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THE

PRINCIPLES OF SURGERY.

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PAUL'S WORK.

THE

PRINCIPLES OF SURGERY.

BY

JAMES SYME, F.R.S.E.,

PROFESSOR OF CLINICAL SURGERY IN THE UNIVERSITY OF EDINBURGH.

Fourth Edition.

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RARE

PREFACE.

THE object of this book is not to save the reader from the trouble of thinking, but rather to supply materials for such study and reflection as may enable him to acquire clear views for the discharge of his professional duties. A surgeon who practises according to rule, and without the guidance of sound principles, is like the mariner of old, who, devoid of compass and quadrant, crept along the shore, afraid to lose sight of land, and in constant dread of being driven upon the rocks, or blown out to sea. But some of the volumes which have been published under the title of surgical principles, instead of containing the careful conclusions and well-digested results of experience, consist of trivial details and speculative opinions, gathered together from all sorts of sources—so that they may be regarded as no less the parents than the offspring of mediocrity; since nothing can tend more to perplex the mind and weaken the judgment than the perusal of such crude and heterogeneous compilations. In the following pages, I have endeavoured to explain the principles which guide my practice and are taught in my

lectures. They cannot now lay any claim to novelty, but possess what I hope will be considered a better recommendation, from having stood the test of nearly thirty years' hospital experience, and been subjected to trial during the same period, both at home and abroad, by a long succession of pupils, without, so far as I know, ever forfeiting the confidence with which they were received.

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PRINCIPLES OF SURGERY.

CHAPTER I.

INFLAMMATION.

INTRODUCTION.

WITH exception of the cuticle and its appendages, the nails and hairs, all the solid part of the human body is composed of vascular tissues, which consist of blood-vessels and nerves interwoven together through a basis of cellular substance. These tissues are everywhere permeated by the blood, which supplies them with nourishment for their growth and renovation. Some of them, as those of which the bones and ligaments are formed, seem to perform no living action, but that of duly appropriating the nutritious matter thus afforded, so as to preserve their structure in a healthy or perfect state, and this is named their Nutritive Action. Other tissues, as the muscular and glandular, in addition to the power of nutrition, possess various remarkable vital properties, which are named their Functions.

Both the nutritive and functional actions of the tissues are subject to disorder. When the former are perverted, alteration of the structure necessarily results, as is seen in the growth of tumours or the formation of ulcers; but the latter may be disturbed without any obvious change of this kind, as when the digestion of food or the secretion of urine is imperfectly performed, without any perceptible difference in the stomach or kidney. Derangement of function, however, is most frequently connected with alteration of structure, and very apt to lead to it. Disordered action, whether of function or nutrition, constitutes Disease, to remedy which is the object of Medicine.

As the field of medicine is thus very extensive, it has been divided into Physic and Surgery,—the former department comprehending chiefly internal complaints, while the latter includes those which are situated externally, or require for their treatment the use of external means. The art of Surgery consists in the performance of the various manual duties required in the employment of these means; while the science of Surgery directs their choice and application.

In the diseases which constitute the surgical department of medicine,—if we except those depending on the introduction of foreign substances, the retention of secretions, and the presence of concretions in the cavities and canals of the body,—there is always alteration of structure, which may be owing either to morbid nutrition, or to external violence. In both cases, reparation is to be effected, not by mechanical art, but by the action of the nutrient vessels; and all that the surgeon can do, is to remove obstacles impeding their salutary operation. When he speaks of healing a wound, for instance, he means nothing more than placing the part concerned in the most favourable circumstances for undergoing this reparatory process. It is therefore necessary, in entering upon the study of Surgery, to become acquainted with the various actions of these vessels, whether tending to the injury or reparation of structure. And as it very generally happens, that there is interposed, between the natural actions and those alterative of the structure, a diseased condition, which has been named Inflammation, this must be considered in the first place.

Symptoms of Inflammation.

By Inflammation is understood that condition of a part in which it is red, swelled, hot, and painful, along with more or less fever, or constitutional disturbance. But there is still another circumstance of this morbid state, which, though it has not been so much noticed, is really the most important of the whole; that is, perversion of the vital action in the part affected, which is truly essential, and never-failing,—while the other symptoms are extremely variable in their degree, and not even constant in their existence.

Redness.—This symptom is owing to distension of the vessels which convey blood; to blood being admitted into those which usually appear to receive only the colourless part of it, whether this be owing to the red globules not entering at all, or only so few at a time as to conceal their colour, since it is only when existing in considerable assemblages that they appear red; and also to bloody

effusion into the interstices of the structure concerned. Inflammation of the conjunctiva affords one of the best examples of these changes.

The redness varies considerably in shade. It is generally bright and florid, like that of arterial blood, but it often has a yellow hue, and still more frequently is dark, or almost purple. The yellow tinge is most frequently observed along with derangement of the biliary secretion, as in erysipelas; but the dark colour depends on different circumstances, the discrimination of which is of great importance in practice. It was formerly thought a certain indication of putrid tendency, or proneness to die from weakness, and an unquestionable call for administering wine, bark, and cordials. It is now observed to depend frequently on obstruction of the respiratory function, preventing the blood from undergoing its proper change. It is seen also when the venous circulation of an inflamed part is impeded.

Swelling.—This symptom depends partly on the enlargement of the vessels, but chiefly on effusion of the serous or albuminous parts of the blood, or the blood itself, into the cellular texture. It consequently varies with the vascularity and laxity of the tissue concerned. Thus inflammation of the conjunctiva is attended with great swelling, while that of the cornea is accompanied by hardly any.

Heat.—This is a very characteristic symptom of inflammation, and, together with the redness, has no doubt led to the choice of a title for expressing it, since in all languages the term used for this purpose denotes burning. Like the last-mentioned symptom, the sensation of heat varies with the part affected. It is most remarkable in the skin, and in some parts of the mucous membrane, as the urethra.

It was formerly believed that the patient's feeling of heat depended always on a real and proportionate elevation of temperature; but the application of a thermometer at once proves this opinion to be incorrect. John Hunter investigated the subject, and came to the following conclusions:—1. That the heat of an inflamed part is not commensurate with the patient's feelings. 2. That it does not exceed the standard or central heat of the individual. 3. That the greatest increase of temperature takes place in those parts which are furthest from the centre, and naturally coldest.* Thus inflammation of the scrotum, induced by laying open the tunica vaginalis

* Hunter on Inflammation, p. 296, 4to.

raises the thermometer from 92° to 98°. But if the disease elevates the general heat of the individual, the temperature of the inflamed part rises to the same degree, as in erysipelas, where the heat of the inflamed skin is frequently 104°.

Pain.—This is one of the most constant symptoms of inflammation. It is generally proportioned to the violence of the disorder and the sensibility of the part affected ; but there are many exceptions to the latter part of this rule ; and some tissues, as those of the osseous and fibrous kinds, which are not all sensible in their healthy state, occasion the most acute suffering when inflamed. The sensibility of every part in the body is increased by inflammation ; and if this has ever been denied, it must have been from confounding insensibility to those stimuli which require, for making an impression, that the organ to which they are applied should perform a functional action for their reception, with insensibility to chemical and mechanical stimuli, which always excite more sensation when applied to an inflamed part, than to one in a healthy state. Thus during inflammation the eye may be unfit for vision, while the impression of light produces a painful effect. The pain of inflammation varies in kind as well as in degree ; being sometimes hot and burning, as in the skin and mucous membranes, at other times sharp and cutting, as in the serous membranes, or dull and aching, as in the bones.

It is impossible, in the present state of our knowledge, to account for these varieties in the pain, or even for the existence of pain at all. It is usually ascribed to the swelling that accompanies inflammation, causing pressure on the extremities of the nerves, whence it is said the most compact tissues occasion the severest pain ; but this explanation is not satisfactory, as many which possess the softest and most yielding structure excite excruciating pain when they are inflamed, of which the mucous membranes afford a remarkable example.

The pain is not always felt at the part affected, but often at a distance from it, as at the point of the penis when the bladder is inflamed, in the right shoulder during inflammation of the liver, or in distant parts of the limb when the joints are the seat of disease. We are sometimes able to account partly for this by the nervous communications, but more frequently it is quite inexplicable, though highly deserving of attention in a practical point of view.

Derangement of Functional Action.—This symptom of inflammation cannot, of course, attend the inflammation of every tissue,

and must be confined to those which possess some vital property in addition to that of mere nutrition. It is sometimes, however, the only symptom present, or at least the only one that can be recognised; as when the organ affected is contained in an internal cavity. When the function of the organ is to receive the impression of some external stimulus, as that of the eye or the nose, it is performed either imperfectly, or not at all; and hence, as already observed, some have been led into the error of supposing, that the common sensibility of parts is occasionally diminished during inflammation.

Derangement of Nutritive Action.—In addition to the serous and bloody effusions into the cellular texture, which always take place to more or less extent, the most frequent indication of a change in the action of the nutritive apparatus is softening of the tissue concerned. In some cases this alteration is so remarkable, that it has been thought necessary to designate it by a peculiar expression, viz., *ramollissement.* This effect of inflammation is, on many occasions, of great importance, but at present deserves attention chiefly as affording evidence that the nutritive process is not performed in its usual manner. Another fact which leads to the same conclusion is the rapidity with which putrefaction proceeds after death, in parts where inflammation has previously existed. It may be said that the more than usual proportion of fluids congested by the diseased action may account for this speedy decomposition, without supposing that the constituent particles are altered by it in their relation to each other. But, in such a view of the matter, we ought to observe the same putrefactive tendency equally strong in parts where blood has been simply effused into their texture, which is not the case.

Constitutional Disturbance.—The disturbance of the system, or Fever, as it is called, which accompanies inflammation, consists of an alteration in the performance of all the functions of the body. The phenomena, which are in consequence exhibited, vary very much, according to peculiarities of the patient's constitution, and the part which is inflamed. Generally, the pulse is hard and frequent, beating from 80 to 120, and in children much faster,—the respiration is hurried,—the face is flushed,—the eyes are suffused,—the tongue is white and loaded,—there is no appetite,—inordinate thirst,—headache,—constipation,—scanty urine,—dryness of the skin,—confusion of ideas or delirium,—and prostration of strength in the voluntary muscles. This state of general disturbance, which is named Inflammatory or Symptomatic Fever, does

not always accompany inflammation, and is usually proportioned to the violence of the local symptoms. Its type or character also varies, as already mentioned, according to the part or patient affected. The pulse may be small, feeble, and irregular or intermittent,—the tongue brown, smooth, and glazed,—the countenance dark-coloured, contracted, and anxious. These varieties in the symptoms of fever demand great attention, as indications of the seat and degree of the local disorder, and as guides for directing the remedial measures. The state of the blood, also, in this condition, requires particular consideration.

When blood is taken from one labouring under inflammatory fever, instead of coagulating as usual into a homogeneous red tremulous mass, it throws up to the surface a clear transparent fluid, which coagulates into an opaque buff-coloured, tough, membranous-looking crust, which is named the buffy coat. It is usually about a quarter of an inch thick, and presents a concave surface, owing apparently to preserving its original extent, while the subjacent part of the clot contracts during the separation of the serum. Whatever hastens the coagulation of the blood tends to prevent the formation of the buffy coat. Thus weakness of the individual,—smallness in the quantity of blood abstracted,—exposure of it to an extensive surface of dead matter,—and its being abstracted in a small stream or by drops, all oppose the appearance in question. The formation of the buffy coat has therefore been supposed to depend merely upon slowness of coagulation, allowing the red particles to descend, and leave the fibrinous portion pure; but there is certainly something more than this concerned in the process, since the tough yellow crust under consideration differs materially in appearance from the fibrinous mass which is obtained by washing away the colouring matter of healthy coagulated blood, and when the disposition to its production is strong, it takes place notwithstanding the most rapid coagulation; while blood drawn from an animal in health may be retained for a long time fluid, without shewing any trace of it. The constituent proportion of fibrine seems to be actually increased, and there is a preternatural tendency to its separation from the blood, both while it circulates in the vessels, and after it is withdrawn from the body. The buffy coat, though very generally, is not invariably, observed during inflammatory fever; and it also appears occasionally, though no inflammation exists. Pregnancy, and violent agitation, whether of body or mind, are apt to cause its formation.

Nature of Inflammation.

The heat, redness, and swelling which attend inflammation, naturally suggest the idea that the blood of the part is increased in quantity and moving force. Before the circulation of the blood was discovered, and it was supposed that this fluid moved from the liver, then regarded as the source of its formation, to all parts of the body, inflammation was referred to a preternatural flow, or determination of its stream in some particular direction. After the discovery of Harvey, that the blood incessantly performs a double circulatory movement, the heart being regarded as the great or rather sole cause of motion, it was readily concluded, that inflammation must be owing to some obstruction, which checked the progress of the blood forwards, while the *vis a tergo*, viz., the contraction of the heart, continued in operation. This obstruction, it was thought, might proceed from one or more of the following sources: morbid lentor of the blood—*error loci* of the globules—and spasm of the extreme vessels. The two first of these were the doctrines of Boerhaave, the last that of Hoffman, but better known in this country as advocated by Cullen. The morbid lentor or thick state of the blood was inferred to exist from the apparent redundance of fibrine, as shewn by the buffy coat; and it was thought that the small vessels, being unable to transmit their contents, thus rendered more viscid than usual, might occasion the obstruction in question. The same effect seemed likely to result from an *error loci*, or entrance of the globules into vessels not fitted for their reception. This opinion rested on the belief that the structure of the globules was very complicated, each red one consisting of six serous, and each serous of six lymphatic globules, for the conveyance of which, vessels of three different sorts and sizes were provided as channels of communication between the arteries and veins. In this view of the case it seemed probable that a globule getting into a wrong vessel might obstruct all those behind it. The third doctrine of obstruction referred it to inordinate contraction of the orifices which the capillary vessels were supposed to possess.

It will be shewn below that mere obstruction is not sufficient to account for the symptoms of inflammation, but the hypothetical causes which have been mentioned are inadequate to produce even this effect. The blood, so far from being more thick and viscid during inflammation, is now ascertained to coagulate more slowly,

and to allow the red globules to subside more readily than usual. The free communication which exists between neighbouring vessels, through means of the anastomoses of their branches, would surely prevent any inconvenience from being caused by *error loci*, granting the possibility of such an occurrence ; and the doctrine of spasm is objectionable, to say nothing of other grounds, on the very serious one that the alleged mouths of the vessels are found not to exist.

A different explanation of inflammation was given by Vacca.* He thought that the first step in the process was debility of the capillary vessels, which allowed them to be distended by the current of blood passing through them. The blood thus accumulated would cause heat, swelling, redness, and pain, and the action of the heart consequently becoming affected, the blood would be driven with more force into the arteries, which again would contract with violence proportioned to the extent of their dilatation.

Vacca rested this doctrine chiefly on its satisfactorily explaining the phenomena of inflammation, and also agreeing with circumstances frequently observed in the cause and cure of this morbid state. But his followers have called in to their assistance, and indeed considered as their strongest argument, the appearances which are observed in the capillary vessels of inflamed parts when they are surveyed through a microscope. Their statement is, that, as inflammation commences and proceeds, the globules move more and more slowly, and at last cease to do so at all, while the vessels become greatly enlarged and distended.

These observations, though regarded by many as conclusive in favour of the doctrine of debility, seem, upon a more careful consideration, rather opposed to it ; for relaxation of the vessels ought to favour the transmission of their contents, and the retardation that might be expected from their increased capacity ought to be extremely inconsiderable. But it has always been remarked, that the globules begin to move slowly *before* the vessels dilate,† and that the dilatation increases in proportion to the slowness of their motion. It may be further observed, that if the blood of an inflamed part were stagnant, the colour of it ought to be dark like that of venous blood, while, on the contrary, we know that, unless in particular circumstances, when the difference can be accounted for, it is always bright and florid ; and also, that if the enlarge-

* Vacca de Inflammationis Natura, &c., 1765.

† Wilson Philip, Med. Chirg. Trans., vol. xii. p. 407.

ment of vessels necessarily implies debility, blushing, the turgescence of glands, and the erection of the penis must then be considered the effects or indications of debility.

John Hunter, in defining inflammation, said it was simply an increased action of the vessels; wisely observing that dilatation was as much an evidence of power as contraction. This definition, however, is plainly open to objection; for the symptoms, which have been mentioned above, clearly shew that the natural actions during inflammation are not merely increased but altered. And here it may be noticed, that a great mistake has been committed in constructing theories of inflammation, by limiting them to the explanation of the least important, though certainly the most obvious symptoms, viz., the redness and swelling, while the heat, pain, and disturbance of the vital action, whether nutritive or functional, have been treated with neglect.

As the secretory and various other important actions, which suffer derangement during inflammation, depend in their healthy state upon the nervous energy, or power of life, and as all our efforts have proved insufficient to approach the truth more nearly in their explanation than by referring them to this source, we must be satisfied with doing the same in regard to their derangements; and being thus obliged to admit, as the essence of inflammation, disturbance in the nervous energy of the part, we may employ this also to account for the changes observed in the circulation, which have never been satisfactorily explained otherwise.

The various local determinations or flows of blood so constantly occurring in blushing, secretion, the turgescence of the erectile tissue, the growth of tumours, the formation of the fœtus, &c., plainly prove that the motion of the blood is not entirely owing to, or under the control of, the heart. When physiologists began to recover from the first dazzling effect of Harvey's brilliant discovery, they saw the necessity of taking into account some other motive power besides that of the heart; and much dispute has since existed as to the respective shares of it which ought to be assigned to the arteries, and their capillary terminations. It would be easy to shew that any supposed conditions of these vessels as to enlargement or contraction, however energetic or alternated, are inadequate to account for the phenomena in question, and that we must, therefore, infer the operation of some other power in them than that of muscular contractility. But this is unnecessary, as there are some vessels in the system which beyond all dispute

possess such a power. The vessels of the fœtus, and those which absorb the chyle, can perform their office only by exerting an attractive force on the fluids exterior to them, similar to what must be exercised by the roots of vegetables. And if we admit the operation of such a power in some parts of the vascular system, we may not unreasonably suppose it to exist wherever similar effects are produced. The absorbing property, which is now acknowledged to belong to the veins, can hardly be explained in any other way :—and then we have only to go a single step further to grant it to the venous capillaries, which communicate with those of the arteries.

Vacca seems to have perceived the necessity of attributing an attractive power to the capillary vessels, if we may judge from the following passage of his work above quoted : "Ergo vis sanguinis, quae canales sanguineos distrahere et distendere nititur, contra eadem oscula quoque agit, ipsaque aperire tentat. Verum oscula illa in salubri corporis statu vigore eidem impetui proportionali semper resistunt, et idcirco tam angusta conservantur, ut ipsa ingredi minime possit nisi conveniens secernendus liquor non ex mechanica impellanti vi, *sed ex attractionis virtute.*"* To which he adds the following note—"Attractionis leges inter terrestrium corporum materias nondum detectæ sunt ; attractionis vero existentia evidentissime est demonstrata." Vacca had the more merit for forming and thus confidently expressing this opinion, as the curious discovery of Reuss of Moscow, which has been so much extended by M. Dutrochet, that galvanism, a power resembling the nervous energy in many other respects, exercises a locomotive effect on fluids, was not made till long after the time he wrote.†

If we allow that the motion of the blood through the capillaries is influenced by the vital power of the vessels, the explanation of all the symptoms of inflammation becomes equally easy and obvious. It has already been found necessary to suppose that there is a disturbance of the nervous energy, in order to account for the various alterations of vital action ; and the same power, which is thus disturbed, being regarded as controlling the capillary circulation, a corresponding derangement of it ought to be expected.

* Op. cit. p. 20.

† Reuss de Electricitatis voltanæ potestate hydragoga—Moscow Transactions, vol. ii. p. 307.—De viribus sanguinem moventibus, ib. p. 327—Dutrochet sur l'agent immediat du mouvement vital, 1826.

Inflammation may therefore be defined to be,—*a perverted action of the capillary system, generally attended with heat, pain, redness, and swelling.*

Inflammation terminates in various ways. Sometimes all the symptoms disappear, and the part resumes its natural condition, when it is said to terminate in Resolution. At other times it ends by destroying the life of the part; and is then said to terminate in Mortification. It also terminates in various actions, producing alteration of the structure, or the separation of matters from the blood, differing in quantity or quality from those naturally secreted by it. Of these the most remarkable are the following:—The formation of a peculiar fluid named Pus, which is called Suppuration,—the Effusion of serum, or lymph, *i.e.*, the fibrine, in a state resembling the buffy coat,—the removal of solid or fluid parts of the body, which is named Absorption,—and the production of some solid structure, differing in quantity or quality from that naturally existing, which may be designated Diseased Nutrition.

Inflammation has been variously divided and named, according to its termination,—the predominant local, and constitutional symptoms,—the degree of its violence,—and the part affected. Most of these distinctions, so far from simplifying the subject, have tended greatly to obscure and perplex it. Instead of causing inflammation to be regarded as a morbid action, always of the same nature, and merely modified in its symptoms and termination, according to the part and constitution affected, they have made it appear a group of dissimilar processes, arranged under one title, but widely and essentially different from each other.

Inflammation of particular organs and tissues is expressed in modern nomenclature by adding the termination *itis* to the anatomical title of the part affected, as Iritis, Gastritis, Phlebitis. For some parts the old and peculiar appellations are still retained,—as Erysipelas for inflammation of the skin, Ophthalmia for that of the eye.

The severity of the symptoms also requires to be distinguished; for which purpose the terms Acute and Chronic are employed to denote the two extremes of violence, while the intermediate degrees are indicated by qualifying epithets. Acute inflammation frequently passes into the chronic; but the latter often exists independently and originally. When the inflammation is acute, it terminates one way or another in a few days at furthest, and sometimes even in a few hours; but when chronic, it may exist for weeks or months

with little change. With acute inflammation there is almost always accompanying fever; but with chronic hardly any.

Causes of Inflammation.

The causes of Inflammation, or circumstances which give rise to this morbid state, are very numerous and various. They may be divided into those which act directly on the part affected, and those which do so through the medium of the system.

The direct causes of inflammation, or local irritants, as they are usually called, comprehend all the natural stimuli of action when excessive in degree or continuance; various animal, vegetable, and mineral matters, such as cantharides, croton oil, and tartrate of antimony, which are named irritants from their effects; and every sort of violence, whether chemical or mechanical, which alters the structure of the body.

The effect of these causes varies with the irritability or tendency to excited action of the part or patient. Parts are generally irritable in proportion to their vascularity and sensibility. Thus the iris is more readily excited to inflammation than the cornea. But there are many exceptions to this rule; and particular tissues are most under the influence of particular irritations. The urinary bladder, for instance, is irritated by distension; and the joints by forcible extension of their ligaments. Parts occasionally become more irritable than usual. The circumstance of having been previously irritated sometimes renders them so. Weakness or diminished power of action, also, as from interruption of either the nerves or blood-vessels, or any other cause, contrary to what one might expect, produces the same effect. Habit, or the continued exposure to an irritation, lessens its effect.

The differences observed in constitutional irritability are very striking and important. Sometimes they seem to depend on original or congenital peculiarities of the system; but very frequently proceed from the injurious effect of deviations from propriety in diet or exercise. They are also often connected with mental irritation, which has a powerful influence over the irritability of the body. In these different states of the system, the same local irritation produces the most opposite effects; and while one individual may have his limb lacerated and the bone shattered without suffering so much inflammation as to occasion symptomatic fever, another dies from the intense action excited by the prick of a pin. The common expressions of a good and bad constitution are nearly

equivalent to the possession of little or much tendency to suffer irritation from causes of disturbance; and the difference in this respect, as has been already observed, may either depend upon congenital peculiarity, or be acquired through circumstances connected with the mode of life.

A most important fact in relation to the effect of irritation is, that it always proves inconsiderable when another which had been previously in existence, and exciting disturbance, is removed by its means. The success of operations frequently depends on this principle, as when amputation is performed on account of a diseased joint, which has kept up excitement for a considerable time without too greatly reducing the patient's strength.

The indirect causes of irritation, or those which act through the medium of the system, constitute a difficult, but very interesting and highly necessary subject of study. One of the most remarkable differences between animals and vegetables is the mutual dependence of the component parts of the former. Though each part is induced to act by particular stimuli, and produces peculiar effects, the whole are so connected together that one can hardly be affected without causing more or less disturbance of others. Sometimes the whole system suffers, and then fever results; at other times the consequent disorder is confined to a part merely. This fellow-suffering, whether partial or general, is usually expressed by the term Sympathy. Various explanations have been offered to account for it, of which the following are most deserving of notice: —1. The anastomosis of Blood-vessels, as that of the epigastric and mammary arteries, to which has been attributed the fellow-suffering of the uterus and mamma; 2. Continuity of Texture, as that of the conjunctiva, and lining membrane of the nose, to which the sneezing caused by exposing the eyes to a bright light has been referred; 3. Nervous Communication, as that between the phrenic and cervical nerves, which has been supposed to account for pain being felt in the shoulder when the liver is inflamed; 4. The Medium of Sensation, as when stimulants applied to the nose cause sneezing, though they do not induce this effect during insensibility; 5. Participation in the same function, as when the breasts become painful in the early months of pregnancy. None of these explanations admit of general application in accounting for sympathy; and many cases of it are not explicable by any of them. But though the cause of sympathy is at present, and probably ever will be, beyond the reach of human understanding, the facts which are

generally observed in regard to its manifestations are fair subjects of inquiry, and of the utmost importance in practice. Of these, the six following, or what may be called the laws of sympathetic action, deserve especial attention :—

1. Disturbance of action in one part, occasions disturbance in others.

In a healthy state of the system, all the organs perform certain actions with a certain degree of vigour, and whenever any one of them has its activity either excited or diminished, more or less change ensues in the action of others, which may thus become disordered in whole or in part. The effect of excited action in causing sympathetic derangement is well known, as in the common case of fever attending inflammation; but the consequences of diminished action are more apt to be overlooked, though not less frequent, or less productive of serious disease. The most extensive and frequent derangement which occurs in this way proceeds from interruption of the mucous secretion of the intestinal canal. All attentive practitioners have remarked, that, when the bowels become costive, various diseases are apt to break out in distant parts of the body. This has been attributed to irritation caused by retention of the fæces, and to the effect of an inflamed state of the lining membrane of the bowels,* but it may be more correctly referred to interruption of the usual secretion.† Next in order as a source of derangement, from diminution of usual action, ought to be reckoned the skin. The effects of checked perspiration, or mere chilling of the skin, in occasioning general fever and local inflammation, are constantly presented to our attention.

