for wet or dry-cupping are the back and front of the thorax,—the back of the neck, because in these positions the surface is more level and extended, and the deep parts are thoroughly protected from injury.

Subcutaneous injections of morphia or ergotine, bichloride of mercury, &c., are given by inserting the point of the instrument under the skin. Pinch up a piece of skin between the thumb and forefinger of the left hand, and run the point of the injector well into the subcutaneous areolar tissue about an inch ; then inject the required amount of fluid, and press with the thumb firmly over the point of perforation while withdrawing the instrument. Then pass the other thumb along the skin, diffusing the injected fluid into the tissues beyond.

In **opening abscesses,** after seeing that your knife has a sharp point and edge and is quite clean, carry the point at once through the skin into the cavity of the abscess : the absence of resistance to the point, and the appearance of pus, will indicate when this is reached. Afterwards, enlarge the opening as much as is necessary in the case : with an acute abscess free opening is necessary : with a chronic one a valvular puncture may be advisable. Do not squeeze an abscess to get the pus out (see p. 18).

Passing the catheter in the male.—Where this is done for retention without stricture, make use of a full-sized gum elastic catheter with or without a stilette, and if the patient be advanced in years take care the catheter is long and the curve considerable, for the prostate may be expected to be enlarged. If a silver catheter be preferred the curve depends much upon the fancy of the surgeon. Catheters which are nearly straight are sometimes useful in the treatment of stricture, but they are most dangerous instruments in the hands of the inexperienced.

In learning the use of a catheter do so by watching those who are experienced, or practise under their guidance. It is totally unjustifiable to practise blindly at the expense of the

patient; a lifetime of misery may be the consequence of a novice's blunders. Remember that the appearance of blood means laceration somewhere.

The catheter should be passed steadily in as far as the triangular ligament, *i. e.* about four or five inches. If passed with the concavity of the curve backwards and upwards, the penis may be put on the stretch so as to do away with any puckering of the mucous membrane of the urethra. If passed with the concavity downwards and backwards, the handle of the instrument must be slightly raised as the point reaches the triangular ligament, then turned round over the patient's left groin and brought up to the middle line. In either case the catheter must now be depressed as the point passes under the triangular ligament and travels along the prostatic part of the urethra, which, it must be remembered, runs nearly vertically upwards. If the depression of the handle of the instrument be continued until this position is reached, the catheter should glide easily into the bladder, unless any obstruction exists.

The mind of the operator should follow the point of the catheter, and unless he is quite sure where this is, he is not justified in using any force whatever. Sometimes the finger in the perineum or the rectum will assist by determining the position of the catheter, or tilting the point of it. The injection of warm oil or warm water will also often assist where a stricture exists, particularly where a patient has already been clumsily catheterised. Being sure of the road, finding the catheter held by a stricture, and not being warned by bleeding, remember that patient endeavours may have to be continued for some time before a stricture is passed. No operation requires more caution or patience, and none is followed by worse consequences if performed with hurry or violence.

If a patient is sure of not giving way it is best that he should stand with his back against the wall and his legs apart during the operation; if, however, it be thought preferable that the patient should lie down, the operator will find it most convenient to stand on his left side.

Passing the catheter in the female.—Should be effected without exposing her if possible. She should lie on her

left side, with the nates brought well up to the edge of the bed, and her knees flexed. With the left forefinger the orifice of the urethra is readily felt immediately behind the clitoris, and between the nymphæ ; and with the right an elastic catheter is to be directed to the spot. Or the operation may be performed with the patient lying on her back.

Introducing the rectum-tube, or bougie, or the finger.—Carry it, well greased, at first directly inwards, then backwards, then upwards, following the concavity of the sacrum. A stethoscope over the colon will sometimes assist in determining whether fluid injected into the rectum has passed into the bowel above an obstruction.

Introducing the œsophagus bougie or tube for stomach-pump.—It should be curved slightly downwards, and then carried directly to the back of the pharynx, over the dorsum of the tongue ; steady pressure will then carry it into the œsophagus. If too much curved the end will pass forwards into the larynx ; but this may be avoided by pressing the tongue backwards, and guiding the point of the instrument with the forefinger of the left hand.

Taxis for hernia. See page 148.

Plugging the posterior nares. See page 118.

To use the ophthalmoscope. See page 130.

To use the laryngoscope.—Let the patient and surgeon be placed as in using the ophthalmoscope. With the left hand the patient's tongue may be drawn forward, a towel or handkerchief being used to prevent the fingers slipping. The light from the reflector is to be thrown steadily on to the back of the patient's fauces, and the laryngeal mirror then introduced. If the back of the tongue is avoided there is not usually much irritation, and the laryngeal mirror may be carried to the soft palate and past it. A little practice will teach the surgeon how to manage the instrument, and where the patient has accustomed his throat to the presence of an instrument, a view of the vocal cords and glottis can be easily obtained. He should be made to utter expiratory and inspiratory sounds during the examination. By reversing the instrument a view of the posterior nares may be obtained.

Memoranda for assistants at operations.—See that all things, instruments, applications, splints, bandages, water, sponges, &c., are ready and usable before the operation is commenced. Understand what is specially required of you during the operation, and while giving your special attention to this, watch the operator, consider what he is likely to want next, and see, if possible, that it is at hand for him. Instruments should be placed within reach unless one person is giving his attention entirely to them. Take care not to get in the way of the operator. Do what work is to be done quietly and steadily. Watch the surgeon carefully and follow his work, but try to anticipate his wants; the operator has his mind concentrated on the immediate steps of the operation, his assistant should also foresee the next step and its requirements, and be prepared for its casualties. If the assistant have charge of flaps he should be ready to put his finger on any bleeding point: he must economise space, he must economise means; ten fingers can do much if rightly used. Take care to hold the flap or stump in the most convenient position for the operator, not in the best position for the assistant to see; and do not let an anxiety to see what is going on place your head or any other obstruction in the way of the operator. If the assistant have to sponge, let him see that his sponges are clean, and squeezed dry. Understand when to wipe and when to dab; wipe when a surface has to be cleaned, dab when clots or twisted or ligatured vessels are not to be disturbed. If he is giving chloroform let him give his whole attention to it, and not partly to watching the operation; for many of the fatal cases of chloroform inhalation are to be traced to such a division of attention. If he is compressing an artery let him make sure before the operation is commenced that the vessel is commanded: much force is not usually required if he compresses against bone and in the right direction; and he should try to avoid compressing the vein as well as the artery; he should also take care not to press upon the patient's chest, or otherwise interfere with his breathing.

Finally, an assistant should be ready to give advice or warning where it is needed; and this should be done quietly, for unneces-

sary or excited interruption to an operator is not only an annoy-
ance but may be of serious consequence.

An operation being completed the assistant may have to see
after the removal of the patient, who should not be left until
he has fully recovered from the effects of chloroform. Before
leaving him the assistant should also see that no hæmorrhage or
other casualty has happened to the wound.
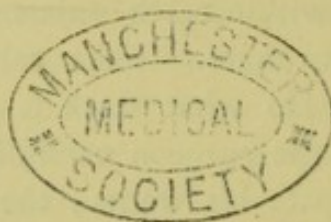
SECTION IX.

SURGICAL ANATOMY.

I.—OF ARTERIAL TRUNKS AND VEINS IN REFERENCE TO DISEASE AND OPERATION.

THE remarks already made when describing the ligature of arteries (page ·196) may be supplemented by a few notes on their anatomical relations, and on the bearing of these upon operations, wounds, hæmorrhage, aneurysms, &c.

Aorta.—The position of this vessel at its commencement, immediately behind the sternum, will account for the dulness found here in aneurysm of the arch, and the bulging forwards of the bone which eventually occurs. The oblique position of the vessel will also account for the aneurysm being more frequently to the right of the middle line. The transverse part of the arch crosses the trachea, œsophagus, and thoracic duct, while the left recurrent laryngeal winds round it. These relations are important, as they account for peculiar symptoms, which sometimes attend an aneurysm of this part of the aorta. Thus, pressure on the trachea may produce cough, dyspnœa, &c.; while pressure on the recurrent laryngeal may give rise to symptoms, so closely resembling those of laryngitis as to call for operation. Pressure on the œsophagus may cause obstruction in that tube, and if force be used in passing a bougie under such circumstances, the instrument may perforate the aneurysm and produce sudden death. An aneurysm may burst spon-

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taneously into either of these tubes. By pressure on the thoracic duct the patient's life may be destroyed by inanition.

Innominata.—This vessel lies so deeply and is so short that a ligature is rarely placed upon it. It must be remembered that the inferior thyroid veins cross over it, and must be carefully avoided in operations about this part, as secondary hæmorrhage from them is serious. Immediately to the outer side is the right pleural sac, and this must also be carefully avoided; while on the same side are placed the pneumogastric and phrenic nerves with the right brachiocephalic vein. The thymus gland lies to the inner side in early life. An aneurysm of this vessel will usually project into the neck, and as it commonly implicates the carotid and subclavian, the circulation in both these vessels is interfered with, and the recurrent laryngeal pressed upon ultimately, giving rise to irritating cough, spasm of the glottis, and interference with the voice. Sometimes the sympathetic nerve being involved, an inequality of the pupils may be detected as one of the first signs.

Common carotid.—It must be remembered that the course of this artery is along a line drawn from the sterno-clavicular articulation towards the front of the mastoid process, and that the artery usually divides opposite the upper border of the thyroid cartilage. It passes from under cover of the sterno-mastoid, usually opposite the upper border of the cricoid or lower border of the thyroid cartilage, and it is just below this point that a ligature is generally placed upon it. In this position the jugular vein lies outside it, and the pneumogastric nerve rather deeply between the artery and vein; while the descendens noni commonly passes down upon the artery, but superficial to the sheath : neither vein nor nerves, however, are necessarily seen in the operation. The omohyoid crosses the vessel here, and may be displaced upwards or downwards if necessary.

External and **internal carotids.** — Neither of these vessels require especial remarks as they are not commonly ligatured, the common carotid being more suitable for the operation, on account of the absence of branches and the greater readiness with which it can be reached.

Lingual.—This vessel is sometimes divided in cut throat, or may have to be secured for hæmorrhage in cancer of the tongue. It passes forward horizontally along the upper border of the hyoid bone, at first with the hypoglossal nerve ; but when it reaches the edge of the hypoglossal muscle the artery passes under cover of it, while the nerve is superficial and generally placed somewhat higher.

Facial.—The facial artery, after passing deeply in the sub-maxillary region, winds over the lower jaw immediately in front of the masseter, and a groove in the bone marks the position of the artery. The large facial vein is usually to be found lying posterior to the artery.

Subclavian.—The third part of this artery is that which is of the greatest interest to the surgeon, as it is here that ligature is usually applied for aneurism or injury, and digital pressure is used in controlling hæmorrhage from the axillary, or from the brachial higher up. Notice, first, that the artery leaves the outer border of the scalenus anticus, and lies obliquely on the upper surface of the first rib : the brachial plexus of nerves lies above and behind it, while the subclavian vein is lower and more anterior, and quite under cover of the clavicle. The edge of the scalenus and the first rib then are the fixed points which must serve as a guide for finding the artery. Trace the edge of the scalenus to the first rib, and the finger is immediately upon the vessel. Sometimes a tubercle on the surface of the rib indicates the position of the vessel. Reference to the omohyoid is of little or no use.

It must be borne in mind that in many cases where ligature has to be applied to this vessel the clavicle is much displaced, and the artery consequently appears to be more deeply placed. Superficially the external jugular vein may be seen passing behind the border of the sterno-mastoid while crossing the root of the neck, and sometimes over the position of the artery will be the transversalis colli vein, which must be pulled on one side if in the way during the operation for ligature. The proximity deeply of the cords of the brachial plexus and the first rib have led to these structures being mistaken for the artery. Bear in mind also that from the third part of the subclavian it is not uncommon

to find a large branch (generally the posterior scapula) given off.

Axillary.—The course of this artery is indicated by a line drawn from the middle of the clavicle to the angle of junction between the anterior and posterior folds of the axilla. Above the pectoralis minor the artery is covered by the dense costo-coracoid membrane, which hides also the vein on the inner side. The nerves are behind and external. Ligature is rarely applied to this part of the artery, but should it be deemed necessary the position of the cephalic vein must be borne in mind, as it crosses this region, and care should be taken to avoid the large acromio-thoracic artery coming from beneath the upper edge of the pectoralis minor.

The third part of the axillary is somewhat superficial below, and is usually free from branches below the edge of the sub-scapularis. In this position it is covered by the median nerve and the venæ comites closely invest it, while the ulnar nerve lies against it on the inner side. The basilic vein and internal cutaneous nerves are superficial and rather internal to the artery.

Brachial.—A line drawn from the outer angle of the axilla to the middle of the bend of the elbow will mark the course of this vessel. It must, therefore, be remembered that in compressing it the pressure must be directed directly outwards above, directly backwards below, and intermediately between these two directions half way down the arm. The artery lies along the edge of the coraco-brachialis above and of the biceps below. The median nerve lies to the outer side of it above, then crosses it, and ultimately lies to the inner side, while the ulnar nerve, which is close to the inner side of the vessel above, leaves it about half way down the arm to reach the back of the inner condyle : the ulnar can be felt to roll under the fingers more easily than the median. Immediately under the skin the median basilic and basilic veins are to be found lying over the course of the artery, together with branches of the internal cutaneous nerves. At the bend of the elbow the bicipital fascia crosses the vessel towards the flexor muscles of the forearm ; and as this structure intervenes between the artery and the median

basilic vein, which from its size is most commonly opened in venesection, the danger of wounding the artery in that operation is thereby lessened.

Radial.—A line drawn from the outer border of the tendon of the biceps to the front of the styloid process of the radius indicates the course of this vessel. It passes at first rather outwards, and gets under cover of the supinator longus, but in the lower half of the forearm it can usually be felt pulsating between the tendons of the flexor carpi radialis and supinator longus. For the upper and lower thirds of its course it is not accompanied immediately by any nerve, but in the middle third the radial nerve lies to its outer side. A large anastomosing branch (anterior carpal) sometimes crosses deeply the front of the limb near the carpus, and gives rise to bleeding after ligature of the vessel; and a large superficial volar can occasionally be felt pulsating over the ball of the thumb.

Below the styloid process the radial passes backwards deeply, close to the external lateral ligament and under cover of the extensor ossis metacarpi and primi internodii, to the back of the space between the first and second metacarpal bones, where it is more or less overlaid by the extensor secundi, and where it gives rise to considerable trouble when injured.

Ulnar.—A line drawn from the inner border of the tendon of the biceps, slightly curving inwards along the upper third, then straight down to the radial side of the pisiform bone, will indicate the course of this vessel. The ulnar artery usually runs deeply at first, but it is sometimes superficial in its whole extent, and can be felt pulsating under the skin. It is joined by the ulnar nerve between its middle and upper thirds, and continues to lie under cover of the flexor carpi ulnaris.