Whenever an accustomed secretion or action of any kind is suppressed, though there may not ensue indications of actual disturbance, there is always a strong disposition to it; and therefore all operations, even of the most trivial kind, ought to be abstained from in such circumstances, as the direct irritation proceeding from them, together with the indirect inducement to derangement already present, might probably occasion violent local and general disorder.

2. A diseased action may, from long continuance, become as it were adopted by the system, so as to occasion disturbance by its suppression.

The fact is well known to the vulgar, who have in consequence the greatest dread of interfering with local complaints of long

* Dr Hamilton on Purgative Medicines.

† Abernethy on the Constitutional Origin of Local Diseases.

standing, especially such of them as are attended with discharges. This prejudice is no doubt generally carried too far ; but it should be carefully recollected, that excited and disordered action of a part, which has from habit ceased to irritate the system, cannot be suddenly removed without the risk of causing general derangement. Thus, when disease of a bone has occasioned the discharge of matter for a number of years, amputation, especially in adults, is found to be almost certainly fatal.

3. All parts of the body do not sympathise with equal readiness, —but seem to be influenced by continuity of texture, contiguity of situation, and participation in the same function. As examples, may be mentioned the connexion which is very frequently observed between affections of the mucous membrane at different parts of the body—the suppuration of the cheek which is apt to be caused by the irritation of a decayed tooth—and the fellow-suffering which is displayed by the breast and uterus in the derangements of each other.

4. Excited action of one part may take the place of that in another, the system seeming inadequate to the support of both.

This translation of disease from one part to another is named Metastasis, and constitutes a most important principle of practice, as being the foundation of what is called counter-irritation, or the excitement of artificial disease for the relief of others more inconvenient or dangerous, as in the common case of a blister being applied to the chest to relieve disturbance of the lungs.

5. Pain, hemorrhage, inflammation, increased nutrition, and excited secretion, take the place of each other, so that they may be regarded as equivalents of action. Thus, in the disease named *tic douloureux*, an intensely painful affection, which usually proceeds from derangement of the mucous secretions, the most effectual relief is obtained by causing copious discharges from the bowels through the operation of powerful purgatives. The monthly discharges of blood from females cease when the nutrition of the *fœtus in utero* commences—or when a large tumour is formed in any part of the body ; it also does not appear while the secretion of milk continues ; and when, independently of these conditions, it ceases to appear, local inflammation, as that of the eye, is apt to occur. The local abstraction of blood and the establishment of suppurating surfaces are every day practised for the counteraction of inflammation. It is unnecessary to mention more examples of such counterbalancing effects ; but it must be observed, that the

exchange is more ready between some of these morbid states than others, which must be attended to in the use of counter-irritation.

6. General disturbance or fever, however induced, is apt to terminate in some local affection.

Most people have what may be called their weak part, which gives way on such occasions, and in many acts like a safety-valve, by protecting organs of more importance; as when sore throat, herpetic eruptions of the ears, or erysipelas is apt to result from constitutional disturbance. This proneness to particular local diseases may be either congenital or the result of habit. In the former case it leads to what is called hereditary disease, of which gout may be mentioned as an example.

Treatment of Inflammation.

The great object in treating inflammation is to make it terminate in Resolution,—that is, to subside and disappear without leaving any change in the structure or actions of the part. The most obvious step in the first instance with this view is removal of the cause which excited the disease, should it still continue in operation. When the cause is direct, this can sometimes be accomplished speedily and perfectly, as when a foreign body occasions disturbance by its presence. But when it is of an indirect kind, such as the suppression of some natural secretion or discharge, from the mucous membrane or uterus for instance, the process for removing it is generally more difficult, requiring the careful administration of medicine and strict attention to regimen. When the cause cannot be remedied at once, or when the inflammation continues after its cause has ceased to operate, which is generally the case, the morbid action requires the use of means for its suppression.

The symptoms of inflammation naturally suggest the abstraction of blood,—and this until lately has accordingly always been regarded as its great antidote, though much less often really required than was formerly believed. Blood may be withdrawn *locally*, from the inflamed part or its neighbourhood, and *generally*, from the larger veins or smaller arteries. The veins are almost always preferred for this purpose, from being more superficial than the arteries, whence they are more easily opened, and from being more easily closed. Those at the bend of the arm, the external jugular, and more rarely the veins of the hand and foot, are chosen for venesection.

Venesection.—The patient should be placed in a reclining posture, unless the peculiar circumstances of his case should render some other more convenient; a bandage is then to be put twice round the arm, about an inch above where it is proposed to open the vessel, and tied with sufficient force to obstruct the veins without impeding the current of the artery. The surgeon now chooses the largest vein, which is generally the median basilic—puts the limb into such a position as may be preserved while the blood is flowing, and presses the thumb of one hand upon the vessel immediately below where he proposes to puncture it, in order to prevent it from rolling, and the blood from escaping until he is ready to receive it; then holding the lancet with the other hand, he introduces it into the vein obliquely, in respect to the direction of the vessel. When the blood appears, he ceases to push the instrument deeper, but carries it a little further forward, in order to enlarge the opening of the vein; and, lastly, elevates the point, so as to make the external wound of sufficient size. The pressure of the thumb is then removed, and the blood is allowed to flow so long as seems proper. The surgeon, when a sufficient quantity has been abstracted, slackens the bandage—places his thumb upon the orifice—cleanses the arm from blood—lays a small compress of folded lint on the wound—and applies with moderate firmness a single turn of a bandage in the figure of 8.

It frequently happens, from the operator making too small a wound, or the opening of the vein ceasing to correspond with that of the skin, that the blood enters the cellular substance, and constitutes a tumour, which is named *Thrombus.* It produces no inconvenience, further than arresting the flow of blood; and if from this, or any other cause, the quantity desired cannot be obtained, it is better to open another vein, than to run the risk of exciting inflammation in the one already wounded, by introducing probes, or using any other contrivances for assisting the blood to escape. When the patient is fat, or the vessel small, the surgeon not being able to see the veins, must feel for them; and then the one already mentioned, the median basilic, is generally recognised most easily, both from its large size and regular situation, on the inner side of the tendinous attachment of the biceps to the fascia of the forearm. The humeral artery lies under the vein at this point, but runs no danger of being wounded, unless the lancet is used with undue force. The only artery that can be injured in a natural distribution of the vessels is the humeral; but the arteries of the fore-

arm frequently take a superficial course, which makes them assume the appearance of veins; whence it is always proper to ascertain, before introducing the lancet, that the vessel is really a vein by its want of pulsation. The cutaneous nerves are so small and intimately connected with the veins, that they cannot be avoided by any precaution; and there is reason to believe, from the acute pain occasionally complained of, that they are not unfrequently divided; but bad consequences seldom if ever result, either from this source or the alleged pricking of tendons, which was formerly much dreaded.* When any local inconvenience results from the operation, it is now thought to depend upon inflammation of the skin, cellular substance, or vein, owing to peculiar irritability of the patient's constitution, or the manner in which the surgeon has inflicted or dressed the wound. These accidents will be best avoided by performing the operation as has been described above; and when they do occur, ought to be treated according to the principles which will be explained hereafter, in connexion with the textures liable to injury.

The external jugular may be rendered sufficiently tense for being opened, by pressing on it with the thumb a little above the clavicle. The lancet may then be introduced in the same way as has been recommended; and if the incision be made in the direction of the sterno-mastoid muscle, it will not only insure the division of the superjacent fibres of the *platysma myoides*, but also have the proper degree of obliquity in respect to the coats of the vein. The edge of the cup, which is to receive the blood, being held tightly below the aperture, will determine the blood to flow through it; and when a sufficient quantity has been obtained, its further escape will be easily prevented by applying a small compress of lint, which should be retained by two crossing slips of adhesive plaster, rather than by a bandage encircling the neck, as this might reinduce the bleeding.

Arteriotomy.—The only artery now ever opened intentionally for the abstraction of blood is the temporal. Either its anterior or middle branch may be selected, but the former is the most convenient; and the best part of its course for the purpose is just where it begins to be covered by the hairs of the head, a few of which ought to be shaved off previous to the operation. The artery is sometimes so large and superficial that it may be opened in the

* Benjamin Bell's System of Surgery, vol. iii. p. 184, 7th ed.

same way as a vein; but, in general, this method would not succeed, as the small size and depth of the vessel render it extremely difficult to avoid either cutting its coats entirely across or pricking them slightly, in both of which cases the blood does not flow freely. Many plans have been proposed to obviate this difficulty, but the simplest and surest is to place the point of the fore and middle fingers over the artery so as to ascertain and mark its course—then to make an oblique incision about half an inch long with a lancet through the integuments over the vessel where it lies between the fingers—and lastly, to introduce the instrument gently again and again until the blood springs out. The operation may also be rendered more certain by using a small cupping-glass having an oval aperture fitted to the shape of the temporal region; even if the artery should have been completely divided, this means will induce the blood to flow from it. To stop the hemorrhage a firm compress of lint should be placed on the wound, and then a bandage a yard or two long, and an inch broad, rolled up at each of its extremities, being applied first to the opposite side of the head, should be brought round and crossed over the artery, after which its ends are to be carried back again in the opposite direction, and this repeated until sufficient pressure is effected.

Effects of Bleeding.—The first effect noticed is a diminution in the force and rapidity of the circulation, which is manifested by the pulse becoming slower and softer. By and by the motion of the heart is so much weakened that it no longer propels the blood with sufficient force to support the functions of the brain. The individual becomes pale—he complains of weakness and nausea, which sometimes proceeds to vomiting, but more frequently, the functions of the brain becoming more and more completely suspended, he loses all power of sensation and voluntary motion—he is no longer able to stand or sit—there are frequently slight tremors of the muscles, and in some rare cases violent convulsive contractions of them—he makes some deep inspirations and expirations—looks wildly about him, and falls into a state closely resembling death, which is named Syncope. Syncope occurs most readily when the patient is in an erect posture, and a very large quantity of blood may be withdrawn without inducing it if he lies horizontally. The most effectual method of recovering one from this state is consequently to lay him down with his head on the same level as his body. The quantity of blood which must be abstracted to induce syncope in ordinary circumstances is extremely variable. Sometimes several

pounds may be withdrawn before its symptoms appear, and at other times a few ounces are sufficient for the purpose; the patient's mental alarm has a considerable share in producing the effect, but in general sixteen or twenty ounces are required.

When the patient is very weak, or very largely depleted, the syncope either passes directly into death, or is succeeded by an intermediate state, named Sinking. In this condition the pulse is small, feeble, and intermittent; the countenance is deadly pale, and bedewed with clammy moisture: the extremities are cold, and the patient has a distressing sensation of weakness. He lies in a dozing state; and when roused from it, takes some time to recollect his situation, often at first expressing himself incoherently. His breathing is uneasy, being performed with dilatation of the nostrils, and is frequently attended with slight crepitation, or mucous rattle in the chest. This state, after continuing for hours, or it may be even for days, terminates in recovery or in death; the latter being usually preceded by hiccup and vomiting.

When the quantity of blood abstracted is not too great, in proportion to the strength of the patient, there is a recovery or reaction of the system. After an ordinary syncope, the symptoms go off in the inverse order of their approach; and when the patient has completely regained his faculties, it is generally observed that the actions which were suspended are performed with a slight degree of excitement. This is most observable with regard to the pulse, which is rather more sharp and frequent for some time afterwards than it was before, provided the patient did not labour under any febrile disturbance.

This excess of reaction is observed to be proportioned in degree to the strength of the patient and the quantity of blood withdrawn, provided it is not so large as at once to induce sinking or death; and, in circumstances favourable for its production, may become so excessive as to simulate closely the symptoms of inflammatory fever. The pulse is extremely frequent, and has a peculiar jarring or jerking sort of character—the respiration is hurried—the face is flushed—the eyes are red and suffused—the patient complains of intense headache, and distracting noises in his ears—and when blood is drawn it exhibits the buffy coat, though hardly the cupped surface which is seen during inflammation. The local symptoms of inflammation are not wanting; and the brain, with its membranes, is the part which most frequently suffers; but the viscera of the thorax and abdomen are not exempt from risk.

This curious state, for pointing out which we are much indebted to Dr Marshall Hall,* may be induced either by one or two very large bleedings, or by a number of small ones, causing a continued drain on the system for days, weeks, or months ; and accordingly, as it occurs in one or other of these ways, the symptoms vary in the degree of their violence or acuteness. It may terminate in fatal effusion on the brain, or some other important organ, in sinking, or in a return to health. Bleeding, as might be expected, though it affords temporary relief, is apt to increase the evil, either by making the state of excitement more quickly terminate in sinking, or by increasing the violence of its symptoms. Perfect rest, both of body and mind ; cold applications to the head ; gentle opiates ; and the gradual operation of time, ought to be trusted to as the means of relief.

The discrimination between the symptoms of excessive reaction and those of inflammation, is of the utmost importance in practice; and the following observations as to the circumstances which modify the effects of hemorrhage are deserving of much attention.

In young subjects, that is to say, children and infants, the power of reaction is feeble, and the risk of sinking consequently great ; but if the immediate danger be surmounted, recovery is accomplished quickly and perfectly.

In adults who are weak from age or any other cause, there is also small power of reaction ; but their danger of sinking is not merely in the first instance, and continues for a much longer time afterwards, as the restoration to health is slow and imperfect.

In the healthy and robust individual there is always excessive reaction, unless the bleeding be so small as not to affect the system sufficiently, or so profuse as to cause sinking or death in the first instance.

Pain, fear, and the exhaustion produced by protracted fever or the discharge of matter, increase the risk of sinking.

Local Bleeding.—Blood may be abstracted locally by scarifying, leeching, and cupping.

The first method can be employed only when the part inflamed is superficial, or when the skin and subjacent cellular texture are affected. In which cases incisions are often useful, not only by allowing blood to escape, but by relieving tension.

Leeches should be dried before they are used, and the part to

* Med. Chirurg. Trans., vol. xiii. p. 127.

which they are applied ought to be carefully washed with warm water. When they are wished to fasten at a particular point, they should be enclosed in a small cone of paper or linen, which allows merely the head to project. After they fall off, the bleeding is to be encouraged by fomentations or a poultice, unless it proves excessive, as sometimes happens, particularly in children, when a small piece of lint ought to be pressed firmly on the wound. If this means should fail, which it seldom does, the nitrate of silver may be applied, or the wound may be transfixed by a small needle or pin, and tied with a thread. The quantity of blood obtained by cupping depends greatly on the part which is chosen for the purpose. The skin should be well fomented before the operation, and carefully protected from the influence of cold during its performance. The glasses should have wide mouths, and be frequently emptied, to prevent the blood from coagulating over the wounds, which opposes its flow, unless they be made of such a shape as to prevent this. The most convenient form, especially to an operator not practised in the management of ordinary cup-shaped vessels, which require to be frequently emptied and reapplied, is that of a distended leech,—the glass being about six inches long and two inches wide at the mouth. In using this apparatus a piece of paper moistened with spirits is introduced into it and kindled—the mouth is then applied over the wounds which have been made by the scarificator—and, the bulging part of the vessel being placed in a dependent position, the blood continues to flow into it without coagulating upon the orifices, until a sufficient quantity is obtained.

Purgatives.—These are substances that, when introduced into the intestinal canal, produce more or less irritation: the effect of which is a greater secretion from the mucous membrane, and increased contraction of the muscular fibres. In consequence of this double operation, the dejections are more frequent and copious than usual; and the patient is not only relieved in the way of metastasis, that is from having an action excited at a distance from the diseased one, but also has those secretions restored, the suppression of which is frequently the indirect cause of inflammation.

Many different purgatives are employed in medicine; but the most useful in subduing inflammation are calomel, colocynth, jalap, rhubarb, croton oil, and sulphate of magnesia. The saline purgatives induce a very copious secretion from the whole surface of the intestines, while calomel is thought to act more particularly on the

liver, by restoring or promoting its secretion. The blue pill and rhubarb are very beneficial in gradually restoring these actions to a state of health when their disturbance has occasioned chronic inflammation.

Purgative agents are often introduced into the rectum with the view of hastening the effect of those administered by the mouth, or superseding the necessity of their use, when from any circumstance their employment happens to be inconvenient. The grand essential of these injections, clysters, or enemata, as they are named, is quantity sufficient to distend the rectum, since this is the proper stimulus of that gut. From one to two pounds of gruel, or simply tepid water, should be used, and made more or less irritating, according to circumstances, by the addition of common salt, olive oil, castor oil, sulphate of magnesia, or oil of turpentine, &c. Various apparatus used to be employed for the purpose of injection; but the simple and efficient means of Read's syringe, and Higginson's tube, have superseded all the others.

Diaphoretics.—These are remedies which, in the effect they produce, bear the same relation to the skin that purgatives do to the mucous membrane of the intestines. They increase the action of the skin, and are thus beneficial either in the way of metastasis, or in removing the cause of the inflammation, by restoring a secretion which has been suppressed.

The salts of ammonia have a diaphoretic effect; but, being of a stimulating nature, are questionable remedies for subduing excited action of the system. The *Aqua Acetatis Ammoniae*, however, may be given with much advantage in small doses, from time to time, after the force of the disease has been broken by other means. Ipecacuan is less objectionable in this respect, and the combination of it with opium, constituting Dover's powder, is often extremely useful. By far the best diaphoretic, however, for subduing inflammatory action, is the tartrate of antimony, given in small and frequently repeated doses, so as to maintain a slight nausea, or even occasional vomiting. The warm bath is a powerful diaphoretic, and would often be very advantageous if it could be procured; but the difficulties which usually attend its employment in private practice are so great as almost to proscribe it. The vapour-bath is more readily administered, and may perhaps come into general use. All the apparatus required is a piece of lead or tin tube three or four feet in length, a tea kettle, and a blanket. The patient sits on a stool near the fire and covered with the blanket. The tube is

attached to the spout of the kettle by one extremity, and has the other placed under the stool. The heat may be ascertained by a thermometer, and regulated by the degree of ebullition. Much benefit is frequently derived from the semi-cupium or hip-bath, and the pediluvium or foot-bath; and, still more, local baths are of great service in the form of Fomentations and Poultices. Fomentation is generally effected by applying a piece of flannel or a sponge wrung out of hot water, and changing this from time to time as it cools, for the space of fifteen or twenty minutes. A flannel bag containing chamomile flowers, and allowed to cool sufficiently after being boiled a short while, is preferred by many for the purpose; and a decoction of poppy heads also is occasionally employed. Poultices may be prepared from any substance which, together with warm water or milk, constitutes a soft pulpy mass, capable of retaining the heat and moisture. Bread, barley-meal, and linseed-meal are chiefly used; but carrots, turnips, and leaves such as those of spinach and hemlock, are thought preferable in certain cases. These articles are either enclosed in a thin linen or muslin bag, or placed directly on the part concerned, in which case it is necessary to spread some butter or other oily substance on the poultice, to prevent it from adhering inconveniently to the surface of the body. Instead of poultices, some folds of lint, moistened with hot water, may be applied, and covered with a piece of oiled silk. Heat is sometimes applied locally without moisture, as by means of a bag containing heated salt, but is then found to be not so efficacious.

Narcotics.—These are medicines which, without causing any real diminution in the power of the system, produce a temporary indisposition for action. Of these the most useful are opium, tobacco, hyoscyamus, and belladonna.

Astringents.—These are remedies somewhat similar in effect to those last mentioned. Cold, acetate of lead, and nitrate of silver, are the best means of this kind. Cold is more efficient in preventing than curing inflammation. It is of no use unless it can be applied either to the part affected or in its immediate neighbourhood; and then only when the diseased action proceeds from direct irritation. The acetate of lead is used externally in solution, either alone or along with opium, in the proportion of three or four grains of each to the ounce. It is generally applied warm, and has great effect in allaying inflammation depending on undue irritability.

Pressure.—When the part or system is disposed to overact by

the weakness of its power, especially when it is attended with œdematous swelling, pressure may often be exercised advantageously by bandaging.

Counter-irritants.—The means of removing inflammation which are included under this title act on the principle of metastasis, and excite irritation of various degrees as to intensity and duration. The most gentle in their effect are named rubefacients, of which may be be mentioned mustard, oil of turpentine, ammonia, gum ammoniac, camphor, and some of the mineral acids. Blisters or vesicatories are applications which, as the name implies, occasion blisters of the skin or elevations of the cuticle, by fluid diffused under it in consequence of their irritation. The plaster of cantharides is most frequently employed for this purpose; but, when the effect is wished to be strong and immediate, recourse may be had to boiling water, or the concentrated mineral acids. The nitrate of silver is occasionally preferred for the purpose, being rubbed on the part after it has been moistened with water.

So soon as the blisters caused in either of these ways have risen, they ought to be cut, so as to allow the serous fluid they contain to escape, after which the surface is to be dressed with some simple ointment. In order to prolong the irritation of blisters, it used to be customary to dress the raw part with an ointment containing savine leaves, or the powder of cantharides, which prevented it from healing, and maintained a discharge of matter. When continued irritation is required, it is now more frequently effected by the tartrate of antimony, which, when applied to the skin either in solution or ointment, occasions a pustular eruption, that may be regulated as to extent and duration by the same means.

Another mode of causing permanent counter-irritation, is to institute a discharge of matter from a breach in the continuity of the skin. The introduction of a seton used to be, and still is, with many people a favourite way of effecting this. The operation is most easily done with a seton-needle,—an instrument shaped like a lancet, about three inches long, three-eighths of an inch broad, slightly curved, and having an eye at the blunt end. A fold of skin being held up, the needle is pushed through, and by its means a thread, to which a skein of silk or cotton sufficient to fill the aperture can then be introduced. In absence of the needle, a straight sharp-pointed bistoury and probe will be found to answer nearly as well. In a few days, when the discharge of matter

commences, a new seton may be passed by drawing it through the loop of the old one—and this may then be repeated daily. Issues are now more frequently employed with this view. They are merely breaches in the surface caused by the knife, caustic, or the actual cautery; that is, red-hot iron. When the knife is used, it should be pushed through a fold of the skin, and then some foreign bodies must be placed in the wound to prevent it from healing. The caustic potass is generally employed for opening issues. It may either be applied for three or four hours made into a paste with soap or bread, and limited in its operation by a defence of adhesive plaster, having an aperture cut in it of the requisite size, or simply rubbed in substance upon the skin until the alteration of colour and consistence indicates that its effect is sufficient. In either case, after the action of the caustic is completed, a poultice ought to be applied until the portion of skin that has been destroyed separates, when some foreign substances, such as those already mentioned, must be introduced to prevent the opening from closing. The actual cautery is the best method of the whole, since the breach which it occasions requires no means for keeping it open, and does not heal until after many weeks or months, or healing applications are employed. The pain is severe but almost momentary, and, on the whole, much less than that of the caustic; while the counter-irritating effect is found to be greater than that of any of the other means.

Counter-irritation may be effected also by moxa. This consists in burning small cones of the down of the Artemisia, or what answers equally well, provided the combustion be maintained by a blow-pipe or bellows, raw cotton made into cylinders from one to two inches wide and three-quarters of an inch thick. Every degree of irritation may be thus produced, from the slightest reddening to the most complete burning; but it is difficult to regulate the effect, and there seems to be no advantage in attempting to do so, as the other means which have been mentioned are more under command, and at least equally efficacious.

Acupuncturation.—This remedy for inflammation must stand by itself. It consists in the introduction of slender needles from one to three inches in length into the inflamed part by a gentle rotatory motion. No respect is paid in doing this to the importance of the organs, and the heart, stomach, arteries, and nerves have all, it is said, been transfixed without any ceremony, though fatal consequences are reported to have sometimes resulted from

this rash practice. No pain or other symptoms of irritation are in general produced, and, on the contrary, a diminution of the inflammatory indications is alleged to be frequently observed. This practice is of ancient origin, and held in much esteem in Eastern countries, where, as in China and Japan, its employment is said to constitute a distinct department of the surgical profession. Some years ago it was tried pretty extensively in France and also in this country, but it now seems to be going, or rather to have already gone, into disrepute, except in the treatment of Sciatica, where it is of the greatest service. It would seem that the effect of acupuncturation is proportioned, not to the number of the needles, but to the depth they are introduced, and the time they are allowed to remain. I generally use only one at each seat of pain, and leave it for two hours.

Choice and Combination of the Means which have been mentioned in treating Inflammation.

General bleeding is of no use as a preventive of inflammation, unless it removes some derangement of the system, or counteracts its tendency to excite inflammation. It has most effect at the commencement of inflammation, and is most beneficial when there is great power of action. It is better to take a large quantity of blood at first, so as to produce some decided effect, than to bleed frequently by small portions. When it is found necessary to take away a large quantity of blood, an opiate given immediately afterwards is useful, by diminishing the tendency to reaction, and a small bleeding of a few ounces is often serviceable, with the same view, if practised soon after the first one, just when the symptoms of returning action appear.

After the force of the disease has been broken by bleeding, if necessary, purgatives and diaphoretics are proper. It is usual to premise the mercurial, and follow them up with the saline ones. The tartrate of antimony is the best diaphoretic, and, by powerfully diminishing the tendency to violent action, in a great measure supersedes the necessity of bleeding, except at the commencement of the attack. Local bleeding is of most service, in treating acute inflammation, as an adjunct to the measures of a general kind. Blistering is most useful in chronic inflammation, and ought never to be employed in other cases until by bleeding, or some other means, the power of action has been lessened. All the other modes

of counter-irritating are most advantageous in, or rather entirely restricted to, chronic inflammation.

Opiates and astringents are most beneficial, both externally and internally, when there is much irritability, or tendency to act more than in proportion to the strength of the part or system.

Resolution.—When the symptoms of inflammation subside, they do not leave the part affected altogether in its natural state. It generally remains for a time somewhat swelled, tender, and unfit for the performance of its duty, whence it requires rest, mechanical support, and gentle stimulation.

CHAPTER II.

MORTIFICATION.

Symptoms of Mortification.