Palmar arches.—The superficial arch is indicated by a line drawn from the cleft between the thumb and index finger across the outer half of the hand, then upwards to the radial side of the pisiform bone. This line should, therefore, describe a curve with the concavity upwards and outwards. The arch is usually formed by the junction of the ulnar with one of the terminal branches of the radial, usually radialis indicis or princeps pollicis, but not unfrequently the superficialis volæ.

The position of the deep arch is indicated by a line drawn across the wrist, an inch nearer the carpus, from the unciform process to the spaces between the bases of the first and second metacarpal bones.

Wounds occurring to these vessels are sometimes attended by serious bleeding, which may require ligature of the brachial on account of the free anastomosis, not only between radial and ulnar, but also with the interosseous.

Abdominal aorta.—The aorta divides about an inch and a half below the umbilicus, and pressure directly over the umbilicus may be necessary in amputation of the hip-joint.

Common and **external iliacs.**—A line drawn with a slight curve outwards, from the bifurcation of the aorta to midway between the spine of the pubes and the anterior superior spine of the ileum, indicates the position of these vessels. About the first two inches of this line belong to the common iliac and the remainder to the external. The meter crosses the common iliac close to its termination. It must be noticed that the veins of the two sides bear a somewhat different relation to the arteries ; the left common iliac vein lies below its corresponding artery, and passes under the right common iliac artery at right angles, a fact which may partly account for the greater frequency of obstruction to venous circulation in the left limb. In addition it must be remembered that the commencement of the rectum lies on the left common iliac vein—another fact which explains the occurrence of plugging in the left iliac and femoral veins being not uncommon.

Obturator.—This vessel, which usually arises from the internal iliac, in some cases comes from the epigastric and may complicate the operation for femoral hernia. When rising from this abnormal source it passes inwards and downwards and usually external to the crural ring, but if it should pass close along the inner edge of the ring before descending into the pelvis it must inevitably be divided when the hernia knife cuts through Gimbernat's ligament. In such a case, if the ends cannot be seen, use acupressure above and below.

Femoral.—The course of this vessel is marked by a line drawn from midway between the spine of the pubes and the

anterior superior spine of the ilium to the inner side of the knee. The artery is felt pulsating on the pubes, and it is here that it can be commanded most readily.

In the upper third of the thigh it is uncovered by muscle, and has the femoral vein to the inner side, but soon passing behind it, while the anterior crural nerve lies to the outer side, immediately under Poupart's ligament; below this the nerve breaks up into branches, of which only two are related to the artery— the long saphenous accompanying it under the sartorius, and the internal cutaneous lying along the posterior border of the muscle.

In the middle third of the thigh the artery is covered by the sartorius, and lies in what is termed Hunter's canal. The vein gradually passes behind the artery, and at the point where they pierce the adductor margins—at the junction of the middle and lower thirds of the thigh—the vein is rather to the outer side. The long saphenous nerve lies either within or upon the sheath of the vessels, and a dense fibrous structure stretches across the vessels under the sartorius, between the vastus internus and the adductor longus. The saphena major vein lies usually along the posterior edge of the sartorius, immediately under the skin, and should be pulled to the inner side if in the way during the operation for ligature of the artery.

The position at which branches come off from the main trunk should be noticed, as it is not advisable to apply a ligature close to a large branch. The profunda usually leaves the outer and back part of the femoral about an inch and a half below Poupart's ligament, and then passes deeply behind the adductor longus. No other large branch is given off from the femoral until it is about to perforate the adductor magnus, when the anastomotica magna passes forwards deeply towards the knee-joint. The spot most commonly selected for ligature of the femoral is either at the apex of Scarpa's triangle or in Hunter's canal, immediately under the sartorius.

Popliteal.—This vessel is rarely the subject of ligature, but one of its anatomical relations should especially be noticed. In the popliteal fat lymphatic glands are to be found, and these may become inflamed or enlarged, and the pulsation of the

artery underneath be communicated to them, simulating thus a popliteal aneurysm ; but the existence of a cause for inflamed glands and the absence of lateral pulsation will usually distinguish this disease from aneurysm.

Posterior tibial.—This vessel courses down the middl eof the back of the leg to behind the inner malleolus, where it can be felt pulsating behind the flexor longus digitorum, about a finger's breadth behind the malleolus. It lies deeply in the upper part of its course, under the strong fascia covering the deep muscles, and the nerve is then placed to the inner side, while two venæ comites accompany the vessel. As it is traced downwards the nerve crosses it, to reach its outer side above the ankle. In its upper two thirds it lies midway between the tibia and fibula, and behind the malleolus the deep fascia still covers it. Occasionally the artery divides before reaching the ankle.

The plantar arch is formed by the external plantar artery, which passes deeply under cover of the flexor brevis digitorum, and then dips down opposite the base of the fifth metatarsal bone, under cover of the flexor tendons. It crosses then towards the inner side of the foot, deeply placed on the inter-ossei muscles near the bases of the metatarsal bones, to reach the space between the first and second metatarsal bones, where it anastomoses with the dorsalis pedis.

Anterior Tibial.—A line drawn from the front of the head of the fibula to the middle of the front of the ankle marks the course of this artery. In the upper part of its course it is very deeply placed between the extensor communis and tibialis anticus, and the anterior tibial nerve is separated from it by the fibula. In the lower half of the leg the extensor proprius pollicis lies to the outer side, and crosses the artery just above the ankle. The guide to the vessel is the outer border of the tibialis anticus. The nerve reaches the artery about one inch and a half below the head of the fibula, and may be found on either side of the vessel, but ultimately it lies externally when they reach the ankle.

TABLE OF THE MOST IMPORTANT ANASTOMOSES, AFTER LIGATURE OF CERTAIN ARTERIES.

Branches from cardiac side   *with*   *Branches from distal side.*
      of ligature

Innomimate.

1st aortic intercostal	Superior intercostal.
Lower intercostals	Thoracic branches of internal mammary.
Deep epigastric	Internal mammary.

Also communications across middle line in neck and brain.

Common carotid.

Inferior thyroid	Superior thyroid.
Profunda cervicis	Princeps cervicis.

Also communications across middle line in neck and brain.

Subclavian, 3rd part.

Superior and posterior scapular	Subscapular.
Internal mammary	Long thoracic and subscapular.

Brachial, upper part.

Circumflex and subscapular	Superior profunda.

Radial, near wrist.

Ulnar	by superficial and deep palmar arches.
Interosseus with	deep palmar arch.

Ulnar, near wrist.

Radial	by superficial and deep palmar arches.
Interosseus with	deep palmar arch.

Common iliac.

Superior hæmorrhoidal	Middle hæmorrhoidal.
Middle sacral	Lateral sacral.

Branches from cardiac side   with   Branches from distal side.
*   of ligature*

Common iliac (*continued*).

Internal mammary, in-   Epigastric.
ferior intercostal and
lumbar arteries

Last lumbar   Ilio-lumbar, and circumflex
iliac.

Gluteal   Sacral.

External iliac.

Gluteal   External circumflex.
Obturator   Internal circumflex.
Sciatic   Perforating arteries.
Ilio-lumbar   Circumflex iliac.
Internal pudic   External pudic and internal
circumflex.

Femoral, at apex of Scarpa's triangle.

Profunda, perforating, muscular branches ⎫
to vastus internus, descending branches ⎬ articular branches of popliteal.
of external circumflex, comes nervi ischi- ⎪
atici. ⎭

Posterior tibial, in middle of calf.

Anterior tibial   External plantar and ante-
rior peroneal.

Anterior tibial, in front of ankle-joint.

Anterior peroneal   External malleolar.
External plantar   Anterior tibial, digital, and
interosseous branches.

II.—OF NERVES, IN RELATION TO DISEASED GROWTHS AND OPERATIONS.

Although the position of the chief nervous trunks is such as to afford them protection for the most part in accidents, such as fractures and dislocations, and in structural diseases, they are occasionally injured, or are liable to injury in surgical operations.

Cerebral nerves.—In operations about the eyelids for the removal of tumours over the orbit, below the orbit, or on the chin, *the three divisions of the fifth nerve* may be severally divided or injured, unless care be taken to avoid them. Occasionally the operation of dividing or excising a portion of one of these nerves has been practised for painful tic of the face ; but the results of this proceeding are not very encouraging.

Loss of sensibility to the conjunctiva is disastrous in its results, involving usually destructive inflammation and sloughing of the globe.

The proximity of the *facial* nerve to the termination of the external carotid artery in the parotid gland should be studied. Paralysis of the facial muscles from the pressure of tumours in this position is thus explained ; and in operations in the face, the trunk of this nerve, crossing the cheek with the parotid duct and transverse facial artery, should be avoided if possible.

The relation of the facial and *auditory* nerves, before they leave the skull, explains the concurrence of deafness with facial paralysis in abscess of the temporal bone.

The *pneumogastric* nerve is related, throughout the neck, to the carotid artery, lying between it and the jugular veins. It is, therefore, pressed on in aneurism in this position, and must be carefully excluded in placing a ligature on the artery. In tying the subclavian artery, internal to the scalenus on the right side, both the trunk and its recurrent branch must be turned aside. In case of œsophagotomy, the left recurrent laryngeal nerve rests on this tube, just prior to its final distribution.

In ligature of the lingual artery for hæmorrhage from wound or ulceration, the artery will be found below and a little behind the hypoglossal nerve ; when opposite the tendon of the digastric muscle, the hyo-glossus subsequently intervenes between them, the nerve being superficial. In hemiplegia the protruded tongue is directed *towards* the affected side, by the action of the genio-hyo-glossus of the sound side, which approximates the base of the tongue to its own side, and thus projects the apex in the opposite direction.

Cervical plexus.—The *descending branch of the lingual* nerve lies on the sheath of the common carotid, and must be turned aside in placing a ligature on that vessel.

A superficial ascending filament of the cervical plexus accompanies the external jugular vein, and may be punctured or divided in opening that vessel. The *phrenic nerve* is out of harm's way in tying the subclavian artery external to the scalenus ; but in placing a ligature on the artery in the first division of its course, this nerve would be liable to division if the inner edge of that muscle were cut.

Brachial plexus. *The three cords* which constitute this plexus are found, in the posterior, inferior triangle of the neck, above and behind the subclavian artery, but rapidly converging towards that vessel in their descent to the subclavicular space ; subsequently they rest on the first digitation of the serratus magnus muscle, and soon surround the artery in their interlacements, and separate it from the vein which lies superficially. These relations are important to the surgical anatomist, not only in operations, but as a key to many phenomena accompanying surgical disease. The proximity of the vessels and nerves explains the pain, numbness, or even loss of motive power and of sensation in the parts to which the nerves are distributed, in cases of pressure from aneurismal enlargement of the subclavian artery, innominata, or even aorta. Their position necessarily renders them obnoxious to injury in accidents or operations, such as the extirpation of tumours, from the clavicular region, behind the sterno-mastoid muscle. Again, the relation of the nerves to the subclavian artery, external to the scalenus muscle, may lead to the mistake which has been

made, of including one of the cords in a ligature instead of the artery. The pulsation of the artery is of assistance; but the test is the cessation of throbbing in the sac when pressure is made on this artery with a finger.

Temporary paralysis may be produced by injury to the sternum or clavicle, either from displaced bone or extravasation of blood. Deep-seated abscess may cause a similar result. The pain and numbness of the arm, in dislocation of the head of the humerus into the axilla, is referable to pressure on and tension of these nerves.

In the axilla, this relation of the various branches of the brachial plexus to the artery renders ligature of this trunk troublesome. It is rarely needed.

The internal cutaneous nerve lies on the ulnar side of the brachial artery; its external branch passes over the median basilic vein, and is liable to be punctured in venesection.

A branch of the *external cutaneous*, crossing the median cephalic, runs usually behind that vein, and is thus secure from injury in this operation.

The ulnar nerve lies to the inner side of the artery above; but as it inclines towards the back of the inner condyle, the intermuscular septum is interposed between them. Whilst lying on the edge of the triceps, this nerve is accompanied by the inferior profunda artery, which is on its radial side. In case of enlargement of this arterial branch these relations might lead to its being mistaken for the brachial, which is similarly related to the median nerve. In the forearm the ulnar nerve joins the artery in the middle third, and lies to its inner side, accompanying it to the hand, and crossing the wrist superficial to the annular ligament. These relations should be borne in mind when the artery is tied, lest the nerve be included in the ligature. The trunk of the nerve is liable to contusion, whilst behind the inner condyloid prominence; and it must be carefully drawn aside and secured from injury in excising the elbow-joint. Laceration of the digital branches of this and of the median nerve is frequent in wounds of the hand, where they should be carefully excluded from any ligature which may be used to tie the bleeding vessels. Such injuries are not

infrequently the cause of tetanus, and the risk would be aggravated by tying the nerves.

The *median nerve* is usually on the inner side of the brachial artery, but often varies its relative position. Its relation to the median basilic vein may render it obnoxious to punctures in venesection. This has occurred, and the suffering is then referred to the digital extremities of the nerve : in wound of the cutaneous nerve, under similar circumstances, the forearm is the seat of numbness and pain.

In ligature of the upper part of the brachial artery, the *musculo-spiral* nerve is most liable to injury, as it there lies behind the vessel and is unseen. In tying the superior profunda after amputation, the proximity of this nerve should be remembered. The radial branch lies to the outer side of the radial artery, accompanying it in the middle third of its course only.

The **intercostal** nerves may be wounded in fracture of the ribs, or in paracentesis thoracis, when the precaution taken to avoid the artery will also secure the nerve from injury, viz., the perforation of the intercostal space close to the inferior of the two ribs, between which the opening is made.

Inguino-cutaneous nerves.—The origin and distribution of these nerves account for the pain in the back, loin, groin, perineum, and down the thigh, severally, in diseases of the uterus, rectum, kidney, bladder, ureter, &c.

The main trunk of the **anterior crural nerve** is too far removed from the femoral artery to be involved in injuries to or operations on this trunk, but its saphenous branches may be implicated. The stretching of the *internal saphenous nerve* by a femoral aneurism occasions acute pain in the course of the nerve, even to the great toe. Its relation to the artery, viz., on its outer side, should be borne in mind in deligation of this vessel in the middle third of the thigh ; and care also should be taken to avoid including this nerve in ligature of the artery after amputation of the thigh. The subsequent relation of this nerve, near the knee, to the anastomotic artery has caused this vessel, when enlarged, to be mistaken for the femoral trunk. On the inner side of the knee the saphenous nerve is exposed to

injury from contusions or wounds in this position. Such lesions may be succeeded by much suffering in the course of the nerve ; and even tetanus has been thus produced. This nerve may be implicated in various operations for obliterating its accompanying vein, or in opening that vessel at the inner malleolus.

Sacral plexus.—*The pudic nerve may* be wounded in the lateral operation of lithotomy, where it lies on the inner side of the ramus of the ischium in company with the artery. In aneurism of the popliteal artery, the pressure on the great nerves occasions both numbness and pain. In ligature of the tibial vessels, the relation of the nerves to the arteries should be remembered ; the nerves are usually to the outer or fibular side. The proximity of the vessels and nerves should also be borne in mind in tying the former after amputation. It is remarkable how rarely the tibial nerves are injured in fracture of the leg.