WHEN inflammation, instead of terminating in a return to the natural action, goes on to the destruction of the part concerned, it is said to terminate in Mortification. In this case, the part is not only deprived of sensation and voluntary motion, but is completely divested of all vital properties, so that no opposition being any longer presented to the exercise of chemical attraction, putrefactive decomposition at once commences. The appearance of a mortified part varies with its texture, just as happens in putrefaction. The soft juicy tissues suffer most alteration, and the hard fibrous ones least. The former are reduced at once to the state of a fetid pulp, while the latter retain their distinctive characters for a much longer time. Another circumstance that affects the appearance of a mortified part, is the degree of action which has preceded its death, since the softness and fetor will of course be greater if much fluid has been accumulated previously. This has led to the old-fashioned division of mortification into *moist* and *dry*. These terms have also been employed with less propriety to express the difference which depends upon the disease being of internal or external origin; in other words, spontaneous, or the result of injury.

The symptoms of mortification may be divided into those which precede its accomplishment, those exhibited by the mortified part, and those of the system which attend the local changes.

The symptoms that precede acute mortification are, generally speaking, those indicative of intense inflammation. The redness is bright and fiery, the pain hot and burning, and the swelling tense. As mortification approaches, the swelling, though it may rather increase in extent, becomes less tense, and pits on pressure. The skin acquires a yellowish hue, and exhibits dark mottled spots or broad lines over its surface. The temperature of the part becomes lower; and vesicles, containing a thin serous fluid of a yellow, green, or purple colour, which are named *phlyctenæ*, make their appearance.

This state is called Gangrene, or gangrenous inflammation. The part is not dead, but only threatening to die, and may still admit of recovery, though a portion of it at least usually does perish. When the vital power is completely extinguished, the part ceases to be painful or sensible, shrinks in proportion to its previous distension, becomes black, brown, ash-gray, or buff-coloured, and emits a peculiar characteristic fetor, which is nearly the same whatever be the tissue concerned. It is then said to be sphacelated, or to constitute a slough.

The symptoms presented by the system, while these local changes are taking place, deserve great attention. They are nearly those which have been already described as attending sinking from excessive hemorrhage. The countenance is pale, cold, and moist; the features seem small and contracted; and the appearance exhibits that ill-omened aspect which has been designated the *facies Hippocratica;* the pulse is quick, feeble, and irregular; the tongue is brown; and the lips frequently display small dark-coloured scabs. The patient lies on his back completely collapsed, or, as it were, sunk down into his bed; he has frequent coffee-coloured vomiting, and suffers from almost incessant hiccup. His body emits a peculiar odour, somewhat like that of moist earth. He sometimes retains his mental faculties entire; but more frequently falls into a dozing state, alternated with low muttering delirium. The breathing becomes obstructed by mucous effusion, and death closes the scene.

It is not easy to account for these constitutional symptoms. They have been attributed to the sphacelated part acting like a poison. But where sloughing is induced directly by chemical or mechanical means, even to a great extent, it is not usually attended with the effects in question. They have been also referred to the general exhaustion of power which the system suffers from the intense overaction that precedes the mortification. But this opinion is irreconcilable with the fact, that removal of the sphacelated part alleviates, and sometimes completely arrests, the constitutional symptoms. They have, therefore, as the only other explanation, been accounted for by supposing that the gangrenous or dying action extends itself over the system. Whatever be the true reason of the constitutional effect, there can be no doubt that it bears a direct proportion to the importance of the part affected, and the violence of the action which precedes the destruction of its vitality.

In chronic or dry gangrene, the local changes are of a similar

kind, but slower progress, and less striking character. The constitutional symptoms, also, are milder in a proportionate degree; and, indeed, not unfrequently altogether absent.

Causes of Mortification.

The causes of mortification, or circumstances which induce inflammation to terminate in it, may be referred to weakness, or defective powers of action;—excessive irritability, or disposition to act; and excessive irritation, or excitement to act.

Weakness.—The different tissues possess different powers of action. The tendons and shafts of the bones are very apt to die when inflamed—the cellular substance is less so—the skin still less—and the coats of the arteries least of all. The weakness which predisposes to mortification may also depend on general debility of the system. In the advanced stage of fevers, the slightest irritations are apt to occasion sloughing. In weakly children, exhausted still further by disease, this effect is of course more certainly produced; whence blisters are dangerous applications in such circumstances. Bad or defective food, and especially the use of unsound rye, when subject to the morbid condition named Ergot, may cause such an unhealthy state of the system, that the slightest local irritation, or even inflammation occurring spontaneously, leads to extensive sloughing of the extremities.

A part merely of the body may be rendered weaker than usual, so as to be more prone to mortification, and this in various ways. When the principal artery of a limb is tied, there is no longer sufficient strength for carrying on the usual actions—the weakened part seems to make an effort to recover—heat, pain, swelling, with the other symptoms of inflammation, supervene, and, if they are the least excited by external circumstances, soon wear out the diminished power that remains. The arteries occasionally become obstructed spontaneously, and this probably gives rise to the mortification of the toes which not unfrequently happens in old people.

The *Gangrena Senilis*, as it has been named, was so well described by Mr Pott, that his name is generally connected with it. The disease is seldom met with before the age of sixty. It occurs more frequently in males than females; and chiefly affects persons addicted to the pleasures of the table. It is usually preceded by uneasy feelings, sometimes amounting to intense pain, in the foot, which, at the same time, is observed to be more or less swelled. A

brown or purple spot then shews itself—most frequently in the neighbourhood of one of the nails, but it may be in the sole or on the instep; the surrounding skin becomes red, hot, and distended; the cuticle separates from the discoloured spot, and exposes the subjacent texture in the state of slough. The morbid process then either gradually advances until the patient sinks under it at the end of weeks or months, or gradually relaxes in severity, and, ceasing to extend, permits a cure to be accomplished in the way hereafter to be explained. It has generally been supposed that the cause of this disorder consisted in a weakened condition of the foot, probably depending upon obstruction of its arteries, or ossification of their coats; and though the evidence in support of this opinion is very defective, there can at all events be hardly any question as to the propriety of regarding weakness as the root of the evil.

Nearly the same effect is produced, when the blood is prevented from returning through the veins by pressure or closure of them from other causes. The obstruction of one vein, even though the principal one of the limb, may produce troublesome consequences, occasioning mortification. But if the principal artery be at the same time obstructed, death of the part is certainly induced.

Defect of nervous energy also predisposes to mortification. People who are paralytic in the inferior extremities, are apt to have sloughing induced by slight bruises. When the principal nerve of a limb is cut or otherwise interrupted, a tendency to mortification is frequently observed at the extremity.

Irritability or excessive disposition to act.—Weak parts are always irritable; and hence this cause of mortification is to a certain extent comprehended in the former one. But, independently of weakness, and in the most opposite state of part or constitution, there is frequently an excessive disposition to overaction. People who exceed in eating or drinking, or who do not take exercise in proportion to their food, are liable to this morbid disposition, which is also sometimes met with as an original peculiarity of constitution.

Excessive irritation or excitement to act.—Generally speaking, while other things are equal, the violence of inflammation is directly in proportion to the irritation. Whence it follows, that severe injuries, or other great and continued irritations, are apt to occasion mortification. Thus there is no constitution able to resist mortification from the shattering of a limb, or the infiltration of urine into the cellular substance.

Treatment of Mortification.

The prevention of mortification requires the use of means proper for obviating the predisposing causes. If there is general weakness of the system from the use of improper food, or any other cause, it must be remedied by a more wholesome regimen, and, if necessary, supported in the meantime by the administration of wine, spirits, and other stimuli of speedy operation. If any cause of local weakness exist in operation, it ought, if possible, to be removed; and the part which is weakened should be protected from all excitement. If the principal artery of a limb, for instance, has been tied, or if the part has been weakened by exposure to intense cold, every sort of local stimulating application should be carefully avoided, while the system is at the same time protected from excitement. In the treatment of *gangrena senilis*, it was customary to prescribe large quantities of wine and spirits, with a corresponding allowance of animal jellies and other nutritious articles of diet, and to employ, under the title of hot or invigorating dressings, various articles of a stimulating nature. Under this treatment, the evil progresses; and even the opium that is often used, in compliance with Mr Pott's advice, fails either to afford relief from the pain, or to check the advance of the disease. It would appear, that, in this as on other occasions of deficient strength, while the power to act is lessened, the tendency to excitement is increased; and that, as cordials and stimulants cannot supply the vigour which is wanting, they merely increase the morbid disposition to inflammation. I have therefore advised, on theoretical as well as on practical grounds, that the diet of patients labouring under this disease should be strictly vegetable, and chiefly farinaceous; that they should be confined to the horizontal posture; and that the part affected should be enveloped in a thin linseed-meal poultice of gentle temperature. The only addition to these means required, until the cure be completed, is the use of muriate of morphia, in doses proportioned to the patient's sufferings.*

If, instead of weakness, the irritability depends on strong power of action, it ought to be lessened by bleeding, purging, tartrate of antimony, and tobacco injections. When the mortification is completed, the slough should be cut away so far as is practicable, without encroaching on the living parts, in order to diminish the fetor; yeast poultices are sometimes used with this view, but they generally occasion uneasiness. The chloride of lime or soda in

* Contributions to the Pathology and Practice of Surgery, p. 5.

solution, diluted nitrous acid, or the *unguentum resinosum,* with an equal quantity of oil of turpentine, are less objectionable applications; but nothing answers so well as a poultice of some soft soothing substance, such as linseed meal.

The extreme prostration of strength that accompanies the acute form of mortification, peremptorily demands diligent support from wine and spirits. When the mortification does not cease to extend, it comes to be a question whether or no the surgeon ought to interfere with the knife. The objection to doing so is, that, although the constitutional symptoms may be alleviated for a time after the amputation, the patient is in general soon reduced to the same state by sloughing of the cut surface. The most prudent course seems to be a middle one—to abstain from amputation when the mortification depends upon an internal cause, or one that cannot be removed, and to operate when the cause is external or within reach. In the case of *gangrena senilis,* it would therefore be improper, while in spreading mortification occurring as a consequence of gunshot wound or compound fracture, the patient should be afforded this chance of escape from otherwise certain destruction. It does not follow from this rule, however, that amputation should always be performed when mortification of a limb ensues from external irritation, since the most trivial injury is sufficient to induce it in an unhealthy subject. It is only when the violence of the action is fairly referable to the local cause, without supposing constitutional defect, that the operation can be practised with propriety. Though the extent of mortification may not be defined, if it depends upon a cause which is limited in its operation, as the obstruction of an artery at some ascertained part of its course, the propriety of amputation will be still more manifest.

In those cases where the mortification spontaneously ceases to extend, as when it has resulted from the exposure of a part to cold, it often becomes a question whether the process should be confided entirely to the power of the system, or be anticipated by amputation, in order to hasten recovery, and provide a better stump than could be expected if the bones were allowed to separate without any covering being provided for them. On the whole, it seems best to adopt a middle course, and avoid interference until the soft parts are nearly detached, when they may be easily dissected a little upwards so as to expose the bone and allow it to be divided with a saw, or disarticulated sufficiently high to let the integuments meet over, and afford the necessary protection to its extremity.

The discrimination between those cases of external injury in which the mortification is to remain local, and those in which it is to extend, requires no less experience than judgment; and it appears not improbable that some, at least, of the cases in which amputation has been reported as successful on account of spreading gangrene, were not really of the formidable nature supposed. For although the inflammation induced by a local injury may be extensively diffused over the limb, the mortification is frequently limited to the part directly concerned—as where the leg has been bruised by the wheel of a waggon—so that if amputation be performed in the early stage of such a case, it may have the appearance of limiting the gangrenous process, which, if left to itself, would probably not have extended any further. But there can be no doubt that, upon some occasions, the destructive action, when really spreading, has been prevented from pursuing its fatal course by timely amputation.

CHAPTER III.

EFFUSION.

Effusion of Serum.

THE action or process which is denoted by the expression Effusion, consists in the separation of the serous, or fibrinous portion of the blood, and its discharge into some part of the body.

Effusion is not necessarily preceded by inflammation, but is very frequently a consequence of it. It has already been remarked, that a slight degree of effusion almost always attends inflammation.

Serous effusion takes place chiefly into the interstices of the subcutaneous cellular texture, and into the cavities which are lined with serous membranes, as the *pleura*, or *peritoneum*, and the joints. In the former situation, it occasions a swelling of the part affected, which, unless inflammation exists, is colourless, and pits on pressure. This is Œdema or Anasarca. It occupies chiefly those parts which are most dependent, especially the inferior extremities and the scrotum, and changes its place with the position of the body. In the serous sacs it constitutes collections of fluid, which are named Dropsies.

The fluid, both of œdema and dropsy, generally bears a close resemblance to, or rather seems identical with, the serum of the blood. Sometimes it is more limpid and colourless, tinged with blood or bile, more watery, or loaded with a larger proportion of albumen.

Serous effusion is induced in the cellular texture and serous sacs by various circumstances. It is often observed distinctly as a consequence of inflammation, but in this case the serous sacs are chiefly concerned. It very frequently results from the venous circulation being impeded either by the mere posture of the body, or obstruction of the vessels, or from disease of the heart or liver, or the presence of a tumour compressing the veins, of which pregnancy frequently affords an example in causing œdema of the limbs. It also by no

means rarely occurs without either any previous excitement of the part, or obstruction of the venous circulation that can be observed, and seems to depend on weakness alone. This may happen in both situations, but most frequently occurs in the subcutaneous cellular texture of the inferior extremities, as may be seen in the course of most chronic diseases which terminate fatally.

The means of preventing serous effusion is, of course, to obviate so far as possible the circumstances which occasion it. Inflammation should be treated on the principles which have been explained to make it terminate in resolution. If the circulation of the veins is not free, the impeding cause ought to be removed. If weakness threatens to occasion the effusion, it must be counteracted by means suited to the case, and especially by the use of bandaging, together with the horizontal posture.

The cure of effusion is sometimes accomplished by simply puncturing the skin, or sac containing the fluid, and allowing it to flow out. But very generally, the vessels from which the effusion has proceeded continue their action, so as to renew and maintain it after such evacuation. It is therefore necessary to change the action of the vessels, and this is done by various means. Mere external pressure sometimes suffices, and is more powerful when preceded by the application of blisters or stimulating ointments and lotions, particularly those containing mercury and iodine, to the neighbouring skin. When signs of excited action continue along with the effusion, general and local bleeding may be proper, together with applications of a soothing nature; and on the principle of counter-irritation or metastasis, diuretics, diaphoretics, and purgatives are administered. It is generally observed, that the effused fluid is more readily absorbed when it is seated in the cellular substance, than when it occupies a serous bag, provided the exciting cause has been removed. When the dropsical effusion is of small extent and superficially situated, particular operations are occasionally performed for its radical cure, as will be explained hereafter under the titles of Bursæ Mucosæ, and Hydrocele.

Effusion of Fibrine.

When fibrine is effused, it presents the appearance of the buffy coat, and is named Coagulable Lymph. This effusion happens most frequently in the same situations as the serous one, but also occurs on the mucous surfaces, and in the interstices of tissues.

When the lymph is thrown out upon a surface, it takes the form of a crust or membrane,—and if not disturbed, is apt to become organised and vascular, so as to constitute a permanent structure. Adhesions are thus often effected between adjacent surfaces, as those of the pleura. When lymph is effused on a serous surface, there is generally more or less serum also, which in this case is not limpid and colourless, but turbid, with flakes of lymph floating in it. If the patient survives so as to afford sufficient time for the purpose, the lymph, where adherent to the sides of the cavity, is organised into dense membranous structures, and the serum acquires the usual appearance of a dropsical fluid. The loose portions of lymph sometimes become indurated into masses of a tough consistence and yellow colour, which usually resemble each other in size and form, as may be seen not unfrequently in bursæ that have suffered from inflammation.

Effusion of lymph on a natural surface occurs almost always as a consequence of inflammation. It is also occasionally produced by two surfaces of the same kind being pressed together, as may be seen in the blood-vessels, particularly the veins, or in the contents of a large hernia for which an imperfectly fitting truss has been worn. The means of prevention consist in subduing the inflammation that precedes; and it may further be stated, that the constitutional disturbance produced by mercury seems much opposed to the action which occasions the effusion, whence the use of that medicine in cases where injurious effects are threatened from this source, as in Iritis.

Lymph, like serum, is effused into the cellular interstices also, but in this case is not confined to the subcutaneous texture, and occurs with equal readiness in the constituent, as in the connecting cellular substance of organs. If time be afforded, it becomes organised, so as to cause thickening and hardening of the part concerned.

This effusion may occur as a consequence of inflammation, but much more frequently takes its rise from the immediate effect of local irritation, such as that produced by the passage of fluids through preternatural channels, or by the lodgment of foreign matters within the substance of the body, as when the urine escapes by a *fistula in perinæo*, or a bullet lies where it cannot be extracted. The result in these cases is thickening of the surrounding parts, or the formation of a capsule. This process is generally rather beneficial than injurious, as it limits the influence of the irritation,

and prevents it from exciting a more violent or injurious action. Its effects generally disappear so soon as the cause that led to them is removed; if they do not, the same means which promote the dispersion of œdema are required—namely, pressure, with blistering, and stimulating ointments.

Lymph is also effused on the surfaces of wounds, and sometimes unites them, so as to remedy at once the solution of continuity. This process is named Union by the first Intention. The steps by which it is accomplished, and the circumstances that oppose and favour its completion, are extremely important.

Every wound is attended with more or less bleeding; and as it gradually ceases, an exudation of serum takes place, which is readily recognised by the faint-coloured stain it makes on the dressings. From eight to twelve hours after the wound is inflicted, less or more according to its extent, this discharge ceases, when lymph is effused from the cut surfaces, and if they are in contact, or nearly so, glues them together—becoming gradually organised, and completing the union from forty-eight to seventy-two hours after the injury has been sustained. The union, though now perfect, so far as regards appearance and feeling, does not possess much mechanical strength; and if the lips of the wound be torn asunder, they are found to have a coating of coagulable lymph on each of the respective surfaces, precisely similar to that which is effused upon serous membranes as a consequence of inflammation. Inflammation, therefore, used to be considered essential to this mode of union, which was said to be effected by Adhesive Inflammation. It is now ascertained that inflammation, so far from being essential to the process, is subversive of it. A certain degree of excitement is not incompatible; but whenever it goes so far as to occasion pain, or much swelling and redness, union by the first intention is frustrated: and the way is led to another process of reparation hereafter to be described, viz., Granulation.

Inflammation being thus preventive of primary union, and the interposition of any foreign substance, or the separation of the cut surfaces, beyond the extent to which they can be glued together by the thin layer of lymph effused from each, being of course no less adverse to the process, it follows that the plan which used to be followed in dressing wounds should be regarded as equally injudicious and injurious. It consisted in closing them immediately, or soon after their infliction, and retaining their lips in accurate contact by adhesive plasters, or other means, pledgets of ointment and

bandages being applied—and no change made in the dressing till the fourth day. The consequences were, that the blood and serum being confined, the edges of the wound were separated from each other ; and the stimulus of necessity, as John Hunter called it, or irritation produced by the continuance of a breach in the structure of the body, which, if primary union had occurred, would have ceased to exist, caused inflammation as the first step to the other mode of reparation already mentioned. Two insuperable obstacles, either of which would have been sufficient for the purpose, were thus placed in the way of direct adhesion, viz., separation of the raw surfaces, and inflammatory action ; and when the wound was at length undressed, instead of being united, it was found distended into a cavity filled with matter.

It is much more consonant with reason, and will be found much more successful in practice, to close the lips of the wound only partially, or not at all, for ten or twelve hours, until the bloody and serous oozing shall have ceased, and then to place them in the most exact possible contact, at the same time taking care to prevent or allay excited action by cold applications and suitable regimen. If the wound is so situated that its edges can be kept in contact merely by the firm application of dry lint, which does not oppose the sanguineous or serous discharge, it may at once be dressed in this way without any inconvenience, and with the advantage of saving future trouble. In the year 1825, I published an Essay in the *Edinburgh Medical and Surgical Journal*, recommending this mode of treating wounds, and I am happy to observe that it has gradually come into use, even with those who at first most strenuously opposed it.*

* Contributions to the Pathology and Practice of Surgery, p. 70.

CHAPTER IV.

ABSORPTION.

By Absorption is understood an excess in the action of removal over that of deposition by the nutrient vessels. The effect of this is necessarily a diminution in the bulk of the part concerned, which may be either of the surface or the substance. Absorption, therefore, is distinguished into superficial or ulcerative, and interstitial.

It may occur in both situations as a consequence of inflammation merely, without reference to the exciting cause; but much more frequently depends upon some peculiarity of local irritation, which either occasions it directly, or indirectly through the intervention of inflammation.

The most common exciting causes of absorption are pressure, and the presence of something not naturally existing in the body. It frequently removes fluids effused into the interstices and cavities, and when inadequate to effect this, generally opens a passage for their escape externally, by removing the parietes containing them to such extent as is necessary for effecting an aperture. Foreign bodies which excite more irritation than what is sufficient for causing the effusion and organisation of lymph around them, very frequently obtain their discharge by a similar process of interstitial absorption. It is important to notice, that, though the pressure or irritation excited by the foreign matter, one would suppose must be equal on all sides,—the absorbing action always takes place in the direction of the nearest external surface, unless an internal one lined with mucous membrane should be very near, when the process proceeds towards it. It is by ulcerative absorption of the surrounding living tissues that sloughs are detached.

The means which may be employed for inducing absorption, are pressure, stimulating lotions, such as those containing vinegar, spirits, and muriate of ammonia, blistering ointments, and liniments containing mercury and iodine,—also the internal use of the two last-mentioned medicines, in various forms.

CHAPTER V.

GRANULATION.

Effects of the Granulating Action.

THE term Granulation is applied to an action, which repairs breaches in the continuity of the surface that are not healed by primary union. Such breaches may be caused either by violence or absorption, and in both cases are named Ulcers. An ulcer may be defined to be a solution of continuity in a natural surface, secreting matter.

When a wound does not heal by the first intention, it begins about twenty-four hours after the injury has been sustained to be painful, and attended with the other symptoms of inflammation. A thin serous discharge oozes out from it, and by and by the surface acquires a uniform appearance, whatever be the tissues which compose it, owing to an effusion of lymph that seals up the interstices of the cellular substance, and forms a thin superficial covering. About the third day, sooner or later, according to the activity of action, the incrustation of lymph becomes organised,—it acquires a red colour, bleeds when touched, and before many days have elapsed, shoots up into small granular projections, whence the process is named. These granulations are small, pointed, firm, and vascular,—they are covered with a fine pellicle, and secrete a peculiar straw-coloured fluid named Pus, the properties of which will be more particularly described hereafter.

The wound is now, properly speaking, an ulcer, and the subsequent process of healing is the same as in ulcers caused by absorption. The inequality of surface, if any existed, gradually disappears, the bottom of the ulcer becomes regularly concave, and at length there ceases to be any difference of level between it and the surrounding parts. While these changes are taking place, the extent of the breach is daily diminishing, by a general contraction of the surface. Then a fine blue pellicle is observed at the edge, which

increases in breadth, and at last covers the small remnant of the ulcer that is not closed by the contraction just mentioned. This new-formed skin is named the Cicatrix ; which is, of course, always smaller in extent than the original breach of continuity. At first it is blue or purple, and very vascular, but afterwards it ceases to be so, and becomes dense, white, and bloodless, at the same time contracting still further.

Nature of the Granulating Action.

It is generally believed that the granulations grow up above each other by the effusion and organisation of lymph in successive layers, until the cavity is filled to the proper level. That then the thin pellicle on the surface begins to be thickened and formed into skin at the circumference of the ulcer, while the granulations below shrink, owing to absorption of their constituent substance, and draw the edges of the breach together.* There can be no doubt, however, that this opinion rests on inaccurate observation, and is quite incorrect. The subject was carefully investigated by the French Academy of Surgery ; and the essays of Louis, Fabre, Pibrac, &c.,† leave hardly anything to be desired for its elucidation. They shewed that there is never any real reproduction of lost parts, with the exception of bone, which in some circumstances is regenerated. The skin also ought, perhaps, to be excepted ; but the difference as to appearance and properties between the substance that constitutes a cicatrix, and the ordinary integument of the body, would rather lead us to regard this structure as a new formation. In all other cases it will be invariably found, that when the cure is completed there either remains a depression corresponding to the loss of substance, or such a contraction of the neighbouring parts as compensates for the want.

The first step in the healing of an ulcer seems to be subsidence of the surrounding swelling, if any exists ; and then a gradual emaciation, chiefly of the fatty, but also of the other tissues concerned, so as to render the skin more lax and easily drawn together. Hence it is that the cicatrix when first formed appears to be on a level with the neighbouring surface, though there may have been a loss of substance to a considerable depth. After the cure is completed, the usual plumpness returns, and the cicatrix will then be found depressed. Ulcers being thus healed by contraction, and

* Sir A. Cooper's Lectures, by Tyrrel, vol. i. p. 160.

† Mém. de l'Académie de Chirurgie, t. iv. and v. 4to ed.

not by any new production except what forms the cicatrix, the reason appears why their cure is accomplished more readily in parts that are lax, than in those which are comparatively fixed from adhering to the subjacent bones. The sore which remains after the removal of nearly the whole scrotum by sloughing or operation readily heals, with a very small cicatrix; while injuries of the scalp attended with loss of substance are repaired very slowly, and with a considerable depression at the part. The old stories of regeneration following removal of the lip for cancer, and destruction of the *glans penis* by sloughing, when inquired into and stripped of their exaggerations, are found to admit of easy explanation. In the former case, it is apt to appear that the disease occupies a larger extent of the part affected than it really does, from the morbid growth taking the place of, and pressing aside the sound textures. Hence the whole lip may seem to be involved and taken away by operation, while, in fact, a comparatively small portion only has been removed, and the remainder is ready to stretch out when its surface is drawn together by the granulating action, and thus, in a great measure, supply the loss of substance. Something of a similar description occurs in sloughing of the tongue or *glans penis*, —the swelling which attends the preceding inflammation making the part concerned appear much larger than it really is, so that, though the destruction is only partial, it may be thought complete. On all occasions, when a sore heals by the granulating process, there is great risk of supposing that the cavity is filling up, while, in truth, the bottom remains at the same level, and appears to rise from the surrounding skin descending towards it, just as the banks of a river seem to glide past the observer, who is carried smoothly on by the current. The best evidence as to this is afforded by sores seated over bones or other fixed points, between which and the surface of the granulations, the distance is not found to increase. In the old way of performing amputation, by cutting all the parts of the limb nearly on the same level, a large granulating surface resulted, which, if successive layers of organised structure were really formed by it, should have grown out into a bulbous shape. But, instead of this, it is well known that just the opposite condition took place, and that the surrounding skin was drawn in a puckered form closely round the bone. In short, the healing of an ulcer should be regarded as an action not of effusion or new formation, but of absorption or contraction; and it will be found, on considering the treatment of ulcers, that whatever causes

swelling of the part concerned impedes, while everything productive of an opposite effect tends to hasten, the progress of recovery.