The pain in many dislocations is due, in a measure, to stretching or contusion of neighbouring large nerves.

III.—OF THE JOINTS AND MUSCLES, IN RELATION TO DISLOCATIONS AND FRACTURES.

The construction of the two ball-and-socket joints presents a remarkable contrast in many particulars, by which each is adapted to its special functions. In the shoulder every arrangement exists, every sacrifice is made, to facilitate movement. In other words, every other consideration, as regards the configuration of the joint and its ligamentous connections, is subservient to the all-important one of affording every facility for varied and extended movement. The small and shallow glenoid cavity and the loose and extended capsule seem to invite displacement ; and this accident, frequent though it is, would be far more common were it not for the compensating

arrangements which exist in the free mobility of the scapula, and the great strength of the capsular muscles.

In the ilio-femoral articulation, where a more limited amount of movement is demanded and greater security is required against displacement, by a member which has thrown upon it the superincumbent weight of the trunk, the articular cavity is large and the head of the femur is buried deeply within it, and held in its position by the interarticular ligament, for the free movement of which, without risk of attrition, a provision exists in the form of a non-articular padded depression in the bottom of the acetabulum, extending inwards and downwards to the insertion of that ligament into the borders of the cotyloid notch. The round ligament checks the various movements of the joint and protects it against dislocation ; indeed the only dislocation which can occur without its rupture is that into the thyroid foramen. The thick ilio-femoral ligament, or accessory fibres of the capsule, strengthen that strong fibrous expansion and limit abduction and extension ; whilst the expansion of the large synovial membrane beyond the cartilaginous surface of the joint offers every facility for movement, within the limits permitted by the igaments.

In the enarthrodial joints the muscles which are chiefly instrumental in determining the dislocation of a bone from its articulating cavity are those which are situated at some distance from the joint. But it is rarely, if ever, that such displacement occurs when the joint is in its normal position of rest ; that is, when the arm is by the side, or the leg perpendicularly below the trunk. A necessary condition, therefore, for muscular action to assist in producing dislocation is, that the head of the bone should be prepared for such result by partial displacement from its articular cavity ; or, in other words, by a change from that adaptation of its articular surfaces which exists in a state of rest. The muscles which immediately surround a ball-and-socket joint, and which are attached close to it, can alone act efficiently in resisting dislocation, and are, consequently, often lacerated or ruptured.

In dislocation at the **shoulder-joint** the capsular muscles —those inserted into the tuberosities of the humerus—are both

passive and active agents in protecting the head of the bone from displacement.   Their thickness and strength supply that resistance which the capsule is neither competent nor intended to afford.   In fact, the osseous configuration of the joint and its ligamentous connections are designed especially to facilitate variety and extent of movement ; the true sustaining ligaments, functionally, being the capsular muscles and the long tendon of the biceps.   Moreover, this muscular support is more needed in consequence of the mobility of the scapula ; and their efficiency is enhanced by the circumstance that each of these muscles acts concurrently with other powerful muscles, the contraction of which tends, under favouring circumstances, to produce dislocation.   In this respect the subscapularis is the antagonist of the pectoralis major ; the infraspinatus and teres minor that of the latissimus dorsi ; and the supra-spinatus that of the deltoid ; and for this reason, that the smaller muscles act with the larger in elevating or in drawing forwards and back-wards the head of the humerus, whilst their proximity to the joint or fulcrum enables them to hold in contact the surfaces of the articulation, which the others, under favouring circum-stances, have a tendency to displace.   All these capsular muscles combine to form a strong tendinous covering around the joint, except at its under part.   Here their presence would necessarily impede movement ; and it is in this direction that primary dislocation of the head of the humerus most commonly takes place.   But the feebleness of this part of the capsule is not the only reason why dislocation usually occurs in this direction.   When the arm is raised from the side, or forcibly thrown up, the lower part of the articular surface of the head of the humerus is already partially out of its socket in this direction ; and the resistance of the capsular muscles around the joint is insufficient to neutralise the powerful action of the pectoralis major, latissimus dorsi, and teres major, which, acting on the lever at a distance from the fulcrum, draw the head of the bone into the axilla ; the deltoid aiding by elevating its lower extremity.   The relation of these muscles to each other and to the shoulder-joint are, therefore, deserving of the most careful study by the surgical anatomist.   The short head of

the biceps and coraco-brachialis also cross the joint, but cannot help much in protecting it from injury. The efficient aid afforded by the capsular muscles is well exemplified by the spontaneous dislocation which may occur in paralysis of the shoulder, if the arm be not supported.

In the dissections of recent dislocations of the head of the humerus some of these muscles have been found ruptured, and even portions of the tubercles torn away. Probably the tediousness in recovery of some of these cases is dependent on the extent of laceration.

In axillary dislocation the supra-spinatus and subscapularis have been found torn ; in sub-coracoid dislocation the long tendon of the biceps has been ruptured ; in sub-clavicular dislocation, the infra-spinatus and subscapularis ; and in the dorsal dislocation, the subscapularis has been found lacerated.

The muscles which immediately surround and are inserted into the neighbourhood of the **hip-joint** are, relatively, not so strong nor so competent to resist violence as those which directly enclose the shoulder-joint : but, for the reasons assigned, there is less need for their support. Any force sufficient to produce dislocation would not be resisted by the capsular muscles of the hip. But the clustering rotator muscles behind, consisting of the pyriformis, gemelli, obturatores, and quadratus, must aid the gluteus medius and minimus in performing that protective duty, which is fulfilled in front of the joint by the conjoined psoas and iliacus and the pectineus.

Probably, in the great majority of dislocations at the hip-joint, the round ligament is torn. Its attachment to the acetabular notch permits of displacement into the thyroid foramen without rupture necessarily occurring, and it is recorded that instances have occurred, verified by dissection, in which the ligament was not torn in dislocation on to the dorsum ilii. The capsular ligament is necessarily torn in all complete dislocations. The capsular muscles must suffer more or less ; and dissection has shown that the posterior small rotator muscles are torn through in the dorsal dislocation, and even the pectineus. In the obturator dislocation the last-named muscle and small adductor have been found ruptured ; and the same

injury has been seen accompanying dislocation on the pubes. But the amount as well as the character of the attendant muscular laceration must necessarily be determined, to a great extent, by the force which produced the displacement of the head of the bone.

The **elbow** and **knee** are both hinge-joints, but present few characteristics in common, beyond the circumstance of their admitting chiefly of angular movement. The more complicated arrangement which exists in the elbow is associated with the superadded motion between the bones of the fore-arm; but the osseous configuration of the joint is such as to constitute an important protection against dislocation. Although the lateral ligaments are strong, the rest of the ligamentous connections of the elbow are not of a character to afford much protection against displacement ; and, under favouring circumstances, the attachment of the muscles in the neighbourhood of the joint is such as to promote rather than to obstruct dislocation. Thus, in the dislocation backwards of both bones—the most common form of displacement—the triceps takes an important part, which the biceps and brachialis anticus are incapable of resisting. This accident, if complete, must be attended by fracture of the coronoid process of the ulna, or rupture of some part of the brachial muscle inserted into it. In some instances the insertion of the biceps tendon holds the radius in its normal position, and the ulna breaks away from its connections to that bone, and alone is dislocated backwards. When the radius only is dislocated, it is usually forwards, in consequence of the action of the biceps upon its upper end : the annular ligament surrounding the radio-ulnar articulation is necessarily torn in both these displacements.

The **knee-joint,** so far as its form is concerned, is amongst the feeblest in the body, its breadth of surface being the only element of strength it possesses. But the ligaments are powerful and all important, and these are materially strengthened by the aponeurotic expansion and accumulated tendinous fibres around the joint. Not only do the interarticular fibro-cartilages deepen the articular depressions on the head of the tibia, but their mobility suffices to permit of their accommodation to the

various movements of the joint, including slight rotation. The crucial ligaments within, the lateral ligaments on either side, especially the broad internal lateral, the ligamentum patellæ, or true insertion of the extensor muscles in front, and the posterior ligament derived from the semi-membranosus muscle—these together constitute a resisting force which amply compensates for the feebleness of the osseous configuration. In addition to the muscles noticed, the tendon of the popliteus stretching obliquely across the back of the joint adds to its strength ; and the insertion of the hamstring muscles below the joint, and the origin of the gastrocnemius above it on its posterior aspect, and the passage of the extensor tendons, with their great sesamoid bone in front, by their antagonism help to hold the articular surfaces in contact. It is the amount of laceration which necessarily attends complete dislocation of the knee-joint, that renders this accident so serious, and so commonly demands the sacrifice of the limb to save life. Probably muscular action has but a small share, under any circumstances, in producing, or even in determining, the direction of these dislocations.

Rupture of the internal lateral ligament alone is sufficient to entail a life-long feebleness in the joint. Although muscular injury is of secondary importance in dislocations of the knee, it should be remembered that the relation of the vessels and nerves to the back of the joint renders them obnoxious to laceration— a complication which necessitates amputation to save life.

The **radio-carpal** articulation is said to be liable to dislocation forwards and backwards. Such displacement is, however, of very infrequent occurrence, and its rarity is probably in great measure due to muscular action. No doubt the annular ligaments, especially the anterior, afford considerable protection to this otherwise feeble joint ; but a fall on the palm of the hand, when the arm is out-stretched and the hand itself bent back, would put the strong flexor mass of tendons in front of the wrist on the stretch ; and this tension would be increased by the simultaneous contraction of the muscles, which would thus offer an almost insuperable obstacle to dislocation in this way. When the hand is forcibly bent forwards similar resistance, though to a feebler extent, is offered by the extensor

tendons ; therefore dislocation by this accident is more probable.

The radius, near to its carpal extremity, is often fractured by force, which might otherwise produce articular displacement—-a circumstance which demonstrates at once the degree of resistance afforded by the muscles, and the amount of violence which is required to produce dislocation.

The form of the **ankle-joint,** which includes the lower extremity of the fibula, is well adapted to prevent displacement ; but the necessity for a considerable amount of lateral motion demands protection by strong ligaments on the sides of the joint ; and their capacity for resistance is manifested in the infrequency of their laceration, the malleoli to which they are attached being more frequently broken.

The peronei and posterior tibial muscles materially add to strength of this joint, to which they are closely applied.

In dislocation of the foot backwards the action of the gastro-cnemius will reproduce the displacement, if care be not taken to prevent it.   In these dislocations, when compound, the most serious complication is that of lacerated vessels and nerves.

When the **Phalanges** of the fingers or toes are dislocated, the strong lateral ligaments oppose reduction ; and this passive resistance is, no doubt, aided by muscular action.

In fractures of the long bones the muscles are more or less actively engaged in disturbing the relation of the broken ends, and thus marring the efforts of the surgeon to preserve their relative position.   Yet, even where the mechanical conditions are identical, the results vary very much in different individuals, owing to differences in temperament.   The spasmodic inter-ference of muscles in fractures is usually limited to the early period of the treatment; and if they are then patiently humoured as far as is consistent with the safety of the patient, they become tractable by degrees.   In some instances it is necessary to coerce the muscles, and occasionally to neutralise their inter-ference by section of their tendons.   But gentle treatment is preferable where practicable ; and tenotomy should never be practised without due consideration of the fresh forces which may be brought into action, by suspending the natural antago-

nism.   The union of a divided tendon goes on, *pari passu*, with that of a broken bone, and does not protract the recovery. Muscular action has no appreciable influence on fractures of the *spine*, *chest*, or *pelvis*; and the same may be said, usually, of the *scapula*, which is so surrounded and covered by muscles, that the relations of different parts of the bone, when it is broken, are rarely disturbed so as to require any arrangement for their adjustment.   Even in fracture of the coracoid process the strong ligaments prevent much displacement by muscular action.

In fracture of the **clavicle** displacement of the fragments is, no doubt, due in a measure to muscular action, but in a less degree than to other causes elsewhere noticed.   The fact is, that the correspondence of the insertion of the trapezius to the origin of the deltoid, and that of the great pectoral muscle to the sterno-mastoid, enables these muscles severally to neutralise each other's action; and if the weight of the shoulder can be prevented from producing overlapping of the fractured ends, in most cases muscular action will not impede their adaptation. When fracture occurs in the centre of the clavicle the outer fragment generally rides below the inner, whilst the latter is thrown in front of it; but this is due, so far as the muscles take part in it, to the scapula being drawn forwards, and carrying with it the attached portion of the clavicle.   When either extremity of the bone is broken, the strong ligaments prevent displacement to any extent.

The treatment of fractures of the shaft of the **Humerus** is rarely impeded seriously by muscular action.   It is true that the deltoid will tilt the upper fragment, but simple splints, with the arm depending, are usually sufficient to counteract this cause of displacement.   In the rare accident of fracture of the great tubercle of the humerus, the muscles inserted into it necessarily displace it, and the arm must be placed in such position as to relax them.   Some displacement, in fracture of either condyle of the humerus, may be due to muscular action; but if the ligaments be not torn, this is inconsiderable.

In fracture of the bones of the **Fore-arm**, muscular action is often troublesome in counteracting the efforts of the surgeon

to keep the broken parts in position. The triceps draws up the separated olecranon, the brachialis anticus the coronoid process, the pronators approximate the bones and obliterate the inter-osseous space. In the same way, fracture of the lower extremity of the radius is attended by displacement due to the same cause, the shaft of the bone being drawn forwards by the pronators, and the lower fragment with the hand being thrown backwards by the long supinator and radial extensors.

In fracture of the shaft of the **Femur,** the contraction of the powerful muscles attached to it produces shortening by drawing the lower fragment upwards, whilst the psoas and iliacus rotate the upper fragment outwards and tilt it forwards. This latter action is most marked when the fracture occurs a little below the insertion of those muscles into the small trochanter; and the deformity is so persistent from this cause as to require special treatment by position, viz. placing the limb on a double inclined plane, to keep the fractured ends in relation. There are few fractures more troublesome to deal with than this. The gluteal and adductor muscles also exercise considerable influence in aggravating the deformity in fractures of the shaft of the bone ; and the external rotator or capsular muscles assist when it is broken high up.

In fractures at or close to the neck of the femur, the limb is drawn up and shortened by muscular action, and eversion is almost always present, as a natural consequence of the loss of support consequent on the fracture. Yet the great preponderance of power in the external rotators aids in producing and perpetuating this deformity; but the facility with which the limb may be inverted proves that the muscular resistance is not considerable. Occasionally, though rarely, there is inversion in fracture of the cervix femoris ; when this is the case, impaction of one fragment within the other may be suspected, or else some muscular laceration near the joint, which prevents the external rotators from acting.

When the thigh-bone is broken across, through or just above the condyles, the gastrocnemius, which springs from them, draws the lower fragment backwards. This deformity is best redressed by flexing the knee, and thus relaxing this powerful

muscle and the popliteus ; in other words, by placing the limb on a double-inclined plane.