When an ulcer is examined by dissection, the cellular substance lying under and around its base is found more or less infiltrated and condensed with lymph; but the granular covering is very thin, being limited to the crust effused in the first instance, and subsequently organised. The texture under the thin pellicle of the granulations is liable to be distended with blood or serum, which occasions a state similar to œdema, and elevates the surface of the ulcer so as to present the appearance which is commonly named *proud flesh.* Morbid nutrition may occur in the same situation, and then growths of various size, form, and appearance spring up; but these, so far from having any share in the process of cure, tend to delay or entirely prevent it. It may be asked, why should not the natural structures be regenerated, if diseased ones are thus formed? But it should be recollected, that all we know of the laws of nature is learned from observation; and mere analogy, in opposition to well-ascertained facts, affords no reason to expect any reproduction of lost parts in the human subject. There are other circumstances under which regeneration takes place more readily—that is, when the parts concerned do not communicate with a breach in the surface of the body. An interstitial process then goes forwards, consisting of the effusion and organisation of lymph, which frequently forms a substitute, nearly or altogether similar to the original texture. The nerves, tendons, periosteum, bones, and ligaments are thus frequently restored, after suffering more or less extensive destruction.

Treatment of Ulcers tending to Heal.

So long as the granulating process proceeds, as has been described, it requires no local treatment, except what is necessary to prevent it from being disturbed by external irritation. Great attention to cleanliness ought to be observed with regard to the parts surrounding the sore, which should be frequently washed, and shaved if there are any hairs upon them. There is no use or propriety in scrubbing the surface of the ulcer itself, as is frequently done, since the pus affords a natural covering to protect it, and would be sufficient for the purpose, if it were not that the risk of injury from contact with external bodies, and the unseemliness of an ulcer exposed to view, require some artificial covering. Old linen, lint, or charpie, may be employed for this purpose; and perhaps the last-

mentioned article is the best, as, being more porous, it allows the pus to pass readily through its interstices. Whatever be the covering employed, it should be either spread with some unctuous matter, at least where it lies upon the edges of the ulcer, to which it is otherwise apt to adhere, and consequently injure them when removed, or, what is better, moistened with water, and prevented from drying by a piece of oiled silk laid over it. The ulcer requires to be dressed frequently, in proportion to the quantity of discharge. Once in the twenty-four hours is generally sufficient, but twice is often necessary—and sometimes the interval may be extended to two days or more.

One granulating surface may unite with another, when they are placed in contact, and retained together. The cure is thus sometimes greatly abridged, and at other times very troublesome adhesions may result, as when the respective surfaces of the fingers are ulcerated from any cause.

Treatment of Contractions caused by Cicatrisation.

When the ulcerated surface is extensive, and the integuments surrounding it are easily drawn together, as is the case after burns of the throat, great deformity and inconvenience are frequently occasioned by the contracting effect of the granulating action, rendering the cicatrix so small as to keep the parts about it permanently displaced and immoveable. Mere division of the contraction is hardly ever sufficient to remedy the evil, as the firmness of the cicatrix prevents the edge of the cut from being separated much, and any relaxation thus gained is almost always lost during the subsequent cicatrisation. An ingenious method of treatment was proposed by Mr Earle,*—namely, to cut out the cicatrix entirely, and then unite the edges of the wound laterally, if possible, by the first intention, but, at all events, so as to prevent contraction in the longitudinal direction. In favourable circumstances for its performance, this operation answers extremely well, but these are unfortunately seldom met with; and it is obvious, that if the cicatrix be broad, or of much extent in proportion to the size of the part affected, no benefit could be derived from its excision. It is an important fact, that the cicatrix, while still recent and vascular, may be extended by mechanical force cautiously and perseveringly employed, since deformities from contraction may thus be not only prevented but sometimes completely remedied. In the case of a

* Medico-Chirurg. Trans., vol. v.

girl, whose fore-arm, in consequence of a burn, was drawn up almost close to the arm, a complete cure was effected by one of my pupils, in the course of a few weeks, through the use of an iron wire splint, fitted to the shape of the contracted limb, and gradually expanded.

Treatment of Ulcers not tending to Heal.

Ulcers are prevented from healing by many different circumstances, which have led to a variety of complicated classifications for their arrangement. As the effect of these has generally been to perplex instead of simplifying the subject, it seems better to adopt an easier system ; and the three following heads will be found to comprehend the whole :—

1. Ulcers which are prevented from healing by defect of action.
2. Ulcers which are prevented from healing by excess of action.
3. Ulcers which are prevented from healing by peculiarity of action.

The circumstance which has occasioned the ulcer, the part of the body in which it is situated, or the peculiarities of the patient's system, sometimes at once denote its nature ; but in general this can be learned best by carefully examining the distinctive features that are presented, in respect—1. to the surface of the ulcer, which may be level with the surrounding skin, depressed below it, or elevated above it, concave, smooth, or irregular ; 2. the shape of its edges, which may be regularly curved and smooth, or eroded and angular, round or sharp, undermined and inverted, or thick and everted ; 3. the quantity or quality of its discharge, which may be purulent, bloody or serous, thick or thin, copious or scanty, fetid or inodorous ; 4. the kind and degree of the pain proceeding from it ; 5. the condition of the surrounding and subjacent parts, which may be hard or soft, inflamed or natural ; and, 6. the mode of its cicatrisation, which may proceed from the circumference to the centre, or from the centre towards the circumference,—on a level with the surrounding surface, elevated above, or depressed below it.

Ulcers prevented from Healing by Defect of Action.

The defect of action has been thought to depend sometimes upon a real want of power, and at others upon a want of disposition to exert the power that exists. The ulcers of this kind have accordingly been divided into Weak, and Indolent or Callous, which exhibit different characters, and require different treatment.

In Weak Ulcers the surface is generally higher than that of the

surrounding skin, and exhibits large flabby granulations, which are either of a dark colour, like that of venous blood, or pale and œdematous. The edge is smooth and flat, or gently rounded ; the discharge thin, watery, and generally profuse ; the pain usually inconsiderable. The parts surrounding and subjacent, constituting what is called the stool or base of the ulcer, are soft and free from any indurating effusion. The cicatrix forms round the margin, and is generally at first elevated above the proper level, to which it usually descends afterwards, owing to the contraction that takes place subsequently to its completion.

This kind of ulcer occurs in parts which possess weak powers of action, either on their own account or on that of the system. The general weakness is most frequently observed in children ; but may be induced at any age, by deficient nourishment, an unwholesome atmosphere, &c. The local weakness may depend on the cause which occasioned the ulcer, or simply on the long duration of the healing process. With regard to the first of these, it may be stated, that whenever the solution of continuity is effected by means which injure the parts concerned, as by lacerating, bruising, or burning them, it displays the characters of a weak ulcer ; and, as to the second, it is sufficient to observe, that every ulcer tends to become defective in action during the process of cure ; so that, if considerable in size, it is sure, sooner or later, to display the features indicative of this condition.

The treatment of weak ulcers consists in employing pressure, together with stimulating and astringent applications locally ; and, if necessary, strengthening the system by the administration of wine, bark, bitters, and nourishing diet. Of the local applications, ointments used to be most employed ; but the preference is now generally given to various metallic solutions, such as those of the sulphate of zinc, acetate of lead, and sulphate of copper, in the proportion of from one to three grains to the ounce. It seems probable that the moist nature of these applications is of more consequence, in producing the effect desired, than the substances dissolved in them, since water alone answers very well for the purpose. These lotions or washes, as they are called, ought to be varied occasionally, as habit lessens their effect. Pressure is always useful, and ought to be exerted by proper bandages. Several folds of moistened lint should be laid over the sore ; and between the lint and bandage it is proper to interpose a piece of oiled silk, to prevent the lotion from soaking away and leaving the sore dry.

The Indolent or Callous Ulcer is distinguished by a smooth surface, generally depressed, of various colours, brown, gray, or white, having no appearance of granulations, and looking as if varnished; a viscid tenacious fetid discharge; a circular or oval figure, with little irregularity; and thick white edges, seeming as if composed of accumulated cuticle. There is no circumscribed hardness in the immediate neighbourhood of the ulcer; but there is always diffused swelling of the limb in which it is seated. The swelling is not soft and yielding like that of common œdema, but firm and incompressible. The pain is very variable. There is no appearance of cicatrix, so long as the sore retains its indolent characters.

Ulcers of this description are confined almost exclusively to the legs of people advanced beyond middle age, and constitute a very troublesome subject of surgical practice, as they are very apt to recur after being healed. Some people, partly from the fear of injuring the system by suppressing a long-continued discharge, and partly from the despair of effecting a permanent cure, bestow little care on the treatment of these complaints; but this is wrong, since the most unpromising cases, under proper management, are often remedied; and there is hardly any disease which interferes more seriously with the patient's comfort, or unfits him more for the active duties of life. This kind of sore is chiefly met with in the labouring poor, and often produces the greatest misery, by impeding or altogether preventing the exertions which are required for maintaining the patient and his family.

The treatment generally thought the most useful, is rest in the horizontal posture, conjoined with pressure. The merit of fully establishing the advantage of pressure, is due to Messrs Whately and Baynton, the former of whom recommended a calico or flannel bandage, to be tightly applied from the toes upwards to the knee; and the latter, in addition to this means, to make the compression more effectual, employed straps of adhesive plaster, an inch or two broad, and long enough not only to encircle the limb, but to cross each other far enough to obtain a firm hold when drawn round the leg, and across the sore. The limb having been shaved, a slip of plaster is applied an inch or two below the sore; then another a little further up, so as to leave a third of the former one exposed; then another in the same way; and so on, until not only the ulcer, but an inch of the skin above it is covered. Lastly, a cotton roller, three inches broad, and five yards long, is applied from the toes upwards. Unless the discharge is profuse, the sore

need not be dressed oftener than once in two days. Under this treatment the swelling of the limb subsides,—the callous edges speedily disappear,—the surface of the ulcer granulates, discharges a purulent secretion, and cicatrises as an ordinary healing sore. The good effects of this treatment are usually ascribed to its stimulating the actions, which are supposed to be in an indolent state, and thus exciting a healing action in the sore. But the true explanation probably is, that it allows the healing action to proceed, by inducing an absorption of the swelling which occupies the limb, and which, though of secondary origin, inasmuch as it proceeds from the continued irritation of the ulcer, when once established, must oppose the contraction requisite for the process of cicatrisation.

I have accordingly found that the application of a large blister, covering the sore and a considerable part of the limb, greatly hastens the cure, and frequently proves sufficient for its completion, without the use of any other means. The immediate effect of this practice is removal of the swelling, so that the thick callous edges disappear, and the surface of the ulcer coming to be on a level with the surrounding skin, granulate, and cicatrises. In favour of this treatment I may mention, that it is more speedy and lasting in its effects than the strapping process—and much more economical, which is a point of great importance in treating the poor people who usually suffer from the disease—since the expense of strapping and bandaging their limbs very often prevents the treatment from being undertaken.*

Ulcers prevented from Healing by Excess of Action.

These ulcers have an angry or irritable look, owing to redness of their own surface and that of the surrounding skin. In general they are deep, of a brownish-red colour, and shew no granulations —they are irregular in shape—their edges are abrupt and usually ragged—their discharge is thin, serous, and often tinged with blood. Sometimes they are superficial—of a regular circular form—and exhibit no redness except a bright line at their margin. The pain attending them is almost always acute. They form no cicatrix so long as they retain the irritable characters. Irritable or over-acting ulcers are met with in full overfed subjects, who possess strong powers of action, and in weak irritable individuals. They may also occur merely as the effect of continued irritation, whether direct or indirect.

* Contributions to the Pathology and Practice of Surgery, p. 42.

The treatment consists in removing all sources of irritation, and using local applications which have a soothing tendency. Of these, heat and moisture, as afforded by fomentations and poultices, are the best; and their effects may be increased by using decoctions of poppy heads, solution of acetate of lead with opium, &c. Scarification of the edges of the ulcer, or leeches, may also be employed if the symptoms are severe, but it is very seldom necessary to do so. Bleeding, purging, calomel, and opium must also be resorted to according to the state of the system, so as to reduce excessive power of action and allay inordinate irritability. In relieving the ulcer from irritation it should be recollected, that motion has a powerful effect in causing or increasing it, and rest therefore ought to be strictly enforced.

Ulcers of this kind sometimes go on progressively enlarging, and are then said to be Phagedenic. When the over-action runs still higher, so as to destroy the life of the part, it constitutes what is called a Sloughing Ulcer. When mercury was given profusely and indiscriminately, in the treatment of venereal affections, it frequently induced such irritability as to make the sore assume phagedenic or sloughing characters. The patients in crowded ill-ventilated hospitals sometimes suffer from sloughing of their sores, attended with great destruction of the parts, or even fatal effects on the system. This Hospital Gangrene, as it is named, no doubt depends on the unwholesome atmosphere exciting preternatural irritability, and the treatment, therefore, essentially requires removal from the sphere of this deleterious influence. Other means will hardly be required if this be afforded, while the most careful administration of dressings and medicines will be of little avail so long as the grand desideratum is withheld. The age, strength, and previous circumstances of the patient may render it proper to vary the subordinate treatment by bleeding or stimulating, fomenting or cauterising. The hospital gangrene, as described by military surgeons, is not met with in civil hospitals to such a formidable extent; but a degree of the same effect, proceeding from a similar cause, is of frequent occurrence, and demands similar measures for its remedy.

In the forms of this affection which I was accustomed to see in former days, when the accommodation for surgical patients in the Royal Infirmary of this city was not sufficiently extensive, the first sign of its commencement was the appearance of one or more small superficial circular excavations, looking as if scooped out from the surface of the sore. They had a yellow or grayish-yellow colour,

and were devoid of granulations. Rapidly extending and coalescing, they entirely altered the aspect of the ulcer, which, at the same time, partly from swelling of its edges, and also from phagedenic action, became much increased in extent. A soft spongy slough of a dirty white colour next presented itself, generally extending over the whole surface, but varying in thickness. While these local changes were in progress, and apparently keeping pace with them, a general derangement of the patient's system was observed. He acquired a sickly yellow aspect, lost his sleep and appetite, and had an extremely quick pulse, together with the foul tongue and all the other symptoms of feverish disturbance. By and by, in the course of a week or ten days, the state of matters usually began to improve; the sore gradually regained its former characters, and, though often very much increased in size, healed more quickly than might have been expected, the general health undergoing a corresponding change. After trying a great variety of treatment without any sensible benefit, I came to regard the attack as one that should be trusted very much to spontaneous recovery. It was more troublesome than dangerous; even in the cases of compound fracture and amputation, hardly, if ever, leading to the loss of limb or life, but merely protracting the cure. A poultice seemed the best dressing that could be applied until the sloughs began to separate, and the only internal remedies that appeared useful were laxatives in the early stage to regulate the bowels, and a moderate allowance of wine in the more advanced period of the complaint.

Ulcers prevented from Healing by Peculiarity of Action.

It was formerly thought that all the ulcers which resisted the means of increasing and diminishing action, owed their obstinacy to peculiarity of disposition, whence they were named specific sores. It is now well ascertained that a very large proportion of these so-called specific ulcers depend on some irritation, direct or indirect, after the removal of which they readily heal.* The most common cause of irritation in such cases is that which proceeds from suppression of the secretions, especially those of the digestive organs, the remedy of which consists in correcting the patient's errors in regimen, and subjecting him to an alterative course of medicine. For this purpose, nothing answers so well, in general, as restricting the diet, increasing the exercise, and prescribing daily doses of the carbonate of soda with rhubarb,—as half a drachm of the former,

* Abernethy on the Constitutional Origin of Local Complaints.

and six grains of the latter. The local treatment must be regulated by the condition of the ulcer as to excess or defect of action, but, generally speaking, lotions answer best, and of these the black wash, which is formed by decomposing calomel with lime water in the proportion of eight or ten grains to the ounce, and a weak solution of sulphate of copper, are the most useful.

Ulcers depending on the suppression of other habitual discharges, such as the menstrual, should be treated on the same principle, the particular means employed being varied according to the circumstances of the case.

When an ulcer continues to exist without any local or constitutional irritation to account for its doing so, the obstinacy may then be fairly referred to peculiarity of action. This morbid disposition is either confined to the ulcer, or exists generally throughout the system. Specific ulcers may accordingly be divided into Constitutional and Local.

Specific Ulcers present every variety of character. Their colour is usually gray, yellow, or purple ; their surface is sometimes deeply excavated, at other times elevated into fungous growths, presenting a sort of cauliflower appearance. Their discharges vary without limit as to colour, consistence, and quantity. The pain attending them is also very variable. The cicatrix exhibits various peculiarities in the mode of its formation, often commencing in the centre or at one side, and shooting over the remainder of the area—or going on at one part while the ulcer extends at another—and being in general considerably depressed below the surrounding surface, but not unfrequently elevated into projections above it.

The treatment varies with the nature of the general or local disposition which maintains the ulcer. If it appears that the patient's system has been disordered by mercury, the best means of promoting recovery are blistering of the sore surface, with the internal use of the iodide of potassium in small doses.

When the ulcer resists every means employed to induce a healing action, it is generally named a Cancer, the only remedy for which is extirpation. This may be effected by caustics, the ligature, and the knife. The first-mentioned means are proper where the sore is of no great depth, or of much extent ; the second where hemorrhage might be profuse, and could not be easily restrained ; while the third, or excision, is the easiest, least painful, and most certain method in the great majority of cases.

The different morbid dispositions which have now been considered

may exist together, so as to complicate the appearance and treatment of ulcers. An indolent ulcer of the leg, by intemperate living and the excitement of motion, frequently, in addition to its own characters, presents some of those which depend on irritation, such as redness and pain. These subside under the influence of poultices and rest, so as to leave the indolent characters alone. Specific ulcers shew every variety of under-acting and over-acting characters, according to their particular circumstances, and consequently require a variety of treatment besides that which their peculiar nature demands.

CHAPTER VI.

SUPPURATION.

Pus.

SUPPURATION consists in the formation of a peculiar fluid named Pus, which possesses the following characters:—It has nearly the consistence of cream: it has a pale yellow or straw colour; it occasions no smell while cold, but when heated to the temperature of the body emits a faint odour; it is opaque, and when examined by the microscope, appears to be composed of globules suspended in a transparent fluid; it sinks in water; it is coagulated by muriate of ammonia; and sometimes has its fluidity diminished, merely by removal from the body.

It was formerly believed that pus originated from putrefaction or degeneration of the blood and other fluid or solid parts; and a loss of substance or breach in the continuity of the solids was thought essential to its formation. It is now ascertained that pus is produced by a peculiar secreting action of the capillary vessels, which may occur without any solution of continuity. The mucous membranes, after being inflamed, frequently take on the suppurative action; and the purulent secretion of granulations may be quoted as another instance, since the pus is discharged here at once from the vessels. A granulating surface in several respects bears much resemblance to a mucous membrane, and may be regarded as a temporary covering instead of skin. Pus varies very much in consistence, colour, and other properties, from admixture of blood, the nature of the part, or the constitution of the patient.

Suppuration may be divided into superficial and interstitial.

Superficial Suppuration.

Superficial suppuration is that which takes place from the surface of the mucous membranes, as the urethra or conjunctiva. It was not admitted by the older surgeons, who accounted for the dis-

charge in such cases either by calling it mucus, or by referring it to some solution of continuity out of sight.

Purulent discharge from a surface, or a running, as it is generally named, is in the first instance accompanied with symptoms of the inflammatory action which preceded it, particularly heat and redness, which require measures of a soothing kind, such as bleeding, purging, warm fomentations, &c. By and by these subside, and the discharge alone continues, when the treatment must be altered to the use of stimulating and astringent applications, such as metallic washes, ointments, &c.

Interstitial Suppuration.

When suppuration takes place within the texture of the body, there results a collection of pus, which is named an Abscess. The matter sometimes is diffused through the interstices of the cellular texture; but more frequently is contained in a circumscribed cavity, which is limited by the effusion of lymph, forming a sort of capsule or containing bag.

When inflammation terminates in the formation of an abscess, the pain loses its intensity, and changes to a throbbing sensation. The tension also diminishes, but the swelling does not subside; on the contrary, it rather becomes more prominent; and when pressed upon by the fingers gives the feeling of a fluid contained in a bag, which is called Fluctuation. The particles of a fluid being equally moveable in all directions, when pressure is made at one part, an impulse is necessarily communicated over the whole surface; and if the fingers be placed at different points, the extent of the cavity may be ascertained. When the collection of matter is small, or thickly covered, a very nice and practised sense of touch, the *tactus eruditus,* is requisite for recognising fluctuation. If the abscess, on the other hand, be very large, simple percussion at one point is sufficient to detect it. When the suppuration is extensive, or seated in any important region of the body, such as the joints or cavities of the trunk, its commencement and progress are usually attended with rigors of various degrees and duration.

It has been questioned whether or not suppuration may occur without being preceded by inflammation. There can be no doubt that the symptoms of over-action previously, are often very slight, and they probably ought not to be regarded as essential; but in the great majority of cases, suppuration certainly is a consequence of inflammation.

The contents of an abscess may be removed by the powers of the system in two ways. They are sometimes simply absorbed into the mass of circulating fluids. This happens most frequently in the case of abscesses connected with the periosteum and lymphatic glands, as those of the groin ; and it is worthy of notice, that, when such absorption takes place, no bad symptoms follow. It is now generally believed, that when pus is formed within reach of the cavities of vessels, as in a recent wound where the effusion of lymph is imperfect, or within the interior of veins, so that it may enter the circulation without passing through the modifying operation of the capillaries,—a portion is apt to gain admission, and, preserving its characters so as to be distinguishable by the microscope, become the source of purulent deposits in other parts of the body. Another, and in my opinion much more probable explanation of such secondary purulent deposits, as they are called, is, that, in certain local suppurations, the whole mass of circulating blood sustains an alteration in its condition predisposing it to secrete pus ; just as during inflammatory fevers, while lymph is thrown out from the capillaries, it separates more readily than usual from the blood during coagulation, and presents the buffy coat. As the globules of the blood and pus differ but slightly from each other, it is easy to conceive that some slight change, attending this morbid condition, may occasion the appearance which has been thought to denote the presence of pus in the blood. Much more frequently the pressure of the matter causes absorption of the surrounding parts, and, in conformity with the general law that those yield to it most readily which lie nearest the surface, the covering of the abscess becomes thinner and thinner, so that the skin alone remaining, it projects from the distension of the fluid, and becomes so thin as to allow the colour of the pus to be perceived through it. The abscess is then said to point, and soon afterwards, the absorption still continuing, an aperture takes place, which allows the contents to escape. A discharge of matter issues from the opening for some time afterwards, but gradually becomes thinner, and diminishes in quantity until a cicatrix is formed.

It is generally stated that this process of cure depends on a growth of granulations from the whole surface of the cavity, which is thus gradually filled up. But if this were the case, it is plain that there ought to be a permanent solid enlargement of the part concerned ; for pus does not proceed from the breaking down or softening of the natural tissues, as was formerly supposed, and is

merely secreted by the vessels into the interstices between them. It separates the muscles, condenses the cellular texture, and elevates the skin, so as to obtain room for its reception; but so soon as vent is afforded for its escape, all the parts that have been pressed aside resume their natural situation, the cavity of the abscess is thus at once greatly diminished, and the contracting effect of the granulating action which ensues upon its surface completes its obliteration.

Instead of waiting for the natural evacuation of abscesses, it is usual to make an artificial opening, in order to hasten the cure. This ought not to be done in general until the fluctuation is distinct, especially if the abscess be seated in a glandular texture, as the process of reparation is otherwise apt to be rendered slow and imperfect. On the other hand, if the abscess is left entirely to itself, the skin frequently becomes so thin and impoverished at the part where it points, that it does not possess sufficient power of action for uniting with the subjacent surface; the matter also may extend over a greater space; and the patient suffers much more pain than he would have done if the abscess had been opened. When the patient is in great suffering—when there is reason to believe that the matter is forming under some thick fascia, or other covering that resists its progress to the surface—or when the matter appears to be diffused in the cellular substance—it is improper to wait for pointing, and it is impossible to make an opening too early. When the suppuration takes place in a gland, or any morbid structure, it is proper to let the abscess either open naturally, or at all events be most completely formed before interfering with it. In other cases, so soon as the fluctuation can be distinctly perceived, and the abscess points, the opening should be effected.

After the matter begins to form, and before it is evacuated, poultices and fomentations are applied, as they are believed to hasten the process of suppuration.

Abscesses may be opened either by the knife or caustic. The former is infinitely less painful and more certain. The best instrument for the purpose is either a straight or curved sharp-pointed bistoury, which answers much better than the old-fashioned abscess lancet,—an instrument shaped like the common lancet, but of a larger size. The narrow blade of the bistoury allows the point to enter the cavity with little or no pain, and then being pushed through the skin from within outwards, at the part to which it is desired the incision should extend, quickly completes the aperture. If the parts to be divided are too thick for proceeding in this way, the knife may be carried through

them directly to the requisite extent. It is always right to make a large opening; and, as a measure for determining its size, the breadth of the part of the abscess which points may be taken, if it does not exceed an inch and a half or two inches. After the matter escapes, so far as it is induced to do so by the contraction of the parts containing it, a piece of lint should be placed between the lips of the wound to prevent them from uniting by the first intention; but care must be taken that it is not so thick or forcibly introduced as to confine the discharge, and consequently oppose the obliteration of the cavity. When the bleeding has ceased, a poultice should be applied, but not before, since a troublesome hemorrhage may otherwise ensue. In some situations, great difficulty is occasionally experienced in arresting the flow from arterial branches divided by the incision, from their resisting the efforts of pressure, and not admitting the application of ligatures, owing to the softened state of the texture surrounding the orifices. In such circumstances, the best method is to pass a needle through the integuments into the cavity, and then bringing it out so as to include the vessel in a ligature, which being tied, proves certainly effectual, and may be removed when it ceases to be required. The poultice may be continued for a few days to promote the escape of matter secreted by the surface of the abscess, and then simple ointment, or wet lint, supported with a proper bandage, should be employed until the cure is completed.