In transverse fracture of the **patella,** produced by muscular action, the width of separation, consequent on tonic action of the extensor muscles of the leg, is proportioned to the amount of laceration of the aponeurotic expansion around the joint, and is to be remedied by keeping the limb extended, and thus relaxing the muscles. As the rectus springs from the pelvis, it is desirable also to raise the whole limb so as to flex the thigh somewhat on the trunk. It should never be forgotten that these powerful muscles exercise great force on the ligamentous connecting medium in these fractures, when the limb is at liberty. Many a good union has been spoiled by permitting too early or unfettered use of the leg in walking.

When either the **tibia** or **fibula** is broken singly, muscular action can exert no influence in producing distortion ; even when both bones are broken, and the fracture of the tibia is transverse, the fragments are but little displaced ; but in double fracture obliquity in the line of fracture of the tibia is the rule, and considerable deformity results, the limb being shortened in consequence of one fragment being drawn over the other by muscles moving the foot. It is remarkable that the line of fracture of the tibia is most commonly directed from behind forwards and inwards ; and thus the powerful flexor muscles, which may have some share in determining the direction of the fracture, draw backwards and upwards the lower fragment. As the gastrocnemius is the chief agent in producing this effect, it should be relaxed by flexing the knee and placing the limb on its outer side, or in a double-inclined splint or a swing box. As the extensor muscles of the leg may have a share in tilting the upper fragment forwards, the thigh should be flexed on the pelvis : the ankle-joint should not be quite rectangular, for the more it is flexed the more the gastrocnemius is put on the stretch. When the tibia is broken across near the ankle, this muscle exercises most influence in displacing the lower fragment, and with it the foot backwards, in some instances, to such a degree as to simulate dislocation of the foot backwards. If the operation of dividing the tendo Achillis should be deemed

expedient in such a case, the proximity of the fracture and infiltrated condition of the tissues to be penetrated with the knife should not be forgotten, in weighing the advantages and risks of the proceeding.

In fracture of both bones close to the ankle-joint, with one or both malleoli broken, and complicated by dislocation, the character and amount of distortion is determined by the nature and direction of the injury under the active agency of the surrounding muscles. Where it is practicable to replace the broken fragments in their proper relation, they must be so retained by the position which seems best suited to the particular case, special regard being had to the relative position of the tibial and peronei muscles to the malleoli, and of the action of the gastrocnemius muscle as an extensor of the ankle-joint.

If the **os calcis** be broken at the junction of its body and tuberosity, the latter is drawn up by the gastrocnemius, and this muscle must be relaxed by flexing the knee and extending the ankle. But if the fracture occur through the body of the bone, its strong ligamentous attachments prevent this displacement.

IV.—OF THE URETHRA, RECTUM, PERINÆUM, AND GROIN.

Urethra.—The curves formed by the urethra should be carefully examined so as to guide the surgeon in passing a catheter. The capacity of different parts of the tube must also be noticed ; and the different structures connected with it anatomically should be carefully studied.

The urethra is generally divided into three parts, the spongy, the membranous and the prostatic ; and the triangular ligament by its anterior and posterior layers limits the membranous portion. The orifice of the urethra is usually the narrowest part of it, but immediately inside the meatus is the fossa navi-

cularis, a dilated portion of the tube, and opening into this part is in the lacuna magna, the largest of the mucous follicles of the urethra. Further in the tube remains much larger than the orifice, and there is another dilatation about five inches down, in what is termed the bulbous portion, owing to its being surrounded by the bulb of the corpus spongiosum. On reaching the membranous portion a narrowing is to be observed, but in the prostate the urethra is enlarged again.

In the spongy part, numerous small orifices of ducts are to be seen, and these open towards the meatus, so that the point of a small catheter may pass into them, and by continuing onwards make a false passage ; near the triangular ligament, in the bulbous portion, the ducts of Cowper's glands open, but these are usually very small. The interior of the membranous part shows no openings or irregularities, but in the lower wall of the prostatic portion projects a ridge, the crista urethræ, at the summit of which is the veru montanum. The veru montanum is hollowed out by the sinus pocularis, into the sides of which open the ejaculatory ducts. Along each side of the crista is a groove, the sinus prostaticus, into which open the ducts of the prostate from twelve to twenty in number. The prostatic portion is limited behind by the projection of the uvula, which corresponds with the middle lobe of the prostate underneath. The uvula and the orifices of the two arteries form the point of the trigone, which is the position selected for perforation of the bladder from the rectum.

The tube is invested by unstriped muscular fibre which is to be found in the submucous tissue, and which, when irritated by contiguous mucous inflammation, becomes spasmodically contracted, producing spasmodic stricture. Around this muscular layer is the proper erectile tissue, called here corpus spongiosum, which ends anteriorly in the glans and behind in the bulb. The corpora cavernosa lie above the spongy body in the greater part of their length, but they are overlapped anteriorly by the glans, and posteriorly they diverge, as the crura penis, to become attached to the rami and tuberosities of the ischia. When the spongy body is infiltrated with inflammatory material, during or after urethritis, it cannot become distended when the corpora

cavernosa are filled, and as a consequence the penis is curved downwards (chordee).

In consequence of the rigidity of the triangular ligament, with the narrowing of the urethra as it passes through, a catheter may be made to pass through the walls of the urethra at this point, if force be used and the operator be inexperienced. Having passed this obstruction, the catheter may again be made to leave the urethra and forced into the prostate, if the manipulation be clumsy : the instrument should be depressed, to induce the point to pass over the veru montanum and the enlarged middle lobe of the prostate.

Rectum.—The relations of the rectum are of great importance to the surgeon. Extendiug from the left sacro-iliac synchondrosis to the anus, the first part of it inclines to the middle line of the sacrum, and is nearly enveloped by peritoneum ; the second part occupies the concavity of the sacrum and reaches as far as the back of the prostate ; while the third part is directed downwards and backwards to the anus. In the male the front of the second part is covered above by the peritoneum of the recto-vesical pouch, consequently attempts to puncture the bladder must not be made too far back, and recto-vesical or, in the female, recto-vaginal or vesico-vaginal fistulæ must not be pared too far back. Lower down the base of the bladder lies immediately upon the rectum, and on each side of this (the trigone) are the vesiculæ seminales and vasa deferentia ; while more anteriorly placed in the prostate a quantity of fat separates the rectum from the coccyx and coccygei posteriorly. Below the prostate the third part of the rectum is embraced by the internal sphincter and supported by the levator ani ; while, at the anus, immediately under the skin, is the external sphincter. It is the internal sphincter which can be felt to grip the finger, and which often requires division in the treatment of fistula. The mucous surface of the rectum possesses several well-marked prominent folds (Houston's), which sometimes obstruct the passage of a rectum tube.

Perinæum.—The boundaries to this region are the arch of the pubes, the tuberosities of the ischia, the great sciatic ligament and the tip of the coccyx. An imaginary line drawn

from one tuberosity to the other separates the urethral from the anal triangles. In studying the perinæum it may be noted that a point about midway between the anus and the front of the urethral triangle corresponds with what is termed the central point of the perinæum ; that the bulb of the urethra reaches to this point ; and that the perineal muscles meet here, while opposite here, also, the superficial perineal fascia dips down deeply to join with the deep perineal fascia, or so-called anterior layer of the triangular ligament. The incision in lateral lithotomy is usually commenced at this point.