When caustic is used, it should be applied as if for making an issue; and in case it does not extend its effect through the whole parietes of the cavity, a knife may be pushed into the eschar or slough caused by its operation. Patients who could not bear the idea of having their sound skin cut, have sometimes comparatively little objection to this.

Some practitioners prefer caustic for opening abscesses, on the ground that, while making the aperture, it hastens the suppurative process. But if means for this purpose are required, there are others which can be used with more effect, and leave the opening to be made by the more eligible method of the knife.

When, owing to peculiarity of the part or patient, it is desirable to avoid making a breach in the surface, means should be used to promote removal of the matter by absorption. The best of these are blisters, followed by pressure. The cases in which they can be used with effect are chiefly those of slow suppuration in the glands, and under the periosteum.

Abscesses are said to be Chronic or cold when the symptoms of

inflammation which precede them are mild or not at all observable.

In such cases, the collection generally forms slowly and insidiously. so as not to attract attention until it attains a large size. Owing to the want of action that attends its origin, there is little effusion of lymph, and consequently little resistance to the extension of the matter, whence the swelling is often of an irregular figure, and readily changes its place according to the tendency of gravity. When the matter passes from one part to another, it constitutes what is called a congestive abscess. The contents of chronic abscesses are generally thin, and bear no small resemblance to whey, especially as they usually have flakes of curdy-looking matter floating in them. The superjacent skin is generally not altered in colour.

These abscesses have little disposition to evacuate themselves spontaneously, as the matter readily extends itself, and thus does not occasion sufficient pressure to induce absorption of the external parietes. It is hence the more necessary to make an artificial opening, but this cannot be done without some danger when the collection is large. The surface of the cavity, which not unfrequently is capacious enough to contain several pounds of fluid, sometimes inflames, and produces such violent constitutional disturbance as proves fatal in a few days. More frequently the bad consequence consists in a profuse and long-continued discharge from the morbid surface, by which the patient's strength is gradually exhausted, and Hectic Fever, as it is called, is excited. In this condition, the patient becomes excessively weak and emaciated; the countenance is extremely pale, with the exception of a red patch on the cheeks, which contrasts remarkably with the whiteness of the other parts of the face and especially of the eyes; the pulse is quick and weak; he complains, particularly in the evening, of burning heat in the palms of his hands and soles of his feet; his skin is dry and hot; and he suffers from nocturnal sweats, often together with diarrhœa.

This kind of disturbance is the usual result of continued irritation operating on a weak subject, and one of its most common causes is the discharge that follows the opening of a chronic abscess. It used to be supposed that the matter occasioned the fever by being absorbed into the mass of circulating fluids, but this opinion is now abandoned, and the effects on the system are attributed to the irritation which attends its secretion. Though the expression Hectic Fever is sanctioned by long use and universal acceptation, there appears to be good reason for laying it aside, since

it leads directly and unavoidably to erroneous ideas of the condition which it is employed to denote. Fever implies disturbance of all the corporeal functions; but in the hectic state, those of the stomach, brain, and many other parts remain unaffected. Instead of Hectic Fever, therefore, it would perhaps be better to use the expression of Hectic Irritation. The effect of this irritation is to weaken the system more and more; at length fever is really induced—the patient shivers—his tongue becomes foul—he loses his appetite—and speedily sinks under the disease.

A method of treating chronic abscesses was introduced by Mr Abernethy, which has generally been regarded as a great improvement, though in general of doubtful expediency. It consisted in drawing off, at first, only part of the contents by means of a trocar, allowing the wound to heal by the first intention, and then repeating the puncture, with the interval of two or three weeks, until the collection was so reduced in size, that the cavity could be safely laid open and healed from the bottom as an ordinary abscess. If the abscess is large, the patient should be confined to bed, and kept quiet for some days previously, and subsequently to the operation; for if these precautions be disregarded, even though the wound should heal by the first intention, there will be a risk of inflammation. Care should be taken to prevent the entrance of air, not because it possesses any power of direct irritation, but because it promotes putrefaction of the remaining matter, and in that way gives rise to the most violent disturbance. If there is reason to suppose that the abscess is connected with any incurable disease in the bones or elsewhere, it ought not to be opened, unless the cause of pain or some other serious inconvenience, since doing so could only accelerate the patient's fate, and bring the surgical art into discredit. Such abscesses often exist for years without suffering apparently any change, or giving the patient much inconvenience, but upon being opened speedily prove fatal.

Sinus and Fistula.

When an abscess is seated in parts the action of which is defective owing to local or general causes, the cavity that remains after its evacuation does not contract completely, but continues to secrete a discharge, which is generally thin and copious, and then constitutes what is called a Sinus. The surface, in course of time, becomes condensed and smooth, so as to resemble a mucous membrane rather than the granulated covering of an ulcer—and if the

discharge be copious, or any source of irritation exist, lymph is effused around the cavity so as to thicken its walls, and render them almost of cartilaginous hardness. In such a confirmed state, the sinus is named a Fistula; but this term is usually confined in its application to sinuses connected with the natural excretory canals, as the urethra or rectum, the contents of which, by passing through the preternatural channel, prevent it from closing, and cause thickening of its walls. This hardening, or callosity, was formerly thought to depend on a morbid disposition of the part, and to require extirpation as an essential step to the patient's recovery. The operations practised on this principle were extremely severe, and one of the great improvements derived from the more enlightened pathology of modern surgery is their entire disuse, in this country at least. It is now found to be sufficient for remedying the induration to remove the cause of irritation that induced it, the methods of doing which will be explained hereafter, in connexion with the different regions of the body which are apt to become the seat of fistula.

In treating sinuses, the objects are to promote granulating action on their surface, and to press their sides together. They are not healed by *filling up* any more than the original cavity of the abscess, but contract until they become obliterated, or close more directly by union of the opposite surfaces.

Great care must be taken to avoid confining the discharge of the sinus, since, if prevented from escaping, it distends the sides of the cavity; and, for the same reason, it is always proper to afford the matter a dependent opening for its escape, either by enlarging the one already existing, or making a new one. The most effectual method of proceeding is to lay open the cavity throughout its whole extent by incision; and it is sometimes necessary to resort to this practice when milder measures have failed, or the result of experience in similar cases authorises the surgeon to dispense with their trial. The patient, by means of nourishing food, together with all the other adjuvants to the recovery of general health, should, so far as possible, remedy weakness of action in the system, if there seems to be any fault in this respect. It is at all times of great consequence to prevent motion of the part affected. If the sinus is connected with any incurable disease, such as a carious bone that cannot be removed, or a malignant degeneration of the texture cancered, any severe measures would be obviously improper, and only those of the most soothing kind should be employed, with the view of affording that palliation which is all the case admits of.

CHAPTER VII.

DISEASED NUTRITION.

Tumours.

By Diseased Nutrition is understood an action of the capillary vessels, which, instead of preserving the tissue concerned in a natural condition, increases its size or alters its texture. The morbid growths thus resulting constitute the principal division of a most important class of surgical diseases, which are named Tumours. The term tumour implies enlargement of a part of the body beyond its natural dimensions, which may be owing to the effusion or accumulation of fluids, as in hydrocele; the displacement of organs, as in hernia; or morbid growths, as in wens.

Morbid growths include simple enlargements of the natural tissues, such as exostosis,—conversion of them into textures foreign to the healthy constitution of the body, such as cancer of the breast,—and the development of entirely new formations, such as fibrous tumours. Mr Abernethy used the term tumour as synonymous with morbid growth, and restricted its application "to such swellings as arise from some new production, which made no part of the original composition of the body."* As this would exclude many important enlargements of natural tissues which constitute tumours very deserving of attention, the more comprehensive definition that has just been stated seems to be preferable.

Morbid growths occur in almost every part of the body, but the glands and subcutaneous tissue are their most frequent seats. They are very variable in the rapidity and extent of their increase, but, generally speaking, grow quickly in proportion to their size; and other things being equal, usually enlarge most vigorously when their situation is dependent. Anything that irritates, or tends to inflame them, promotes their increase; and opposite circumstances are attended with opposite effects; rest, low

* Abernethy on Tumours, p. 6.

diet, cold applications, and leeches, lessen the activity of their enlargement.

When inflammation attacks a morbid growth, it either terminates in resolution or mortification, or leads the way to some of the actions which have been described. But, whatever the action may be, it almost invariably proceeds in a peculiar sort of manner, so as to prevent a cure, or any satisfactory termination. Morbid growths deserve great attention, not only on account of the distressing consequences which thus ensue, but also in regard to the deformity and inconvenience which they occasion directly by their presence. They may be removed in three ways,—viz., by absorption, mortification, and excision. In order to determine on the choice of these means, and execute them properly, it is necessary to be acquainted more particularly with the different kinds of morbid growths.

Mr Abernethy's arrangement and nomenclature of tumours used to be generally adopted. He divided them into Sarcomatous and Encysted: the former being solid; the latter composed of a cyst containing matters of variable consistence.

Of late years, the microscopical investigation of morbid growths has been pursued with great assiduity, in expectation of its affording better characters for discrimination than those appreciable by simple inspection. But the hopes thus entertained have been very imperfectly realised, in consequence of the variations connected with diversity of texture; and it must be confessed that little, if any, practical advantage has been obtained from this source—while the trust reposed in it, by withdrawing attention from the diagnostics presented by the sensible qualities, attendant circumstances, and histories of tumours, has in many cases led to the most serious mistakes. It is not impossible that the microscope may yet penetrate the obscurity which now renders its observations so uncertain; and then the distinctive characters hitherto in use may be safely laid aside. But in the meanwhile, I believe that a surgeon will best discharge the duty which he owes to his patients, by endeavouring to make himself independent of any such assistance.

Vascular Sarcoma.

Of all morbid growths, the simplest and apparently most akin to the natural structure, is that which has been named Simple or Vascular Sarcoma. It seems to be chiefly composed of accumulated cellular tissue and blood-vessels. It sometimes exists as an independent tumour; but more frequently constitutes what are

called simple enlargements of natural parts, as the testicle, or thyroid gland. It produces little inconvenience, except what proceeds from its bulk; and is recognised by negative characters,—that is, by not manifesting the peculiarities which distinguish the other kinds of morbid growth.

Of all tumours, this is the one which yields most readily to means that promote absorption; and these, accordingly, are chiefly employed in its treatment. Of local applications, blisters and stimulating lotions, with ointments containing mercury, iodine, and the hydriodate of potass are the most useful,—more or less pressure being at the same time applied. Mercury and iodine are also very serviceable when administered internally so as to affect the system, care being taken that their use is not pushed too far, so as to injure the patient's health. If the tumour during the treatment becomes red or painful, a few leeches should be applied; and the utmost care is to be taken throughout, that the patient's secretions are duly performed. In this way, chronic enlargements of the glands, and simple sarcomatous growths existing independently, may sometimes be dispersed. Should they prove obstinate, and occasion much inconvenience or deformity, the best method of removing them is excision, if the circumstances of the case, as to the situation and connexions of the tumour, do not forbid it. Some attempts have been made to arrest the morbid nutritive action, or cause sloughing of the mass proceeding from it, by tying one or more of the nutrient arteries; but experience on this subject has hitherto been very limited and unsatisfactory.

Under the head of Vascular Sarcoma may be arranged the excrescences named Wart, and Polypus. The former is a growth from the skin, the latter from the mucous membranes. In both, the natural textures appear to be rather preternaturally extended, with more or less softening and relaxation of the structure, than subjected to any degeneration or morbid alteration of composition. Warts are met with most frequently on the hands, and on the thin skin which surrounds the outlets of the body—as the eyelids, lips, and prepuce. It must be here remarked, however, that most of the excrescences on the face, which are usually designated warts, really possess an entirely different nature, being altogether new formations which have nothing in common with the growth under consideration, except some resemblance of form, and require to be carefully distinguished, since the treatment which is proper for the one sort proves most injurious when applied to the other.

Warts admit of removal by the action of stimulants, such as strong acetic acid, or the concentrated solution of sulphate of copper; also by caustic, the ligature, and the knife or scissors. The first and last mentioned means are the best for the purpose—the former being employed when the growth possesses a soft consistence and broad base, the latter when it is firm and prominent.

Polypus is a growth of softer consistence, but varies considerably in this respect according to the part from which it proceeds. The lining membranes of the nose and uterus are its most frequent seat; and next to them the rectum may be mentioned. It has usually a grayish-yellow colour, and possesses little vascularity, with still less sensibility. The inconvenience caused by its presence is chiefly of a mechanical nature, but, nevertheless, often sufficiently distressing.

The treatment is either palliative or radical—the former consisting in the use of astringent applications, and the latter in removal by evulsion, ligature, or excision. The expression polypus, like that of wart, is often loosely and inaccurately employed to denote growths of a totally different character, merely from their occupying the same situation.

Fibrous Sarcoma.

Under this title may be comprehended the tumours which have been named Fibro-Cartilaginous and Pancreatic Sarcoma. These growths possess a structure varying in density from that named Fibro-Cartilage by anatomists, to the softer consistence of some glandular textures, as that of the pancreas. They usually possess a nodulated, or what mineralogists call a botryoidal surface, and a compact homogeneous consistence, with the exception of small cells, variable in size and number; they are of a yellowish or gray colour; and are enclosed in a capsule, which separates them from the surrounding parts. They are met with in all parts of the body, but occur most frequently in the vicinity of the parotid and mammary glands, which they compress, and thus cause to be diminished by absorption, so as at last sometimes to occupy their place, and appear to superficial observers a morbid degeneration of the glands themselves. They are seldom attended with any inconvenience except what their size occasions, but occasionally become the seat of uneasy sensations; they are not prone to any other action than that of their own nutrition; and after attaining a certain magnitude, remain stationary, but in the course of time are apt to assume a more troublesome disposition.

The only efficient treatment is removal by the knife, and this in general may be easily done. The incision should be made freely through the integuments, and fairly down to the substance of the tumour; and in detaching the cellular connexions, the knife should be directed upon the surface of the growth, since it may be cut with impunity, while the neighbouring parts by doing so are protected from injury.

Adipose Sarcoma.

One of the most common solid tumours is that which has very properly been named the Adipose, or Fatty Growth. The appearance of its structure is precisely what the title indicates, and bears the closest resemblance to that of the ordinary subcutaneous fat. It is generally of a somewhat darker, though sometimes of a lighter yellow colour, and not so granular; it is surrounded by a thin capsule, which keeps it distinct from the neighbouring parts, unless they happen to be pressed together by the patient's clothes or otherwise, when adhesions occur between them; it is generally of a more irregular form than would be supposed from its appearance while covered by the integuments, and frequently sends out long processes in various directions. The skin covering such tumours is not discoloured, but usually shews some inequalities of surface, corresponding with the lobules of the growth. The adipose sarcoma occurs in every part of the body, and at all periods of life, but is most frequently met with under the integuments of the trunk in young females, and middle-aged people of both sexes. There is frequently more than one tumour in the same person. It tends to increase according to the principles already explained, and occasionally attains a monstrous size, so as to weigh ten, fourteen, or even twenty-seven pounds, which was the weight of one removed from the parietes of the abdomen by Sir A. Cooper.* It generally occasions no inconvenience except what is caused by its bulk, but sometimes becomes the seat of uneasy sensations, and weakens, in some way not yet explained, the voluntary action of the neighbouring muscles. It is not prone to any morbid action or degeneration, but has in some cases been found altered in this way.

In treating adipose sarcoma, it is found that the means which promote absorption have little or no effect, and that excision is the only mode of affording the patient relief, unless the tumour happens to have a very narrow neck, when the ligature may be employed,

* Medico-Chirurg. Trans., vol. xi.

but not so advantageously as the knife, since the root or part seated under the skin necessarily remains, and is apt to prove the source of a future growth. The capsule which surrounds the growth hardly adheres to it, except in the circumstance above mentioned of having been subjected to pressure, so that the dissection is extremely easy and readily performed. The incision should be made freely down to the substance of the tumour, which is then to be drawn outwards and detached from the cellular connexions by repeated applications of the knife directed upon its surface. The finger-like processes, often sent out on different sides, must be carefully disengaged in the same way from the sort of sheaths in which they lie, by alternately gently pulling and slightly scarifying them.

Cystic Sarcoma.

Tumours are occasionally met with, which, when divided, exhibit a cellular structure, the compartments being extremely variable in their relative as well as absolute size, and in the nature of their contents. Sometimes they are perfectly fluid, at other times viscid or glairy, and their colour is of every kind, though most frequently yellow or white. Different cells of the same tumour often have dissimilar contents. Sometimes the tumour is entirely composed of cysts, at other times a variable proportion of solid substance is interposed between them, and this possesses the characters of fibrous sarcoma.

This Cystic Sarcoma, as it is called, tends to increase, and does not appear to have any limits to the size which it may attain, as may be seen in the case of ovarian dropsy, which depends upon the great development of a cystic structure in the ovary. It is not prone to degeneration, and does not occasion almost any uneasiness, except by its bulk, causing deformity, impeding the movements of the patient, or pressing injuriously on important organs. It occurs most frequently in glandular structures, especially the ovaries, testicles, and mamma, but is also occasionally observed under the integuments of the trunk, more particularly the upper part of it, and rarely on the limbs. It is recognised by its imperfect fluctuation and bluish colour.

The only treatment that this growth admits of with advantage is excision, which is effected with very different degrees of facility, according to circumstances. If the tumour be seated in a texture of limited extent, such as the mamma, it may be very readily removed. But if it commences simply in the cellular texture, it is apt to spread so widely, and contract such adhesions, as to render

an effectual operation very difficult, or even impracticable. In such situations, it is therefore the duty of the surgeon to press upon the patient the propriety of early extirpation.

Carcinomatous Sarcoma.

The morbid structure which is designated Carcinoma, is distinguished by its great firmness, and almost cartilaginous hardness, whence it used to be, and still is, occasionally called Scirrhus. The dense texture which characterises carcinoma does not constitute a uniform homogeneous mass, but has numerous interstices which are filled with a yellow or brownish-gray friable substance, and it is generally extended in the form of diverging bands which spread into the neighbourhood. When the disease occurs in an organ of limited extent, as a lymphatic gland, it does not tend to diffuse itself beyond the confines of the part concerned, the structure of which it affects more uniformly than when seated in a tissue less distinctly bounded. As the disease proceeds, however, it at last breaks through this obstacle, and then spreads as has been already described. The carcinomatous action extends itself in a different way also, namely, along the absorbent vessels and glands of the part originally affected. It would seem, in general, to take this course more readily than to pass directly from one tissue to another. As to the mode in which the morbid action is transmitted along the absorbents, there exists a difference of opinion—some thinking that matter must be conveyed through the vessels; others that the mere irritation of the disease, propagated along the coats of the lymphatics, is sufficient to account for the sympathetic affection of the parts in question. The fact is certain that glands, in the course of the absorbents leading from a carcinomatous tumour, are often thoroughly tainted, though the original mass remains solid, and contains no fluid matter in its interstices.

Carcinoma occurs most frequently in glandular or secreting structures, and the mamma, lips, skin, tongue, stomach, and uterus may be mentioned as its most common seats. It seldom commences in people below middle age, and from forty to fifty may be mentioned as its favourite time of attack; but it is occasionally observed in persons much younger than this, even in those who are not more than twenty or thirty. I am not aware of its having been ever met with before puberty. The predisposition of parts to carcinomatous action seems to be increased by their suffering chronic enlargement and induration; and the disease is generally called into

existence by some irritation either direct or indirect. Of the former, blows and bruises may be mentioned as those most frequently concerned, and of the latter, suppression of habitual secretions. The cessation of the menstrual discharge, though a natural event, almost always occasions more or less disturbance of the system ; and this occurring at a period of life when, other things being equal, the tendency to carcinomatous action seems to be strongest, has been thought to exert great influence in exciting the disease. The disposition to the morbid action is sometimes so strong, that it begins without any local cause, and is then apt to occur in more parts of the body than one. The patient usually betrays the unhealthy tendency by a peculiar greenish-yellow complexion, and anxious expression of countenance.

The characteristic symptoms of carcinoma are hardness and pain. The hardness exceeds that of any natural texture, except bone and cartilage. The pain is usually of a lancinating or darting kind, not constant, but attacking the patient by fits. Sometimes it is described as hot or burning, and is then usually more fixed.

Carcinoma tends to inflame and ulcerate. If the skin is affected, this takes place on the surface, in which a breach opens, and gradually extends. If the disease be more deeply seated, an abscess is formed within it, which discharges its contents, and leaves a cavity ready to take on the same sort of action as the ulcer which is established in the other way. In both cases the ulcer makes no advance towards reparation, but proves truly specific and incorrigible, and is named a Cancer. The process is occasionally reversed, the morbid formation taking place round a sore, which in the first instance does not present any malignant characters. The base and edges of cancer are of course extremely hard, since the excavation is formed in a carcinomatous mass. The ulcer is very irregular in the shape of its margin and surface ; sometimes it is deep, and as if scooped out of the part; at other times, cauliflower-looking excrescences rise from it, and hang over the edge. The discharge is generally profuse, bloody, and fetid. The pain is usually incessant, and of various kinds, but sometimes gives very little trouble. The patient loses appetite and sleep ; complains of wandering pains and weakness of the limbs ; becomes gradually exhausted ; and at last dies, in general rather suddenly, before the period which might have been expected from the progress of the disease. The rapidity of its course varies greatly, a few months being sometimes sufficient for its reaching a fatal termination ; while in other cases it

exists for years with little change, or even remains stationary altogether.

The treatment of carcinoma in its different stages has engaged more attention than perhaps that of any other surgical disease; and it has been repeatedly believed that means of correcting the morbid action were discovered. More careful observation has uniformly proved these expectations to be fallacious: and it must be admitted, that, so far as we know at present, there is no cure for carcinoma except extirpation. Much may perhaps be done in the way of prevention, by protecting those parts of the body most subject to the disease from the influence of irritation, at that period of life when the disposition to it exists most strongly. Tranquillity of body and mind, regularity in the secretions, and moderate diet, conduce to the same effect. The pain of cancer may be soothed by opiates, used both externally and internally. Hemlock poultices, lotions and ointments of acetate of lead, carbonate of iron, various preparations of arsenic, pressure, and an endless catalogue of applications might be mentioned, as having been more or less confided in for correcting the diseased action, and instituting a healing one. They sometimes afford temporary relief, but *never* effect any permanent alteration to the better. The only proceeding that deserves at all to be considered a remedy for carcinoma, is removal of the morbid structure.

This may be done sometimes by caustics, such as corrosive sublimate and the chloride of zinc, applied in substance or formed into a paste; but these means are very apt to destroy the disease only partially, and consequently do harm instead of good, by exciting greater activity in the portion that remains. The knife or scissors effect the extirpation most easily and securely. It would be subjecting the patient to useless pain, and bringing surgery into discredit, to attempt extirpation in cases where the extent or connexions of the disease prevented its complete removal. It is also incumbent on the surgeon to search very carefully for glands in the course of the absorbents that may have become affected, since it appears that the result of operations for carcinoma, when the glands are affected, is almost invariably unsatisfactory, however perfectly they may seem to be taken away. The reason of this probably is, that the glands do not participate in the disease, unless the system be strongly disposed to it, and consequently their removal, however freely and effectually executed, cannot prevent the patient's relapse. In performing the operation, it is not sufficient to take away the

mere indurated mass, as the surrounding parts are always more or less vitiated in their disposition. If the disease is seated in a distinct organ, the whole of it ought always to be removed, however small the part of it which is actually affected may be; and when the tissue concerned is not in this way circumscribed, the knife should be carried as wide as possible from the tumour.

Medullary Sarcoma.

The title of Cerebriform is perhaps more correct than that of Medullary, to designate the species of sarcoma which is now to be considered; but as the general acceptation of the latter term has fully sanctioned its use, there would be no advantage in attempting a change.

The medullary growth bears a close resemblance to the substance of brain, not only in appearance, but also in chemical composition. When divided, it seems as if composed of irregular masses, enclosed, and separated from each other more or less completely by thin membranous septa, which become more obvious after the soft pulpy mass is removed by maceration, or the action of alkalies. The consistence of the tumour, though in general pretty nearly that of the brain, is sometimes much denser; at other times more approaching fluidity than the natural state of this tissue. Its colour, also, is subject to much variety, from almost pure white to the darkest red,—the difference in this respect seeming to depend on the quantity of blood which circulates through the growth, or is effused into its interstices. The proportion of blood is sometimes so great, that the tumour, when divided, resembles a coagulum; but more frequently it exhibits merely spots or blotches, irregularly interspersed through the substance of the mass.

Occasionally, but not frequently, this morbid growth appears in the form of a cyst, the parietes of which, though of little thickness, are composed of the cerebriform structure, while the cavity is occupied by clear serous fluid, usually of a greenish colour. It is then apt to be mistaken for distension of a bursa or an abscess; especially as the most common seat of the disease in this form is the upper and inner part of the thigh.

Medullary sarcoma may occur in any tissue of the body, but originates most frequently in the bones, testicle, mamma, and eye; next to which the subcutaneous cellular texture, brain, and lymphatic glands, are the most common seats of its commencement. Like carcinoma, it extends both into the neighbouring parts and

along the absorbents. It occurs at all ages, but is most frequently met with in infants, and adults between twenty and forty. It is recognised by its soft semi-fluctuating consistence, which is sometimes very apt to make the swelling be regarded as depending on the presence of a fluid. The superficial veins become very much enlarged; but as they do so, though hardly to the same extent, in nearly all chronic enlargements, this diagnostic mark must be considered merely as a corroboration of the more positive evidence which is afforded by the consistence, situation, and history of the tumour. The pain that attends it is extremely uncertain, being in some cases very severe, in others hardly perceptible.

This morbid growth, after attaining a certain size, tends to open and protrude the soft substance composing it. It does so by sloughing, the formation and evacuation of an abscess, or simply ulceration. In whichever of these ways the bursting, as it is called, takes place, the integuments covering the tumour first beome red and adherent, then the breach is established, the substance of the tumour presents itself to view, and fungous excrescences usually shoot out from the cavity. The discharge that ensues is always profuse, and generally very thin, excessively fetid, and occasionally bloody. In some cases, pure blood is effused from time to time in considerable quantity; and hence, Mr Hay of Leeds, who first gave a general description of the disease, named it *Fungus Hæmatodes*. This term cannot be applied with propriety, and leads to much confusion, because the fungous protrusions of medullary sarcoma do not always, or even generally bleed, while a bleeding fungus may appear without being preceded by the medullary formation. There is nothing peculiar in the texture of such bleeding excrescences; and if the term *fungus hæmatodes* be retained, it should have its use confined to express simply the fact of there being a fungous protrusion from which blood issues.

Medullary sarcoma, in its advanced stage, is attended with a greenish-yellow complexion, and general emaciation. If allowed to proceed, it sooner or later destroys the patient by gradual exhaustion. The rapidity of its course, like that of carcinoma, is extremely variable, and cannot be foretold according to any data with which we are as yet acquainted. The treatment of this disease is, in general, very unsatisfactory. All local applications and internal remedies are admitted to be totally useless, and the only mode of affording relief is excision; while, owing to the tendency of the morbid action to diffuse itself into the neighbouring parts, what-

ever be their nature or texture, as well as the taint, or unhealthy disposition of the system, the operations for this purpose are very often followed by relapse. Unless, however, the case does not permit complete ablation of the tumour, or there should be indications of the disease existing in other regions of the body, or the pulse is quickened by the local irritation—in which case, so far as I have observed, recovery hardly ever follows an operation—it is the duty of the surgeon to give the patient the benefit of the chance that is thus afforded; and, of course, the sooner that this is done the better, after the nature of the malady has been ascertained. The prospect of permanent relief seems most favourable when the disease is seated in the testicle or bones, and most hopeless when the eyeball is affected.

Nearly connected with this kind of growth is that which has been named Melanosis. The title was applied by Laennec to tumours possessing the same soft brain-like structure, but differing in regard to their colour, which, instead of being white, was either green or interspersed with red, dark brown, or black. In other respects, the diseases resemble each other so closely as hardly to require separate designations, affecting the same parts, following the same course, and requiring the same treatment. It may be remarked, however, that the morbid tendency, as shewn by extension, reproduction, or simultaneous formation at distant parts of the body, is not, in general, nearly so active in the melanotic as in the ordinary form of cerebriform sarcoma, and that the prospect of benefit from removal by operation is consequently not so unfavourable.

Scrofulous Sarcoma.

The morbid formation usually called Scrofula, presents different appearances, according to the tissue affected. In general, it constitutes rounded masses or tubercles, as they are named, which consist of a grayish-yellow, gritty, semi-organised-looking substance. It sometimes is not condensed and circumscribed in this way, but exists in a diffused state, so as to produce more or less change in the structure concerned. In the bones, it is confined to the cancellated texture, the interstices of which it fills. In the synovial membrane it produces a remarkable thickening, softening, and conversion into a sort of gelatinous consistence. In the lungs, lymphatic and mesenteric glands, subcutaneous tissue, brain, and *dura mater*, it occurs in the tubercular form. It is not attended with pain, and hardly produces any inconvenience, except by its

bulk causing deformity, or pressing injuriously on important organs.

The morbid formations generally remain stationary for a longer or shorter period, and then are either absorbed, or, as more frequently happens, suppurate, so as to constitute abscesses, containing thin sero-purulent fluid, with flakes of scrofulous matter floating in it. When the matter is discharged, the restorative process advances slowly and imperfectly; indolent sinuses or weak ulcers almost always result; and owing to the situation of the disease, or the nature of the tissues affected, as may too frequently be seen in regard to the lungs and bones, a cure is, perhaps, never accomplished.

The disposition to scrofulous action exists most strongly in childhood, from two to fourteen years of age; but traces of its effects are sometimes observed much earlier, and it would be difficult to prove that its operation does not occasionally continue in the most advanced age. The morbid tendency may be inherited as a peculiarity of constitution, and is usually associated with light hair, blue eyes, a fine skin, and florid complexion; whence scrofulous children often appear very healthy and thriving until they begin to suffer from the effects of their peculiar disposition. The earliest external indications of its presence are, in general, swelling of the upper lip and *columna nasi*, with tumefaction of the edges of the eyelids. Many exceptions occur in which all these signs are wanting; and the patient, though of dark complexion, and exhibiting in other respects characters quite the reverse of those just mentioned, betrays the strongest tendency to the disease.

The scrofulous diathesis or constitution is not always equally well marked in the parents and their offspring; and its effects are much modified by circumstances. Whatever has a weakening influence on the individual seems to incease the morbid tendency. Youth or sickliness of the parents—bad nursing—unwholesome or deficient food—and especially cold with moisture, may be particularly mentioned as causing or contributing to this effect; and as, indeed, sufficient to induce scrofulous action without the presence of any hereditary taint. Persons who possess a scrofulous constitution are generally more liable to other diseases, and suffer from them more severely, than those whose systems are more healthy in their disposition. It is usual to name all these affections scrofulous when they occur in such circumstances, and hence great confusion continually arises. In order to avoid this, it will be better

to restrict the use and signification of the term to those diseases which consist in, or proceed directly from, the morbid depositions which have been described as the result of scrofulous action.

In the treatment of scrofula, the first object should be to obviate the circumstances which increase the hereditary disposition, or supersede its effect. The child should be carefully nursed, warmly clothed, and supplied with a moderate allowance of wholesome nourishing food. Cod-liver oil has been found the most powerful means of invigoration that can be employed for this purpose, in consequence, no doubt, of its nutritive rather than of any real or alleged medicinal qualities. Indeed, the internal use of iodine, to which the agency of this oil has been ascribed, so far from being beneficial, appears very much opposed to the object in view. If necessary, mild means should be used to correct derangement of the intestinal secretions; but nothing is more injurious than to keep up incessant irritation of the canal by frequently administering purgative medicines, the necessity for which may almost always be advantageously superseded by proper regulation of the diet and exercise. Should the indications which have been mentioned, or the parentage of the patient, lead to the persuasion that the disposition to the disease is very strong, the place of residence, if cold and moist, ought, if possible, to be changed for one that is dry and warm.

When the scrofulous depositions are actually formed, the greatest care must be used to guard against the operation of all direct and indirect irritations, which might tend to excite their inflammation or suppuration. The means proper for this purpose depend on the part of the body affected, and will be explained hereafter; but on all occasions it is right to attend to the climate, the regimen, and the secretions of the patient. Local applications seem to have little power in causing absorption of scrofulous tumours; and it should be carefully recollected, that the exciting influence through which they prove beneficial, if not duly regulated, may occasion inflammation and suppuration. When the abscess is seated in a part of the body exposed to view, as the neck, it becomes important to determine what mode of treatment will render the resulting cicatrix least observable. Sir A. Cooper strongly recommended a small puncture to be made with a lancet so soon as any matter is formed, and that then the remaining scrofulous substance should be squeezed out. The result of many trials leads me to conclude, that it is seldom if ever possible in this way to effect evacuation completely.

And what seems to be the safest practice, is to let the matter be very fully formed before opening the abscess, when a free incision should be made. Various drugs are used empirically under the specious pretext of producing a gradual improvement on the patient's constitution. The muriate of lime is one of these; and there are people weak enough to believe the assertion, that it sometimes requires several years to effect any salutary change. Such practice is merely a cloak for quackery, and as such, is not less useless to the patient than disgraceful to the profession. It was formerly believed that a miraculous power of curing scrofulous diseases, by simply touching the patient, belonged to the kings of England from Edward the Confessor downwards, whence the common name of the disease still in use, viz., the King's Evil. The ceremony was performed at the commencement of summer, during which season there is a strong tendency to spontaneous recovery; and this may account for a superstition so absurd.

Encysted Tumours.

Encysted Tumours, or Wens, as they are called when of large size, consist of two parts—1. A bag or cyst of variable thickness, whence they have their title; 2. A quantity of fluid, semifluid, or solid matter forming its contents. They are distinguished, in reference to the nature of their contents, into meliceritous, atheromatous, and steatomatous, accordingly as they possess the consistence of honey, putty, or lard; steatomes often contain, mixed up with the lardy-looking substance, a quantity of hairs, which seem to grow from the inner surface of the sac.

Encysted tumours are of all sizes, but generally between those of a pea and walnut. They are seated immediately under the skin or mucous membrane, and chiefly abound on the head. They are also met with about the organs of generation, but not nearly so frequently, and still more rarely over the limbs. It has been supposed that they are mere overgrowths of the natural sebaceous follicles or crypts, which lie in the skin; and Dr Sharpey has made known to me a curious observation, which would go to support this opinion, viz., that the substance, which may be squeezed out of the follicles in question, contains numerous small hairs, which can be readily seen through a microscope of moderate power. In some cases, the cyst is obviously of this origin, having an aperture in the skin of a size proportioned to its own; but these cases must be regarded as

exceptions, and the completely subcutaneous position, the occurrence in the ovaries, and elsewhere, not in the neighbourhood of sebaceous follicles, and the usually entire, imperforated cysts of these tumours, afford good reason to regard them as altogether new formations.

Encysted tumours are sometimes, but very rarely, absorbed; and local irritation, as that of a blow, especially when it ruptures the bag, occasionally excites the action which effects their removal in this way. More frequently they remain stationary after attaining a certain size, or gradually enlarge, adhere to the skin, inflame, suppurate, and open. When the tumour inflames, the surrounding cellular substance becomes engaged, and diffused swelling, occasionally of large extent, ensues, attended with severe pain and constitutional disturbance. In such circumstances, a free crucial incision should be made through the affected part, and then a poultice be applied until the sore granulates.

The best remedy for encysted tumours in their ordinary condition is excision. When the tumour is seated under the scalp, its cyst generally adheres so very loosely, that the operation may be performed almost instantaneously, and with extreme facility, by running a knife through the long direction of the tumour, so as to divide the bag and superjacent integuments, and then pulling it away with forceps, or turning it out with the handle of the knife. If the tumour is large, and has been subjected to pressure, the skin usually adheres to it at the most projecting part; and when this is found to be the case, an elliptical portion must be removed so as to include the conjoined integument and cyst. In other parts of the body, the bag usually adheres by its whole surface to the surrounding tissue, and must then be either regularly dissected out, or if small, punctured, emptied, and touched with caustic.

General Observations on Tumours.

Though a very large proportion of the tumours met with in practice may be readily referred to one or other of the kinds that have now been described, it must not be supposed that the characters and disposition are always distinctly marked. Various combinations and gradations of structure, as well as properties, frequently present themselves, so as to render the diagnosis difficult and uncertain. In general, however, it is still possible to determine the predominant features, and form a correct opinion as to the nature of the

disease. But tumours also degenerate or change their condition, in respect both to substance and action. Thus fibrous growths, after remaining for many years firm, circumscribed, moveable, and devoid of pain, may become partially or completely softened, confused with the surrounding textures, fixed in position, and the seat of fungous excrescences. Similar changes are observed in the cystic, vascular, and even adipose growths. It would hence be often difficult to recognise the original nature of tumours presented in practice; but this is of little consequence, since, whatever it may have been, the existing characters must regulate the opinion and practice. Thus, as already stated, fibrous growths may, for a long period of years, retain their simple unoffending nature, together with its characteristic features, and at length undergo a change so as to assume the condition of cerebriform tumours, when they are found to constitute no less unsatisfactory subjects of treatment than if they had originally possessed the same malignant disposition.

This degenerating process sometimes occurs in a reproductive form, as is observed in the case of a tumour not unfrequently met with in both sexes at the time of life when youth is passing into maturity, and also, though more seldom, at both earlier and later periods, and which I have been long accustomed to describe under the title of Recurrent Fibrous Tumour. It generally occurs on the trunk, and especially on the dorsal region. The texture is usually white and somewhat fibrous looking, but sometimes can hardly be distinguished from the adipose formation, from which, indeed, it has in some cases been found to differ only in having a slight admixture of cellular substance, rendering it more white and firm. There is at first no pain or other unpleasant symptoms, and the patient usually retains good general health. The operation for removal, in these circumstances, is readily undertaken, and executed without any difficulty or immediate bad consequence. But, sooner or later, after the wound is healed, another growth, or more frequently several of the same kind, appear in the neighbourhood; and if these be removed, they are speedily succeeded by new productions, of which the consistence is softer, the enlargement more rapid, and the distinction from neighbouring parts less complete. They also become painful and inclined to ulcerate and fungate, and finally prove fatal to the patient.

In examining tumours with the view of ascertaining the nature

of their structure, some practitioners are wont to explore their substance by introducing into it a flat needle, plane or grooved, to permit the contents, if fluid, to escape ; and there may occasionally be so much difficulty as to warrant this practice. But, in general, all such liberties should be carefully avoided, as dangerous, from their tendency to excite the morbid disposition of the part, and less worthy of confidence than the information obtained by careful manipulation.

CHAPTER VIII.

BLOOD-VESSELS.

ARTERIES.

THE two great arterial trunks, the aorta and pulmonary artery, agree generally in structure and function, but differ remarkably in two respects. The branches of the former unite or anastomose freely with their neighbours, while those of the latter continue unconnected from their origin to their termination; and the coats of the aorta are prone to morbid action, while those of the pulmonary artery are hardly ever known to suffer from it. It is the aorta alone which affords subject for surgical practice.

The arterial tube is composed of three coats—1. The external or cellular; 2. The middle or fibrous; and, 3. The internal or serous. The first of these consists merely of condensed cellular texture, and is therefore not recognised by some as a distinct tissue, being regarded rather as a modification of the cellular sheath which envelopes other organs of the body. But the larger arteries and veins, where lying contiguous, have usually a covering of this kind in addition to the one in question, which, from its compactness, strength, and constant existence, ought certainly to be considered an essential constituent part of the vessel. The middle coat is composed of circular fibres, which, from their appearance and properties, have been referred to the elastic tissue; but also possess a contractile property. When examined in a large artery of the human body, or in the artery of a large animal, as the horse, they are distinctly extensible and resilient, so as to resemble the *ligamentum nuchae* of quadrupeds, and other similar structures. The elastic property of this coat must tend to preserve the vessel of a certain size, in opposition to the distending force of the blood, and the effect of any vital contractile power resident in the arterial tissue. That the arteries do possess such a power cannot be denied, since during life, and even for some time after death, at

least after the extinction of sensation, they contract much beyond the limit determined by their elasticity, whenever they are freed from the distension of their contents. The internal coat is distinguished by its thinness and smoothness; it is probably lubricated by a secretion from its own surface,—and resembles the membranes which line the cavities of the body, whence it is named the Serous coat.

All of these coats are vascular, and capable of performing the actions, whether healthy or morbid, which are exercised by the nutritious system of other parts; but the internal one is most subject to disease, and generally seems to be the source of alterations from the healthy structure, when they occur in the other constituent parts of the vessel. The actions which take place in it most frequently and readily, are effusion of lymph and diseased nutrition.

Effusion is induced as an immediate effect of various local irritations, such as pressure or wounds; on which circumstance are founded the various methods of obstructing arteries that have been proposed in the treatment of disease. It is ascertained from experiments made on dogs and horses, that, if an artery be subjected for some hours to the pressure of a tight bandage encircling the limb, the canal of the vessel sometimes becomes impervious. This effect results more surely when the sides of the artery itself are directly compressed; and Dr Jones discovered, that, when the internal and middle coats are divided, lymph is effused so copiously that obstruction frequently ensues, though the constriction be not continued after the division is effected. Desault had ingeniously contrived to do this by tying the vessel tightly with a firm round ligature, which making no impression on the tough external coat, but dividing the soft yielding ones within, could be removed so as to leave the former entire, and the latter completely cut. Various attempts have been made to obliterate the arteries of the human subject by such means. Assalini employed little forceps, the blades of which could be approximated with regulated force by a screw passing through the handles. Mr Travers conjoined pressure with division of the inner coats, by tying a ligature tightly with a slip-knot, and removing it from a few hours to two days afterwards. These ingenious and reasonable trials occasionally proved successful in practice, but the results have been very irregular. The obliteration of human arteries, though accomplished by the same process, appears to be not so readily induced or completed as in the lower animals. And there are few situations in which the vessels are sufficiently acces-

sible to admit of the necessary manipulations for effecting a temporary obstruction. All proceedings with this view are therefore now abandoned, and the method invariably followed consists in tying the vessel firmly with a small round silk ligature, which is left to be detached by the ulcerative absorption instituted through the irritation caused by its presence; the effusion of lymph that directly succeeds its application sealing up the cavity both above and below, so as to prevent hemorrhage during the process of separation.

M. Amussat of Paris contrived another method of obstructing large arteries, which generally succeeds in the lower animals, and has also been executed with success on the human subject. It consists in seizing the bare coats of the artery transversely with two pairs of forceps, and then, separating the two instruments from each other, so as to rupture the internal coats, and throw them into folds. The effect of this procedure is interesting in respect to the pathology of the arteries, but will not probably be preferred in practice to that of the ligature.

Lymph is also effused from the arterial coats as a consequence of inflammation; and the spontaneous obstructions which thus ensue deserve much attention. Though probably not very uncommon, they escaped observation until lately, and are yet far from being generally known. The inflammation may be limited to a small part of the vessel, or affect nearly the whole of the arterial system. The circumstances immediately concerned in its production are unknown; but it is observed to be nearly confined to adults at or beyond middle age, having a bad habit of body. According to its extent and violence, the patient feels pain in the region of the vessels concerned, which is aggravated by pressure or motion, and attended with more or less fever. As, from the depth of the vessels, there is no external appearance of disease, these symptoms are usually referred to rheumatism, and medical aid is not required until inconvenience begins to be experienced from the obstruction in the circulation which ensues; at least such has been the case in nearly all the instances of this occurrence hitherto recorded. The impoverished limb becomes cold and numb; and if stimulating means be employed to rouse the weakened actions, they readily excite inflammation, which speedily runs on to gangrene and mortification. On dissection, the vessels are found contracted, thickened in their coats, and firmly plugged with a dense, brown, fibrinous coagulum. The internal coat is sometimes ruptured or irregularly lacerated, so as to impede the channel of the vessel.

Obstruction of the vessels with coagulum used to be considered a regular consequence of mortification; but it is now ascertained to be by no means a common occurrence; and when it does happen, ought probably rather to be regarded as a cause than an effect of the mortification. Instead of the disease leading to the death of the part, there is reason to believe that it sometimes terminates in recovery, owing to the blood passing through anastomosing vessels, which gradually enlarge, so as to convey adequate nourishment. It is now generally believed that arteries may be obstructed so as to produce the effect just described, by vegetations from the mitral valves of the heart, carried along by the current of blood through the aorta and arrested in the smaller vessels.

Opportunity is seldom afforded to treat the primary inflammation, and its diagnosis would not be easy. In case of its being discovered sufficiently early, the proper remedies would be local bleeding and fomentations, with calomel and opium given internally. After the obstruction is completed, which may be learned by the coldness, numbness, want of pulsation, and history of the case, the utmost care must be taken to protect the weakened part from depression on the one hand, and excitement on the other. It ought to be warmly clothed, but guarded against external heat, and all other stimulants. Should mortification ensue, amputation ought to be performed above the obstruction, unless a line of demarcation appears lower.

Diseased nutrition of the internal coat is a very common occurrence, especially in advanced age and unsound constitutions. The consequence of it is a deposition either of a soft pultaceous substance, which is named its atheromatous degeneration, or of calcareous scales, which constitute what is called ossification of the artery. In both cases, this morbid change affects principally the inner coat, a slender film on the surface of which remains as a lining to the vessel. The two diseased alterations generally exist together, in variable proportion. They affect most frequently the aorta, and arteries of the inferior extremities. They seldom take place extensively before the age of sixty; but are then so common, that they might almost be regarded as natural occurrences. Males are more subject to them than females. When a large artery becomes ossified it usually dilates, and thus transmits the blood more readily than might be expected from the thickening which it suffers; but the smaller ones become lessened in their capacity, so as to render the passage much less free than in the natural state; and

the patient complains of weakness, pain, and other uncomfortable sensations, with more or less emaciation in the part of the body where the vessel is distributed.

Wounds of Arteries.

When an artery is wounded, the blood issues from it with great force in a stream, which is either continuous, or varied by successive pulsatory jets, according to the size of the vessel, and the aperture made in its coats. Unless the artery concerned be very large, or particularly circumstanced, as will be explained hereafter,—in which cases the hemorrhage does not cease until the individual has suffered a fatal depletion,—the flow of blood gradually diminishes, and after a time ceases, when the wound heals as it would have done in other circumstances. Various explanations have been offered to account for the spontaneous cessation of arterial hemorrhage. Petit (1730) referred it to the coagulation of blood, first without and then within the orifice of the vessel, so as to form a sort of cork or stopper to it. Morand (1736), in addition to coagulation, insisted upon there being also contraction of the mouth of the artery, both as to length and width, so that it assumed a conical form, which retained the clot. Pouteau (1760) rejected the preceding explanations, and referred the whole effect to injection of blood into the cellular substance. Dr Kirkland (1763) maintained, to the conviction for a long while of most surgeons in this country, that the process consisted in shrinking and obliteration of the wounded vessel up to the first branch that came off above the injured part. In 1807, Dr Jones proved, by a full and conclusive course of experiments, that none of these opinions were correct,—that the process in question was a complicated one,—and that it consisted of various distinct steps. He ascertained that, in the first place, the extremity of the artery contracted somewhat, and withdrew itself by retraction ; that then the blood was injected into the surrounding cellular substance, especially that of the sheath, and coagulated there, after which a coagulum formed first on the outside, then in the interior of the orifice of the vessel ; and that, lastly, lymph being effused from the cut edges of the arterial coats, became gradually organised, so as to complete the obstruction. In the course of time the artery contracted up to the first branch, and the clots were absorbed, when the cure might be considered complete. When the artery which has been wounded is prevented from retracting by its firm connexion with the neighbouring parts, or by

being only partially divided, or when the surrounding cellular substance is either very dense or very lax, this process is impeded, and the hemorrhage proves more obstinate than in ordinary cases. On the contrary, when an artery is not cut, but torn across, it seldom bleeds at all, even though of large size, because the external or cellular coat being the last to give way during the stretching of the artery, when at last ruptured, is elongated beyond the internal and middle ones, and instead of resuming its relative situation with regard to them, collapses into a conical form, so as effectually to close the orifice. This explanation I ventured originally to give on the authority of experiments repeatedly performed, and as affording a more satisfactory explanation of the fact than those previously offered to account for it, viz., that arteries retract more when torn,—that the edges of the orifice are killed by the violence, and therefore induce more speedy coagulation of the blood,—and that the internal coats are more extensively ruptured than the external one, so as to form irregular folds or projections into the cavity. Every opportunity of ascertaining the truth by actual examination, and they have not been few, has tended to confirm my opinion, shewing that the internal and middle coats terminate abruptly by a smooth circular edge, as if cut by a ligature, and that the external one forms a conical bag containing coagulated blood.

In some constitutions there is a remarkable disposition to bleed, so that the slightest wounds become troublesome, or even dangerous. This hemorrhagic tendency is generally observed most distinctly in children, — is associated with both fair and dark complexions, — is frequently hereditary, and can be discovered only by experience of its effects.

The means employed artificially for conducing to the cessation of hemorrhage, may be referred to the ligature, pressure, and styptics. The use of the ligature was introduced by Ambrose Paré in the latter end of the sixteenth century. He, and still more his successors, applied it injuriously by including a portion of the surrounding tissues to give it a secure hold. Paré employed large broad-bladed forceps, called crane-bill from their shape; but the instrument generally preferred was a curved needle, which, being thrust through or around the vessel, together with the parts adjoining, subjected to the ligature a mass not only quite superfluous, but which likewise was apt to occasion great inconvenience by shrinking subsequently so as to render the ligature loose, by delaying its separation, or by exciting inflammation. Mr Bromfield (1772)

pointed out the propriety of tying merely the coats of the vessel, and introduced into general use for this purpose the Tenaculum, which had been previously recommended by Cheselden. It consisted of a sharp, curved, round needle fixed in a handle, and was employed to transfix and draw out the mouth of the artery, so as to let the ligature be tied about it. The common dissecting forceps, until lately, almost superseded the tenaculum, as rendering the insulation of the vessel more easy and complete; but are now little used, in consequence of the more convenient instrument, known by the title of "catch forceps," having been introduced. The best material for the ligature is that sort of silk named "purse twist." It ought to be waxed previously to being used.

When the artery wounded is of large size, it must be tied both above and below the opening, as the anastomosing branches would otherwise maintain the hemorrhage from the inferior orifice. If it is necessary, in order to apply the ligatures, to expose the artery more fully, this should, if possible, be done by dilating the original wound, since there is apt to be much difficulty in finding the aperture when the surgeon cuts down on a different side of the vessel from that which is punctured.

In tying an artery which has bled repeatedly, it is necessary to beware of mistaking for the orifice of the vessel a fibrinous cylindrical extension of it, the ligature of which could not produce any permanent or beneficial effect.