In the urethral triangle the bulb is invested by the accelerator urinæ (bulbo cavernosus), the crura penis on each side are partially hidden by the erectores penis (ischio-cavernosi), and the transversi muscles run from each tuber ischii obliquely forwards to the central point of the perinæum, to which also the superficial sphincter ani is attached behind.

The transversi belong to the urethral portion of the perinæum, as the superficial perinæal fascia dips behind them to join the deep layer : moreover, this superficial fascia is also closely connected with the rami of the pubes and ischium ; consequently, urine extravasated in this position cannot readily pass backwards to the anus or pelvis, or down the thighs, but must pass forwards to the scrotum and penis, and so on to the abdomen and groins.

Between the erector penis, accelerator urinæ and transversus perinæi is a depression, occupied by the superficial perineal vessels and nerves, and fat ; and, in this situation, the membranous part of the urethra is to be reached in the lateral operation of lithotomy, without injuring the erectile tissues of the penis.

Immediately under cover of the tuberosities of the ischium and its ramus is the internal pubic artery, protected by pelvic fascia attached to the great sciatic ligament ; further forward it gives off the artery to the bulb and that to the corpus cavernosum, the former of which may be wounded in lithotomy if the knife be not carried well up behind it. In part of its course the pudic artery lies between the two layers of the triangular ligament, a structure which can be felt in the peri-

næum, and which occupies the pubic arch and is perforated by the membranous part of the urethra. The anterior layer (otherwise called deep perineal fascia) descends from the pubes on the back of the bulb and in front of the compressor urethræ, the pudic artery and Cowper's glands, and meets with the deep layer of the superficial perineal fascia behind the transversus perinæi. The posterior layer (otherwise called subpubic ligament) descends from the pubes upon the front of the prostate with the capsule of which it blends, and behind Cowper's glands and the compressor urethræ, to join again with the anterior layer near the central point of the perinæum.

Before exposing the prostate from the perinæum the levator ani must be cut through where it surrounds that gland. The prostate is enveloped by a fibrous capsule, which is very thick and continuous with the recto-vesical fascia, as well as with the triangular ligament, and in this capsule is a large plexus of veins. In lithotomy it is very important to avoid incising the prostate so freely as to injure this capsule. The nearness of the rectum, too, makes it incumbent upon the operator to avoid cutting too much backwards in the early part of the operation. The prostate should not be divided in the middle line, as the ejaculatory ducts open here into the sinus pocularis.

The groin.—The landmarks of this region are the spine of the ileum, spine of the pubes, Poupart's ligament, and the femoral and inguinal rings, the relation of which should be carefully noticed. The parts above Poupart's ligament are situated in the inguinal region, those below in the femoral region.

Immediately under the skin the fasciæ of the groin are arranged somewhat peculiarly, and by their connections influence the course of a femoral hernia which has escaped from the saphenous opening. The superficial fascia over the middle of the bend of the groin and a little below this point is double ; the superficial layer on it is traceable over Poupart's ligament to the superficial fascia of the abdomen, while the deeper layer of it becomes connected firmly with Poupart's ligament and with the margins of the saphenous opening, and continuous here with the so-called cribriform fascia, which occupies the

opening ; consequently when the cribriform fascia is pushed forward by a descending hernia, it bulges into the pouch formed between the deep and superficial layers of the superficial fascia.

Between the two layers are found the superficial vessels and nerves, and a quantity of glands arranged sometimes in two sets nearly horziontal and vertical ; and the large internal saphenous vein passes to the saphenous opening, after receiving the superficialveins of this region, of which the epigastric is usually the most important.

Inguinal region.—Beneath the fascia is found the aponeurosis of the external oblique, the lower edge of which forms Poupart's ligament, stretching from the anterior superior spine of ileum to the spine of the pubes ; and, owing to its connection with the fascia lata of the thigh, becoming tense when the thigh is extended. This must be remembered in attempting to reduce a hernia : the thigh must be flexed.

The fibres of the external oblique are separated by the cord, or by the round ligament in the female, and those lying on each side of the opening are termed the inner and outer columns of the ring, while certain fibres which stretch across and between them are termed intercolumnar, and a fibrous tissue continuous with the latter upon the cord, or hernia, constitutes the external spermatic or intercolumnar fascia. The external abdominal ring, as this is termed, is situated immediately above and to the outer side of the spine of the pubes, and through it passes the inguinal nerve with the cord.

Under the external oblique aponeurosis is placed the internal oblique muscle. This rises from the outer half or two thirds of Poupart's ligament, besides from other sources beyond this region, and the muscular fibres-arch over the cord to become united with the tendinous aponeurosis of the transversalis, and the resulting " conjoined tendon " passes in front of the rectus to its insertion into the crest of the pubes. The lower fibres of this muscle form a series of loops upon the cord, and can be traced upon it to the testicle. These fibres constitute the cremaster muscle, which, with the intermediate connective tissue, forms a layer called the cremasteric fascia.

Under the internal oblique is the transversalis muscle, which arches over the cord above the level of the last muscle. Its tendon is an aponeurosis which runs altogether in front of the rectus below, but above a point midway between pubes and umbilicus, it splits and encloses the rectus, its anterior layer being joined by the aponeurosis of the internal oblique.

Under the transversalis muscle is the transversalis fascia, a portion of which is pushed down by a hernia, or precedes the descent of the testicle. The position of this bulging is called the internal ring, and it must be noticed that this is further from the middle line than the external or superficial ring, and that the deep epigastric artery is situated more deeply between the two rings.

Under the transversalis fascia is the subperitoneal fat, which is often scanty or absent, and peritoneum.

Femoral region.—The fascia lata of the thigh passes deeply on the surface of the pectineus behind the femoral vessels, while that portion which covers the iliacus lies on an anterior plane, covers the femoral vessels and is connected with Poupart's ligament. The hollow between these two portions is bridged over by a falciform process which forms the upper boundary of the saphenous opening, and by the cribriform fascia which closes it ; the lower edge of the opening does not usually exist as a well-defined structure.

The femoral vessels and nerves are traceable from the pelvis to be passing under Poupart's ligament, below which point they are protected by the layer of fascia lata just referred to. As they pass under the ligament they are arranged in the following manner : the nerves to the outer side in the groove between the iliacus and psoas, then the artery upon the front of the psoas, the vein between pectineus and psoas, and the lymphatics upon the pectineus itself. The artery, vein and lymphatics are enclosed in a well-marked sheath, the femoral sheath, and the three compartments for these structures are well marked. That for the lymphatics being placed most internal, has its lower end at the saphenous opening, and is the femoral or crural canal, down which a femoral hernia passes when such a protrusion of intestine occurs.

The relations of this canal are important. Its lower end is formed by the cribriform fascia : its upper end is closed by some connective tissue and fat termed the septum crurale, and by peritoneum ; while its interior is occupied by lymphatic glands or connective tissue ; on its inner side is the reflected portion of Poupart's ligament, termed Gimbernat's ligament ; on its outer side is the femoral vein ; above it is Poupart's ligament, and below it the horizontal ramus of the pubes. In the descent of a femoral hernia, the sharp edge of Gimbernat's ligament, and the deep fibres of the upper cornu of the saphenic opening are the obstruction to the return of the gut ; the incision for their division should, therefore, be inclined forwards and inwards, with the edge of the knife directed towards the umbilicus.

Occasionally the obturator artery comes off from the epigastric, and may run along the edge of Gimbernaut's ligament, but this is a rare abnormality.

In the female the greater width of the pelvis necessitates greater width of the crural ring, and consequently greater liability to the occurrence of femoral hernia ; in the male the presence of the cord and the descent of the testicle necessitate greater expansion of the inguinal rings, and consequently greater liability to the occurrence of inguinal hernia.

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