Pressure may, on many occasions, be employed to suppress hemorrhage more conveniently than the ligature, as when the artery is but small, or lies over some unyielding part which can afford good counter-pressure,—or is much branched and freely connected with neighbouring arteries of large size, so that several orifices would require to be tied,—when it is situated so deeply that the ligature could not be applied without a serious operation,—or is in a state of ulceration. In wounds of the hands and feet, especially the palms of the former, and soles of the latter, no method is so convenient for stopping bleeding as pressure. Lint or sponge may be employed to effect the pressure; but the former is on many accounts preferable. Folded portions of it, successively increased in size, constituting what are called graduated compresses, ought to be applied over the bleeding vessel, and secured by a proper bandage. Unless the first one is placed directly on the orifice of the artery, the subsequent pieces, however firmly compressed, will have little effect, and therefore the wound should if necessary be dilated sufficiently

to admit the lint. When the hemorrhage takes place into a cavity, the parietes of which are firm and unyielding, it may sometimes be restrained by closing the outlets, so as to make the blood accumulate, and press upon the orifices whence it issues. Thus epistaxis, or bleeding from the nose, may be arrested, and also hemorrhage from the uterus in the early months of pregnancy, by plugging the nostrils and vagina. Bleeding from a leech-bite may be arrested by transfixing the wound with a sewing needle, and tying a thread tightly round it. In the same way was subdued a hemorrhage from the umbilicus of an infant, two weeks old, which I saw with Dr Begbie, and where the actual cautery had been used in vain, at the suggestion of the late Dr Hamilton, who said that the very few cases of the same kind previously seen by him had proved fatal. I passed two sewing needles crosswise as deep as possible through the conical cavity from which the blood proceeded, and then tied a thread round them.

Styptics are agents which, independently of any compressing effect, possess a power of checking hemorrhage. Of these may be mentioned the sulphates of copper, zinc, iron, and alumina, and the nitrate of silver ; strong spirits, oil of turpentine, and the actual cautery ; also soft spongy or powdery substances, such as dried lycoperdon, spiders' webs, and the agaric of the oak or amadou. This last constituted the famous styptic of Brossard, which possessed a very high reputation both in France and in this country towards the close of the last century. Before the proper principles for applying the ligature were ascertained and received, styptics were regarded as important means for controlling hemorrhage ; but they are now very little used. M. Amussat endeavoured to introduce a fourth mode of suppressing hemorrhage, which consists in twisting the mouths of the vessels. This *torsion* is effected differently, according to the size of the artery. When small, it is simply twisted ; when large, the internal coats are first pushed back by means of one pair of forceps, while the extremity is tightly held by another. There can be no doubt as to the possibility of attaining the object on this principle ; but the expediency of doing so seems much more questionable. In the removal of a tumour, or any other considerable dissection, most of the arterial branches which throw out jets of blood, when divided, are speedily obstructed by the spontaneous process ; so that at the conclusion of the operation only the few of larger capacity requiring ligatures present themselves to view. Now, if every bleeding point had been subjected

to torsion in the first instance, it might thus seem to have been productive of great benefit, while, if applied to the larger vessels, it would not afford so complete security as the ligature. There is, accordingly, hardly any case in which the torsion proves useful except in wounds of the lips and cheeks, in which union by the first intention is very desirable, and almost certainly effected if the raw edges are placed properly in contact; while the coronary arteries and other branches of the facial cannot be tied without leaving threads apt to disturb the adhesive process, and, from the projection of their cut extremities beyond the surface of the wound, are very favourably situated for being twisted.

The bleeding, after it has been stopped, sometimes returns, when it is called secondary hemorrhage. If it has ceased spontaneously merely through the natural process, aided perhaps by syncope, which favours coagulation, the reaction of the system that ensues within an hour or two is apt to reinduce it. If arrested by pressure, it may return either at this time, or not until two or three days afterwards, when the feverish excitement which is then occasioned by the irritation of the wound tends to promote it; and if a ligature has been applied, the ulceration by which it is separated, if too rapid or extensive, may cause a bleeding from three days to as many weeks after the infliction of the injury. When the hemorrhage, therefore, is considerable, the local means of restraining it ought to be assisted by those which produce a corresponding effect on the system, such as rest, quiet, low diet, cooling purgatives, and whatever else may seem likely to moderate the force of the circulation.

It has been proposed to obviate the immediately fatal effect of excessive hemorrhage, by transfusing the blood of another individual into the veins of the patient. The experience hitherto acquired on this subject is very unsatisfactory. Indeed, the profuse depletion requisite to sanction such a proceeding is generally either accompanied with some incurable lesion of the system, or happens in circumstances which prevent the preparations for it from being completed soon enough. The simplest and best mode of performing the operation is to fasten a bladder to the canula of a small trocar, or a small silver tube made for the purpose, with its extremity rounded and slightly curved, which being introduced into one of the veins of the arm, will transmit the blood received in the bladder, as it flows from the vein of the person who affords it, and descends into that of the patient by its own weight, or the influence of slight

pressure exercised on the bag. The various ingenious and complicated apparatus, which have been contrived for effecting transfusion, are less manageable than this very simple one, which may always be constructed extemporaneously, and are objectionable on account of the extensive surface of dead matter to which they expose the blood, besides the risk of injecting air that attends their use.

Aneurism.

By the term Aneurism is understood a sac containing blood, fluid or coagulated, and communicating with the trunk of an artery.

There has been much dispute as to the constitution of the aneurismal sac. Sennert, Severinus, Hildanus, Wiseman, &c., supposed that all the coats of the artery were destroyed; and that it was formed by the surrounding cellular substance alone. Forrestus, Ruysch, Diemerbroek, &c., thought that the artery was merely dilated; while Morgagni, Lancisi, Guattani, &c., maintained, that aneurisms might result either from simple dilatation of the vessel, or from expansion of the cellular substance, and therefore divided them into true and false, accordingly as the artery was dilated or ruptured. Scarpa laboured to prove that the former do not exist, there being always rupture of the internal and middle coats. He has not succeeded in establishing his opinion to the full extent, but has certainly ascertained that it is extremely rare to find the artery entire, and forming the sac by its mere expansion.

Aneurisms may be conveniently divided into true and false. The former being those in which one or more of the arterial coats remain entire; the latter, those in which the vessel is completely ruptured, and the sac is formed by the surrounding cellular substance.

True aneurisms may be subdivided into those which consist of simple dilatation of all the coats, and those in which the external one alone remains entire. The former are very rare, and nearly confined to two parts of the arterial system—viz., the aorta, and arteries of the brain. It was formerly supposed, from careless observation, that aneurism of the aorta generally depended on dilatation of all the coats, but Scarpa shewed that, in the great majority of cases, the inner ones at least were ruptured. Exceptions, however, are sometimes met with, in which there can be no doubt as to the integrity of the vessel. In the arteries of the brain, the external coat is very thin, and affords little resistance when the inner ones are destroyed by disease. Aneurism is therefore very

rare in this situation, and when it does occur, depends on a general dilatation of the vessel.

The true aneurisms, in which the internal coats are destroyed, and the external one alone remains, are much more common. Their shape is not so regular as that of the last mentioned kind, since the external coat does not dilate uniformly round the circumference of the vessel, but usually expands on that side where the internal layers are ruptured, so as to form a sort of bag or pouch, which often has only a very narrow communication with the artery. The blood, which is received into this cavity, being removed as it were from the current of circulation, and exposed to a surface different from that of the healthy vessel, has a double inducement to coagulate, and accordingly does so, not all at once, but by degrees, thus forming a succession of concentric fibrinous laminæ, which line the aneurismal sac, and sometimes fill its cavity completely.

The arteries liable to this disease are almost all the great trunks of the system; and the parts of their course most frequently affected are those where they give off large branches, or are exposed by their situation to sudden extremes of tension and relaxation. The aorta at its arch, origin of the cœliac, and its bifurcation, the carotid at its division, the axillary, the external iliac at the groin, and the popliteal, are the most common seats of its occurrence. The first step in the production of this kind of aneurism is the formation of a breach in the inner coats, through which the blood, being constantly urged by the force of the heart, will pass and gradually distend the cellular coat into a bag. The tumour thus caused must press upon the surrounding tissues, and, by its constantly increasing size, effect such a condensation of their textures as will greatly strengthen its parieties. The original breach or crevice can generally be traced either to a blow, sudden extension, and such sorts of violence, or to violent impulse of the heart, attendant upon some violent exertion. It would be difficult for these means to rupture the internal coats of a sound artery, and if they did so, the speedy effusion of lymph would, we have reason to believe, in most cases at least, not only repair the injury, but obliterate the vessel. The artery, therefore, must in general be predisposed to suffer the process that has been described, by undergoing morbid degeneration of the internal coat, which renders it soft, easily torn, and unfit for performing the adhesive action. It has been already stated, that the inner and middle coats, though extensively altered in their texture, usually retain a thin membranous film, were it not for

which, the frequency of aneurism would doubtless be much greater than it actually is; since in that case there would be no occasion for any particular force to cause the breach, and it would occur as a certain consequence of the atheromatous alteration. Males are more subject to the disease than females, probably for the double reason that their predisposition to unsoundness of the arterial coats is stronger, and also that they are more exposed to the exciting influence of violent exertion, which may operate in determining the morbid degeneration of the artery concerned, as well as in directly causing the commencement of the aneurism.

In false aneurisms none of the coats remain entire, and the sac is formed, in part of its extent at least, merely by the surrounding cellular substance. They are generally of larger size and more irregular form than those which retain part of the arterial coats in their composition, whence also their contents are usually more completely coagulated. They are produced in two ways:—1. By the formation at once of a breach through all the coats of the vessels together, which may be effected either by wounds or other kinds of violence, or by ulcerative absorption; 2. By the sac of a true aneurism giving way, so as to allow its contents to escape, and distend the cellular substance into another bag. They are therefore divided into primary and secondary; they occur much more extensively over the arterial system than the true kind, since they not only result from these, but may arise from almost any artery that is wounded, and are frequently connected with vessels of inconsiderable size, such as the temporal or radial, while those of spontaneous origin are limited to the larger trunks. It has been alleged that aneurisms may also be formed by the opening of an artery into the cavity of an abscess, but without any well-authenticated facts to support such a doctrine. Arteries lying near the surface of sinuses not unfrequently ulcerate and bleed, whence it may seem likely that the same thing should happen while the cavity of the abscess remains entire. But as sound pathology rests upon well-ascertained facts, and not upon mere probabilities or assumed analogies, the conversion of abscesses into aneurisms, so far as is known at present, must be entirely discredited.

The signs of aneurism are, a tumour, subsiding under pressure, and returning when relieved from it with a whizzing noise and thrilling feel; pulsation, or rather a forcible distending throbbing; feebleness of the pulse, coldness, numbness, and weakness of the

parts beyond the disease, with œdematous swelling and pain, owing to pressure on the veins and nerves. When the aneurism is internal, these indications cannot always be recognised; but there are then generally others presented by the derangement of function, which is caused by the presence of the tumour impeding the action of neighbouring organs. These, however, are often not distinct, and at the same time are apt to be mistaken for the signs of other affections. The compressibility and pulsation of the tumour are the grand distinguishing characters of aneurism. They are most distinct when all the coats remain entire, because then the contents of the sac generally continue fluid; they are usually well marked so long as the external coat does not give way; but in false aneurisms, especially those of old standing, where the cavity is of large size and irregular figure, they are often very obscure, or altogether unobservable, owing to the extent of coagulation which is apt to occur in such circumstances. The pulsatory movement communicated to solid tumours by large arteries lying under them, is sometimes mistaken for the pulsation of an aneurism. This error will be avoided by recollecting, that in aneurism there is a general and forcible expansion of the whole sac, which can be perceived as distinctly when the tumour is embraced laterally as when the hand is placed upon it, while the deceitful impulse communicated by an artery to a tumour seated over it is merely a faint heaving upwards, which can be felt only when the surgeon presses in the direction of the vessel.

The natural course of aneurism is to grow larger and larger, to change from the constitution of the true into that of the false kind, and then to terminate in one of the following modes:—1. The contents coagulate, and are absorbed with, or without, obliteration of the vessel; 2. The artery becomes obstructed from coagulation or the effusion of lymph, and ulcerative absorption of the parietes of the tumour allows its contents to escape; 3. The sac opens by ulceration or sloughing, without previous obstruction of the vessel. The consequence of the two first of these terminations is a natural cure; that of the third, hemorrhage.

The treatment of aneurism consists in the use of means which tend to promote one or other of the two salutary processes just mentioned. The earliest attempts of this kind were directed with a view to the second of them, and their rudeness was equalled by their severity. The sac having been opened by cutting or burning,

its contents were turned out, and then the hemorrhage was restrained by repeated applications of the actual cautery, or some other powerful styptic. The introduction of the ligature for closing the mouths of arteries rendered this operation less painful, formidable, and uncertain ; but the difficulty and danger attending it continued to be very great, and the instances of recovery were extremely rare. Surgeons, therefore, turned their attention to the other mode of natural cure, and endeavoured to promote coagulation, by lessening the force of the circulation, through the effect of bleeding, low diet, and rest. This plan of treatment is usually distinguished as that of Valsalva. In addition to these means, Guattani recommended tight bandaging of the limb and tumour. Both methods were found to be extremely inefficient and uncertain, so that, though productive of less harm, they hardly afforded more benefit than the bloody proceeding which has been already described, and was in those days called the Operation for Aneurism. Amputation of the limb affected was therefore generally preferred, until it fortunately occurred to John Hunter (1785), and much about the same time to Desault, that an effectual method of causing coagulation would be to obstruct the artery above the tumour, or between it and the heart, so that thus the natural cure by coagulation and absorption might be safely and certainly induced.

The first trials of this new practice were hardly so successful as was anticipated, owing to the vexatious, alarming, and not unfrequently fatal hemorrhage which attended the separation of the ligature applied to effect obstruction of the artery. To obviate this cause of failure various contrivances were employed. The ligatures were sometimes drawn gently, lest they should cut the coats of the vessel, or a little roll of plaster was interposed with the same view between the knot and artery. Ligatures in the form of tapes were employed ; two or three of them were tied at some distance from each other, so as to compress a considerable extent of the vessel ; and ligatures of reserve, as they were called, being introduced under the artery, beyond those which had been tied, were left loose, so that they might be drawn tight if occasion should require. Notwithstanding all these precautions, bleeding still occurred as often as before, and proved, if possible, even more unmanageable. In despair, therefore, of obstructing arteries safely in this way, attempts were made to obliterate them without inducing the ulcerative absorption which was requisite for the separation of the ligature. Simple compression of the vessel, division of its

internal coat, and these two means conjoined, were tried for this purpose, but, as has been already stated, however promising they might appear from their results when practised on the lower animals, they were found to operate very uncertainly on the human arteries. Though these experiments thus did not lead directly to any practical improvement, they occasioned such a series of extensive and accurate observations, as had the happy effect of developing the true principles on which the bleeding caused by ligatures depends, and consequently shewed how it was to be avoided.

The great source of danger was found to proceed from the ulceration which detaches the ligature going beyond due bounds; and it was ascertained that the circumstances most conducive to this, were extensive separation of the artery from its neighbouring connexions, the interposition of much foreign matter between it and them, or the irregular puckering of the coats by flat or twisted ligatures, also laceration and contusion of the neighbouring tissues, caused by exposing the vessel with the fingers or any blunt-pointed instrument, which prevented union by the first intention, and excited inflammation. Such being the case, it naturally followed that the most effectual method of preventing hemorrhage was to use a ligature small, firm, and round, to pass it round the artery with as little disturbance as possible to its connexions, and to draw it tightly. It is to British surgeons, especially Messrs Jones, Hodgson, Lawrence, and Travers, that the profession are chiefly indebted for establishing these principles, which render the use of the ligature in the hands of a good operator equally easy and safe. To them, also, and more particularly to Cooper, Abernethy, and Liston, together with Drs Post and Mott in America, is to be ascribed the honour of leading the way, by their bold and successful operations, resting on the sound foundation of correct pathology, to the present treatment of aneurism, which contrasts remarkably, by its simplicity and safety, with the complexity and danger of the older methods.

The ligature should consist of waxed silk, and may in every situation be passed round the artery by means of a simple needle, after the sheath of the vessel has been opened merely to an extent sufficient for the purpose. One ligature only ought to be employed, unless the operator unfortunately denudes the artery too far, when he will diminish the risk of hemorrhage by introducing two threads, and tying them as far apart from each other as the detachment of the vessel permits. Mr Abernethy recommended this proceeding,

together with division of the artery between the ligatures, as proper on all occasions admitting of it, in order to take off the effect of tension, and place the vessel as nearly as possible in the same situation with one tied after amputation, where the chance of bleeding is known to be greatly less. But the difference of the two cases in all probability does not depend on tension, while cutting the artery between the ligatures is attended with considerable danger of hemorrhage.

After the principal artery of the limb is obstructed, the capillary anastomoses of the branches which arise above and below the impervious part, afford a new channel for the conveyance of the blood, and in general one so free that little apprehension need be entertained of bad consequences from imperfect circulation. The dilatation of the small vessels which occurs before the operation, owing to the natural channel becoming more or less impeded by the disease, also contributes to prevent this. It has been thought by Dr Parry of Bath, M. Maunoir of Geneva, &c., that new branches are occasionally formed, after a time, between the obstructed extremities of the artery, leading directly from the one to the other; but there can be no doubt that the alleged new vessels are really the old ones of the sheath, which become enlarged in a greater proportion than the neighbouring capillaries, conformably with a well ascertained law of anastomotic circulation, viz., that those branches have the greatest tendency to enlarge which lie most nearly in the course of the obstructed vessel. In order to prepare the new passage for nourishing the limb, it has been proposed to delay operating in recent cases; but the inconvenience attending a large sac, the contents of which are sometimes slowly and imperfectly absorbed, or excite irritation that induces suppuration, and the risk of the artery becoming diseased nearer the heart, more than counterbalance any slight advantage to be gained in this way.

However free the new channel may be, it is always inadequate, in the first instance, to afford the full supply of blood requisite for carrying on the various actions as usual. The limb becomes more or less cold and numb, and continues so for a longer or shorter time, seldom exceeding a few hours after the operation. It then rises in temperature even above that of the corresponding sound one, and becomes painful; at the same time slight pulsation may return in the aneurism. To prevent this overaction from proving excessive, and inducing mortification, all sources of additional

excitement, such as friction with stimulants, hot fomentations, and the like, ought to be carefully avoided. When the stage of reaction subsides, which it does in a day or two, the limb still remains weak and liable to suffer from slight irritation, so that even the pressure of its own weight occasionally causes sloughing. The support of a flannel bandage will therefore be proper, and, with a similar view, though low diet and even bleeding may be proper previously to the operation, the patient ought not to have his strength reduced to a very low ebb by much depletion, or very rigorous diet during the cure.

The bad consequences of this operation are gangrene, hemorrhage, and suppuration of the sac. When the sloughing is of limited extent, and dependent on pressure or feebleness of the patient's general strength, it ought to be combated by appropriate local and constitutional remedies; but when it is extensive, and the result of general inflammation of the limb, amputation should be performed without delay, as high at least as the artery has been tied. There seems to be reason for suspecting that the mortification sometimes depends on the principal vein becoming obstructed, in consequence of the irritation suffered by its coats during the operation.

The hemorrhage usually occurs about the time when the ligature separates, which is generally from the fourteenth to the twentieth day after the operation; but it may likewise occur either much sooner or considerably later. It appears for the most part very insidiously, not exceeding a few drops, but recurs from time to time in increasing quantity, until the patient, after being perhaps repeatedly saved by syncope, is finally exhausted. Pressure, together with the means which tend to lessen the force of the circulation, may be tried in the first instance; but if the bleeding continues or returns, the surgeon must, without delay, either tie the artery nearer the heart, or amputate the limb.

Suppuration of the sac is a disagreeable, but not very dangerous occurrence, since it seldom takes place until the artery has been obliterated, so that there is no great fear of bleeding, and little to dread but a foul and extensive abscess. Whenever the matter is actually formed, a free incision should be made to evacuate it, together with the clots; after which, the cavity being in the first instance gently filled with lint, is to be treated with stimulating lotions and pressure. In a case of large diffused popliteal aneurism, for which I tied the femoral artery, suppuration occurred seven months after the operation, and was followed, after evacuation of

the matter, by a very copious bleeding, which proved, upon examination of the amputated limb, to proceed from the breach in the artery leading into the aneurism, the vessel having been obliterated by the ligature only to the extent of three inches.

The object of tying the artery being not to prevent the blood from entering the aneurism, but merely to cause such stagnation of its current as may induce coagulation, it was proposed by M. Brasdor of Paris to obliterate the vessel *beyond* the tumour, when circumstances prevented the operation from being performed between it and the heart. Some unsuccessful attempts have been made on this principle; but Mr Wardrop has recorded several instances of its alleged more fortunate application. It is evident that the operation cannot be performed with advantage, if a branch of any considerable size comes off between the aneurism and ligature, as this would allow the current of blood to continue; it could not be of any use in cases where, the sac being small and regularly dilated, the contents remained fluid; and the only occasions where it promises any benefit, are those in which coagulation is already far advanced. But here the passage through the vessel beyond the tumour must be obstructed nearly, if not altogether, as much as it can be by the ligature; so that there, consequently, does not seem to be much probability of this operation being ever extensively introduced into practice.

Within the last quarter of a century, various attempts and proposals have been made to facilitate the treatment of aneurism, by inducing coagulation through other means than that of ligature. Of these may be mentioned galvanic acupuncture, injection of astringents, such as the perchloride of iron, and pressure on the artery concerned. The two first of these have so little practical evidence in their favour, that they need not be more particularly considered at present; but compression of the vessel deserves more attention. More than fifty years ago, some cases of popliteal aneurism were remedied on this principle in Paris, but at the expense of so much time and suffering as to deter from its general adoption. It now appears, however, chiefly through the exertions of Dr Bellingham, and other surgeons of Dublin, that with a well constructed and carefully regulated apparatus, the object may be frequently attained with a tolerable amount of pain and delay. On some occasions, a few hours have been found sufficient for the purpose; but in general a period of from two to four weeks is requisite.

The great argument in favour of this method is its freedom from

the danger of hemorrhage which attends tying the vessel. But it must be admitted, that while exempt from this objection, pressure is exposed to others, especially its risk of causing engorgement, inflammation, and mortification of the limb, together with the greater difficulty which may attend the ligature, from condensation of the textures, in the event of its subsequently proving necessary. It is only the femoral artery which can be subjected to the method in question ; and if this vessel be tied with proper care, there appears to be little or no danger from the operation. I have performed it twenty-three times without any bad consequences. On the whole, it would seem that the ligature is the quickest, easiest, most certain, and least painful means of remedy, while compression affords a useful substitute when circumstances prevent the operation from being performed with due attention to the circumstances requisite for its safety.

Treatment of Particular Aneurisms.

Popliteal.—One of the most common situations of aneurism is the popliteal artery, which, being subject to sudden extremes of tension and relaxation more than any other part of the arterial system, must be exposed not only to the directly exciting causes of the disease, but also to the predisposing effect of the same circumstances leading to morbid alteration of its coats. The tumour occupies the popliteal cavity, which it gradually fills, but hardly extends beyond, so long as any part of the artery remains entire. A circumscribed pulsating swelling is felt in the ham, which weakens the limb, and usually occasions constantly increasing pain as well as œdema, by pressing on the nerve and vein that lie over it. In some cases so little inconvenience is felt, that the disease escapes observation until it attains a large size. When the external coat gives way, so as to let the blood escape into the cellular texture, and convert the true aneurism into a false one, the swelling suddenly extends in all directions. The limb then becomes entirely useless, excessively painful, and œdematous—the pressure of the tumour induces absorption of the condyles of the femur—and if the disease is left to itself, the aneurism either opens and gives rise to a fatal hemorrhage, or undergoes a natural cure by coagulation and absorption of its contents.

It was here that the old operation proved most difficult and appalling ; and when we consider the deep situation of the artery, the diseased condition of its coats, and their close connexion to the

bone through means of the tendinous sheath of the triceps; also the large and shapeless cavity, at the bottom of which the vessel was to be secured; the hardly repressible hemorrhage; and the obstacle occasioned by the vein and nerve lying over the tumour, it does not seem surprising that its results should have been almost uniformly fatal. Dr Wilmer of Coventry states, that at the time he wrote (1780), there was not an instance of its successful performance in this country.* The modern operation could hardly have been more practicable for aneurism in this situation, if it had not been for the happy improvement of John Hunter (1785), who, observing that no large branch rose from the artery for a long way above the tumour, proposed to tie it on the fore part of the thigh, where it was nearer the surface, and at a greater distance from the disease; where the operation would be easier, and the coats of the vessel might be expected to remain in a more healthy state.

The artery may be tied either before or after it passes under the *Sartorius* muscle, but more conveniently at the former of these points, being there nearer the surface, and further from the disease.

The patient being placed in a reclining posture, with his knee bent and the thigh placed on its outer side, the surgeon should feel with the fingers of his left hand for the triangular hollow which is formed by the meeting of the *Sartorius* and *adductor longus*, and, if necessary, to make this more distinct, desire the patient to bend his thigh—the attempt at which, by calling the muscles into action, renders their outline more palpable—then stretching the integuments not transversely, but in the long direction of the limb, he should make an incision from two-and-a-half to three-and-a-half inches long, according to the thickness of the parts, having its lower extremity situated over the angle of union of the two muscles above mentioned, and running upwards at a nearly equal distance from their respective edges. Separating the lips of the wound, he should expose and divide the fascia, after which, making an assistant hold aside the edge of the sartorius, he will expose the sheath of the vessels, and, lifting it up with the dissecting forceps, open it sufficiently to let the coats of the artery be seen distinctly. It is here that the principal nicety of the operation lies, since too much exposure of the vessel, especially by tearing, or the use of blunt instruments, incurs the risk of secondary hemorrhage; while if the arterial coat be not sufficiently denuded, there is no less danger of injuring the vein in the passage of the needle. The artery should

* Wilmer's Cases in Surgery.

be exposed by means of the dissecting forceps and knife, just as in a careful dissection on the dead body. The opening in the sheath need not exceed three-eighths of an inch in length ; but the cellular or fatty substance immediately enveloping the vessel in variable quantity must be raised in successive portions, and divided, until the surface of the artery appears perfectly white and distinct.

The aneurism-needle previously threaded is then to be passed round the artery, which will be easily effected if it has been adequately exposed, and the edge of the opening in the sheath is held aside with forceps, to let the point of the instrument enter and escape. In doing this it is necessary to avoid the vein which lies below, and the nerve that runs on the outer or fibular side of the artery. On one occasion in the living body, and in another in the dead, I found a large vein, nearly half the size of the femoral, lying anterior to the artery. So soon as the ligature appears, it must be disengaged from the eye of the needle by the forceps or a hook, and pulled out of the wound while the instrument is withdrawn in the opposite direction. The operator having then satisfied himself that the artery and nothing more is included, should tie the ligature tightly in what sailors call the reef-knot, which is done by crossing the ends of the thread first one way and then the other. After the ligature is tied, one of the ends should be cut away to favour union of the sides of the wound. The needle, though introduced carefully and properly, sometimes occasions a pretty copious flow of blood, which fills the wound almost as rapidly as it is wiped out, but ceases upon the ligature being tied, and probably depends upon the injury of a small branch happening to come off at the part. The edges of the wound should be brought together with a couple of stitches, and lightly dressed.

After this operation, there is a greater difficulty to be encountered, in the establishment of an adequate channel for the blood by the anastomosing branches, than occurs in most other cases, as the perforating and external circumflex branches of the profunda pour their contents into those of the articular arteries, and these rising from the popliteal portion of the vessel, which becomes obstructed by the coagulation that follows the operation, must transmit the blood into other branches communicating lower down with the unimpeded arteries of the leg. The limb, therefore, should be protected from cold, and also from any sort of excitement.

If it is wished to tie the femoral artery below the crossing of the sartorius, an incision should be made in the middle of the thigh,

commencing about three inches lower than where that for the former operation terminates. The external or fibular edge of the sartorius being exposed, should be drawn inwards, when a strong tendinous fascia passing from the *vastus externus* to the triceps will be brought into view; and when it has been divided, the sheath will appear, containing the artery and vein, in the same relative situation as they were at the other part of their course. The operation should then be completed as already described.

Though the ligature of the femoral artery is not attended with much difficulty, it is frequently followed by bad consequences. It has long been my conviction that these depend upon the operation being considered too easy, and therefore conducted without sufficient attention being paid to the circumstances above mentioned, in regard to exposing the artery and avoiding the vein. In my own practice, as already stated, I have had occasion to tie the femoral artery twenty-three times for aneurism, and never experienced any troublesome effects from the operation.

Ligature of the Arteries below the Knee.

Aneurism hardly ever occurs below the knee from internal causes; but wounds not unfrequently occasion hemorrhage, which requires the arteries concerned to be tied. In such cases, it is necessary to secure the injured vessel not only above the aperture, but also below it, since the anastomosing branches would otherwise maintain the bleeding.

The posterior tibial may be exposed by making an incision along the inner margin of the tibia, commencing opposite to the insertion of the sartorius, and running three or four inches downwards. The knee being bent, and the foot extended in order to relax the gastrocnemius, the origin of the soleus from the tibia should be brought into view and divided, when the operator may pass his finger down to the artery, which lies somewhat more than a finger's breadth from the edge of the tibia, immediately under the fascia, that covers the deep-seated muscles, and then apply ligatures. But in operating for a wound of the vessel, it is always better to enlarge the existing incision than to make a new one. The artery might, if necessary, be tied very easily at the ankle. An incision about a couple of inches long should be made between the inner ankle and *tendo Achillis*, rather nearer the former than the latter; two layers of fascia, which are the continuations of the superficial one lying immediately under the integuments, and the deep one that covers

the blood-vessels, nerves, and deep-seated muscles, with more or less intermediate cellular substance and fat, must next be divided, and then the artery is found lying with its two *venæ comites* on the tibial side of the nerve. The plantar arteries are sometimes cut, and would be tied with great difficulty, owing to the cellular and fatty textures which cover them being so thick and dense, especially when infiltrated with blood ; but it is fortunately unnecessary to secure them in this way, as pressure properly applied is always sufficient for the purpose. The lint ought to rest directly upon the orifice of the bleeding vessel, and therefore, as has already been remarked, the wound should be dilated, if not wide enough to admit of its introduction.

The anterior tibial artery is liable to wounds at various parts of its course, and may be tied throughout almost the whole of it. This is not required below the ankle, as pressure is equally efficient, and much more convenient ; but it may be necessary to apply ligatures higher than this. The vessel is not apt to be wounded further up than the middle of the leg, where the thickness of the muscles protects it. As it runs close to the interosseous ligament, and along the fibular side of the *tibialis anticus*, it may be always easily found by making an incision about two inches and a half along, at such distance from the outer margin of the tibia as will allow room for this muscle, and then cutting down in the first muscular interstice.

The peroneal artery is so securely defended by the various parts which surround it on all sides, that it can hardly be injured without a very serious wound of the leg ; and in the rare case of its hemorrhage requiring particular attention, instead of performing a very severe operation to apply the ligature,* it would probably be better to enlarge the wound, if necessary, introduce graduated compresses, and support the limb with a bandage applied from the toes upwards.

Femoral, Inguinal, and Iliac Aneurism.

Aneurism of the femoral artery sometimes occurs just before it passes through the sheath of the triceps, in which case the vessel ought to be tied above the crossing of the sartorius, as has been described for popliteal aneurism : or if the aneurism is the result of a recent punctured wound, the old operation may be performed ; as there will be no reason to deem the arterial coats unsound, and the vessel lies favourably for the purpose. A tourniquet having been applied, the cavity is to be laid open, the fluid and coagulable

* Guthrie, Medico-Chirurg. Trans., vol. vii.

blood sponged out, and the orifice being detected, two ligatures must be tied, one above and the other below the injured part. But if the case is of some standing, it will be safer to perform the ordinary operation. I did so on one occasion with perfect success.

The disease not unfrequently appears at the groin, being seated in the common femoral artery above its bifurcation,—and then constitutes a tumour, which fills more or less completely the triangular hollow that exists at this part of the thigh, and is apt to be mistaken for a chronic abscess.

The only effectual remedy is ligature of the external iliac; and Mr Abernethy had the merit of executing this bold attempt for the first time (1804), having previously tied the artery in another case on account of hemorrhage (1796). Both the patients who were the subjects of these operations died; but his next case (1806) was more fortunate. Mr Freer of Birmingham, much about the same time, but rather earlier, met with complete success. Since then, the ligature of the external iliac has been practised so frequently and successfully that it is now regarded as an ordinary proceeding.

The operation consists in making an opening through the abdominal parietes above Poupart's ligament, pushing aside the peritoneum, and then tying the artery, which is thus brought into view, or at all events within reach of the aneurism-needle. The incision for this purpose ought to run nearly parallel with Poupart's ligament, but slightly diverging from it in proceeding upwards, so as to be about the distance of an inch from the superior spinous process. It should be between three and four inches long, and placed lower down or further up, according to the situation of the tumour, so as to let the ligature be applied at some distance from the sac. Generally speaking, the lower end of the incision ought to be about half an inch above the middle of Poupart's ligament. The surgeon may cut through the integuments and tendon of the external oblique, as it is usually called, without any ceremony; but in dividing the internal oblique and transverse muscles, he should use the precaution of raising their fibres with the forceps, before cutting them; and having thus exposed a portion of the *fascia transversalis*, he may readily dilate to what further extent seems necessary, by means of a probe-pointed curved bistoury, guarded with his fore-finger. Gently scratching through this fascia, which, near the crest of the ilium, does not adhere intimately to the peritoneum, he will be able to push that membrane inwards, and introduce his finger down to the artery which runs along the inner side of the

psoas magnus, loosely connected with the vein. If the aneurism-needle is assisted by the counter pressure of a finger placed opposite its point, hardly any dissection will be required for detaching the vessel, and if the convexity of the instrument is turned towards the peritoneum, the risk of wounding it or the vein will be diminished; but in this particular the surgeon must be guided by his own convenience. If any considerable branch of the *circumflexa ilii* is cut during the operation, it ought to be secured. The edges of the wound should be stitched together, and lightly dressed. Sir A. Cooper recommended another mode of operating, which was certainly in some respects easier, but objectionable on several grounds, particularly in so far as it exposed the vessel too low down, in the neighbourhood of the disease, the lymphatic glands, and the origins of the epigastric and circumflex arteries. This method was, to make a curved incision, having its convexity downwards, and nearly in the direction of Poupart's ligament, beginning over the margin of the external inguinal aperture, and terminating near the spinous process, then to cut through the tendon of the external oblique muscle, so as to expose the spermatic cord, which being pushed upwards, along with the muscles lying over it and the peritoneum under it, afforded room for applying the ligature.

The Internal Iliac has, on one or two rare occasions, been tied on account of aneurisms of the glutæal and ischiatic arteries, affecting these vessels after issuing from the sacro-ischiatic notch. The operation is to be performed in the same way as that for the ligature of the external iliac, the incision being merely carried further upwards, and made somewhat longer. The external iliac will form a good guide to the internal, which separates from the other at the sacro-iliac synchondrosis. The ureter crosses the vessel at this part, and might, through want of caution, be included in the ligature.

The Common Iliac can require to be tied only on account of wounds, or aneurisms extending up the external iliac. Wounds of the common iliac, from balls or thrusts of sharp-pointed weapons, granting that they were not attended with any other fatal injury, would very seldom afford the time and opportunity necessary for applying a ligature, owing to their profuse hemorrhage; and where the aneurismal sac extends up into the pelvis, it generally adheres so intimately to the peritoneum as must render the ligature of the common iliac, without injuring this membrane, all but impossible. Dr Mott of New York, nevertheless, succeeded in tying the vessel successfully. The aneurism reached far into the pelvis, but he

managed to separate the peritoneum from its sac, so as to expose the artery, and pass a ligature round it. He made an incision about six inches long, extending higher up than the one requisite for tying the internal iliac artery, and found great assistance from thin wooden spatulas, which were employed to hold aside the peritoneum with the intestines.

The aorta is occasionally found, on dissection of dead bodies, to be very narrow, or altogether impervious, either in consequence of original malformation, or owing to the complete spontaneous coagulation of large aneurisms in its course. In these cases the blood seems to be conveyed to the parts below the obstruction, chiefly by means of the anastomoses between the lumbar arteries, and those of the intestines. If, therefore, the aorta could be tied without the infliction of a mortal wound, there is reason to believe that a cure might thus be accomplished in aneurisms ascending too high for being remedied by ligature of the iliac. In dogs and other animals having long and thin loins, it is not difficult to tie the artery, by making a longitudinal incision between the lumbar and abdominal muscles, and turning aside the peritoneum. In the human subject, there is not room enough for proceeding in this way, and the only practicable method seems to be that first adopted by Sir A. Cooper, as a forlorn-hope, in a case where the patient was reduced to the very point of death by hemorrhage from an iliac aneurism. He cut through the parieties of the abdomen in the *linea alba,* turned aside the intestines, cut through the peritoneum again, and tied the vessel. This operation may be performed without much difficulty, but it does not seem probable that the complicated dangers attending the double wound of the peritoneum, the handling of the intestines, and the shock caused to the system by suddenly impeding the circulation of the great arterial trunk, would leave the patient any chance of recovery. Sir A. Cooper's patient lived thirty-eight hours, and the circulation of the sound limb returned. His death was ascribed to its not doing so in the affected one, which was probably owing to the great extent of the aneurism obstructing a long tract of the artery and its branches, and consequently requiring the blood to be transmitted through many successive anastomoses.

Ligature of the Arteries of the Superior Extremity.

Aneurism seldom if ever occurs below the axilla, except as a consequence of wounds, and then, of course, has its sac formed

entirely by the cellular substance exterior to the vessel. This used to happen most frequently at the bend of the arm when bleeding was in fashion, owing to the lancet being used incautiously, so as either to transfix the median basilic vein, and puncture the humeral artery which lies under it, or to open the radial or ulnar arteries instead of veins, which, when coming off high and running superficially, they very much resemble. When either of these disagreeable accidents unfortunately occurs, strong pressure should be exercised over the wound—a bandage being applied tightly from the fingers upwards to support the arm in bearing it. If one of the smaller arteries is concerned, this treatment will probably prevent the formation of an aneurism, and if the trunk of the humeral itself is wounded, though the chance of its doing so will be much less, there is still room for hope. Even after an aneurism has formed in this situation, the treatment of Guattani, which consists in rest and pressure of the whole limb, sometimes effects the cure, and therefore a trial should be made of these means. In case they fail, it then becomes necessary to resort to the ligature, and it ought always to be applied, here as elsewhere, to the vessel actually wounded, and not to the trunk from which it proceeds. In this situation, the old operation for aneurism is preferable to the modern one, because it affords the easiest access to the artery, and in cases of its high division, saves the surgeon from the risk of tying the wrong vessel; because there is no reason to apprehend degeneration of the coats of the artery in the neighbourhood of the disease, as the aperture resulted entirely from violence; and also because simple ligature of the artery higher up than the tumour has in some instances proved unsuccessful, owing to the free anastomosis of the branches distributed about the elbow. The best way of proceeding is to lay the sac fairly open—to evacuate its contents—and then to apply a couple of ligatures, one above, and the other below the opening.

Should it ever be thought necessary to tie the humeral above the elbow, the operation may be performed by making an incision two inches and a half in length along the inner edge of the biceps muscle. The artery will be found lying on the radial side of the median nerve, strictly connected with its *venæ comites*, and covered by the humeral vein.

When the arteries of the fore-arm happen to be wounded, they ought to be tied at the injured part. The radial is found in the first muscular interspace next the radius, and the ulnar in the first muscular interspace next the ulna.

Wounds of the hands and wrist are frequently attended with profuse hemorrhage, for which the humeral artery is sometimes tied. But the fact of this operation checking the bleeding, proves that the case did not require it, since, if the hemorrhagic tendency were strong, it could not be subdued by a ligature so far distant from the wound, and with so many branches intervening. In all these cases, pressure, if properly applied, will be found perfectly sufficient for the purpose.

Axillary Aneurism.

Next to the ham and groin, the axilla is the most common seat of spontaneous external aneurism. It generally begins in the form of a small circumscribed tumour, formed by the external coat of the artery, and after increasing for a time gradually, suddenly enlarges upon rupture of the sac. It then not only fills the axillary cavity, but projects beyond it.

The first attempt to cure the disease in this situation by operation was made by Pelletan (1786), who proposed to divide the clavicular origin of the *pectoralis major*, and thus expose the subclavian artery where it passes out below the clavicle. His colleagues withheld their consent, and would sanction only a dive with the needle after the integuments were divided. This ineffective and dangerous attempt was tried, and of course proved unsuccessful. Mr Keate afterwards succeeded by executing the proposal of Pelletan (1800) so far as regarded the division of the pectoral muscle, but he also then plunged his needle in search of the artery. Mr Chamberlayne operated more properly (1815) by dividing the muscle, and then dissecting down to the vessel.

This operation is difficult, owing to the depth of parts—the troublesome hemorrhage proceeding from branches of the *thoracica humeraria* that lie in the way—the subclavian vein overlapping the artery—and the close proximity of the large nerves going to form the axillary plexus, which are apt to impose upon the surgeon, and be mistaken for the artery. It is also seldom admissible, owing to the height to which the disease generally extends upwards. The best mode of performing it, is to make an incision along the lower margin of the clavicle, from the coracoid process to near the sternum, and then another about the same length, proceeding downwards from the acromial extremity of the former, in the direction of the space between the deltoid and pectoral muscles. The clavicular origin of the latter being then divided, and any arterial

branch that bleeds considerably having been tied, the surgeon, dissecting down on the acromial side of the plexus of vessels and nerves, in order to avoid the vein, will find the artery, and be able to include it in the ligature.

The subclavian artery can be much more easily and advantageously tied above the clavicle, immediately after it passes out behind the *scalenus anticus*, where it is more superficial, detached from the vein, and at a greater distance from the disease. Mr Ramsden had the merit of first performing the operation here (1808); and, though the case terminated unfavourably, it led to others, which have established this as the best mode of proceeding for the cure of axillary aneurism. Dr Post of New York met with the first instance of success (1817).

The method of operating described by Mr Ramsden has hardly been improved. The patient being placed on his back with the head rather lower than the trunk, and his shoulder having been depressed as much as possible, an incision should be made along the upper edge of the clavicle, from the insertion of the sterno-mastoid to that of the trapezius. Another cut, perpendicular to the former, and of about the same length, ought next to be carried from its centre upwards, parallel with the external edge of the sterno-mastoid. The flaps thus formed should be reflected with the *platysma myoides* and fat—the jugular vein being, if possible, avoided or held aside; and then the surgeon dissecting down to the lower edge of the inferior belly of the *omo-hyoideus*, exposes the *scalenus anticus*, taking care not to cut the supra-scapular artery, which must be tied if wounded. Tracing this muscle to its insertion into the first rib, he is led infallibly to the artery which passes out behind it, immediately above its attachment. He then either carries the needle round the vessel where thus exposed, or, in case of its shewing any sign of morbid alteration, uncovers it a little further, by cutting or turning back the edge of the scalenus—in doing which there is no danger of injuring the phrenic nerve, as it lies here quite at the sternal edge of the muscle, having crossed it obliquely in descending from the cervical plexus. It appears from the cases on record, that the large nerves going to constitute the axillary plexus, though not lying in the way of the artery, are apt from their proximity to be mistaken for it; wherefore the surgeon should be cautious in passing the ligature, and not tie it until satisfied, by the effect of compressing what he has included, that it is really the artery.

The subclavian artery may be tied also on the inner or sternal side of the scalenus ; but the numerous branches that spring from the artery here, together with the close neighbourhood of the pleura, vein, and on the left side the thoracic duct, render this operation extremely difficult and dangerous—while, as already observed, it offers no inducement in regard to increasing the distance between the ligature and aneurism. Dr Colles of Dublin performed this operation unsuccessfully (1813). In a case of immense diffused aneurism extending from the clavicle half-way down the chest, in consequence of the axillary artery being ruptured by external violence, I tied the subclavian at the outer edge of the scalenus, but without the effect of preventing hemorrhage from a puncture that had been previously made, under the impression that the swelling was not of an aneurismal nature, and consequently found it necessary to amputate at the shoulder joint, which proved successful. In another case of axillary aneurism, where mortification had commenced in the arm, I also performed amputation at the shoulder joint with success.*

Carotid Aneurism.

The carotid artery at the angle of the jaw, where it divides into the two great branches, occasionally becomes the seat of aneurism, which is easily recognised by the general characters. Sir A. Cooper first ventured to tie the common carotid for this disease (1805) ; and though the attempt did not succeed, he repeated it successfully not long afterwards (1808). Since then the artery has been secured very frequently, on various accounts, and with so little difficulty or bad consequences, that the operation is regarded one of ordinary interest.

The patient should be placed on his back with the head low—or at all events on a level with the trunk. The external incision should be two inches and a half long, or more if the patient's neck is thick. It should extend along the internal or sternal edge of the sterno-mastoid, and be more or less distant from the sternum, according to the part of the vessel which it is wished to tie. The artery lies most superficially in the higher part of the neck, where it is covered merely by the integuments, *platysma myoides*, and fascia. Lower down it is overlapped by the sterno-mastoid, and sterno-thyroid muscles, and is crossed by the omo-hyoid. The upper part of its course, therefore, would be preferable for the purpose ;

* Contributions to the Pathology and Practice of Surgery, p. 155.

but as the disease or injury which requires the ligature is generally seated here, the surgeon has seldom any choice, and must operate at or below the crossing of the omo-hyoid. The edge of the sterno-mastoid having been brought into view, should be held aside, so as to expose the ascending belly of the omo-hyoid, which in its turn being turned either up or down, accordingly as it is desired to tie the vessel above or below it, of which plans the latter is usually preferable, the sheath of the vessel will present itself. It ought to be opened on the tracheal side, to avoid the *descendens noni*, which runs down the centre, and what is of much more consequence, to prevent any risk of injuring the internal jugular vein, which lies on the outer side, and overlaps the artery. The *par vagum* being situated behind the vessels, is hardly in the way of harm. The convexity of the needle ought to be turned towards the vein.

The bold operation of tying the *arteria innominata* was first performed by Dr Mott (1818), on account of subclavian aneurism. The ligature separated on the fourteenth day, and everything seemed to be going on favourably, when, a week afterwards, bleeding commenced from the wound, and recurred from time to time, until the patient's strength was completely exhausted, which happened on the twenty-sixth day after the operation. Graefe tied the artery (1822) with a similar result. The ligature separated, and the patient seemed to be safe, but died at the end of two months from hemorrhage. It thus appears, that when a ligature is applied so very near the heart, the danger of bleeding continues longer than in other situations, owing probably to the great force of the blood which issues directly from the heart tending to break through the weak and recently formed obstruction. Perhaps the danger might be diminished by weakening the action of the patient's system by depletion and abstinence for some time after the ligature is detached.

The operation, though important and dangerous, is not very difficult. Two incisions should be made of nearly equal length, which may be about two inches—one upwards from the sternum along the inner edge of the sterno-mastoid, and the other transversely, from the same point across the sternal attachment of this muscle. The flap of skin thus formed being reflected, the sternal attachments of the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, must be divided to a sufficient extent for bringing into view the sheath of the vessels, which ought to be opened as if for the ligature of the carotid. This vessel having been exposed, if traced down, will lead to the innominata, round which the needle should be

passed very carefully, in order to avoid the pleura and great venous trunk.

In aneurisms at the root of the neck, not admitting of the ligature being applied between them and the heart, Mr Wardrop has recommended the practice suggested by Brasdor, of tying one or more of the vessels proceeding from the sac, so as to cause stagnation of its contents.* The proposal is not unreasonable, and Mr Wardrop has recorded two cases, in which the patients are said to have been relieved from carotid and subclavian aneurism by tying the vessels respectively; and one of aneurism of the innominata, in which Mr Evans operated successfully by obstructing the carotid. The general observations which have been made above on this subject, render it unnecessary to say anything further in regard to it here.

The temporal artery, from its exposed situation, is liable to be wounded. I have met twice with a small circumscribed aneurism of it originating from external violence without the infliction of a wound. In this case, the best mode of procedure is to make an incision through the skin, and dissect or pull out the sac completely, so as to leave merely the orifices of the vessel, which may then be tied as usual. Hemorrhage from wounds, whether intentionally or accidentally inflicted, may in general be suppressed by carefully employed pressure—a piece of cork wrapped in lint being applied over the part, and secured firmly in its place by a narrow roller, carried round the head and crossed repeatedly over the compress; but if the bleeding has not been effectually restrained at first, it becomes more obstinate from its continuance, by distending the cellular substance, and impeding the effect of external pressure. In these circumstances, there should be no hesitation in cutting through the seat of the injury in the direction of the vessel, separating the integuments a little on each side, and then passing a ligature under the artery by means of a sharp needle, first on one and then on the other side of the breach.

Aneurism by Anastomosis.

Mr John Bell described, under the title of Aneurism by Anastomosis, a subcutaneous tumour, which possessed a flattened shape, a doughy consistence, and a cellular structure, communicating very freely with the branches of neighbouring arteries, so that it pulsated or throbbed obscurely, and bled profusely when opened by incision,

* Wardrop on the Cure of Aneurism by a New Operation, 1828.

though when the morbid structure was cut entirely out there was not any more hemorrhage than might have been expected from the vessels of the part. Mr Bell regarded this formation as composed of cells with which the veins and arteries freely communicated, and into which the blood was induced to flow with extraordinary force. The tendency of aneurism by anastomosis being to enlarge, open, and bleed, Mr Bell recommended complete and speedy excision as the only and essential remedy for it.

More recent and extended observation has not only thrown light upon the nature of this tumour, but also proved that there are others of an analogous kind which should be arranged along with it; and the term of Morbid Erectile Tissue has been employed as the general title for denoting them. Every part of the capillary system probably has the power of inducing blood to enter it, and those portions of the body which, being distinguished by a remarkable degree of this property, are said to be formed by erectile tissue, as the penis, nipple, or wattles of the turkey-cock, in all probability exercise a similar power in a similar manner, but only on a greater scale, proportioned to the development of their structure. Instead, therefore, of being constituted by distinct cells interposed between the veins and arteries, they consist merely of the capillary vessels dilated. In some animals the natural erectile tissue is evidently formed in this way, as, for instance, the glans penis of the ram and fallow-deer, and there are a few cases recorded in which the morbid erectile tissue was no less distinctly composed of dilated and convoluted vessels.*

Under the head of Morbid Erectile Tissue may be ranged—1. Aneurism by anastomosis; 2. Nævus or longing mark; and 3. The subcutaneous nævus, as it has been called and well described by Mr Wardrop.†

Aneurism by anastomosis is always seated in the texture lying under the skin, which is more or less elevated, and in general slightly discoloured, having a blue or purple shade observable in it. The swelling throbs synchronously with the heart, becomes smaller when compressed, and more turgid when the circulation through the arteries is excited, or that through the veins impeded. At birth it is usually small, frequently hardly perceptible, and sometimes does not enlarge until puberty. After becoming active it

* Pelletan, Clinique Chirurgicale, t. ii. p. 59.—Maclachlan, Glasgow Med. Journal, No. 2.—Wardrop, Lancet, No. 211.—Author, Ed. Med. and Surg. Journal, No. 98.

† Med. Chirurg. Trans., vol. ix. p. 200.

generally increases in size, at length opens, and bleeds from time to time, in the female observing the menstrual periods in its tendency to do so. Its most common situations are the head, hands, and feet. The best remedy for this disease is excision; and in performing the operation, it is proper to cut quickly and completely beyond the morbid structure. The ligature also may be employed, care being taken to embrace the whole extent of the disease—since a troublesome or even fatal hemorrhage may otherwise result. The arteries leading to the diseased part becoming much enlarged and tortuous, have repeatedly suggested the trial of attempting to afford relief by tying them, but in no case with success. Ligature of the arterial trunks, as the carotid in aneurism by anastomosis of the face or scalp, has also, for the most part, proved unavailing, though in some instances the result proved more satisfactory. Messrs Travers and Dalrymple tied the carotid with success in two cases of swelling in the orbit, which seemed to be of this nature;* but as these cases were not of congenital origin, they must be regarded as questionable exceptions from the general rule.

Nævus is an enlargement of the venous capillaries, apparently confined to the surface of the cutis. There is little swelling, but very obvious discoloration, generally of a dark or purple hue. There is no pulsation, but turgescence when the circulation is disturbed, especially by any circumstances which obstruct the passage of the veins. The disease is most frequent in the head and trunk, but also appears on the extremities. It is always congenital; and when first observed is usually of very small extent, being merely a point or speck, which increases rapidly after birth. After attaining a certain size, it generally either remains stationary, disappears by absorption, or ulcerates and scabs away by degrees.

The treatment ought to vary according to circumstances. If the nævus is stationary, and not inconvenient, it ought not to be meddled with. If increasing, or so situated as to occasion deformity, it ought to be cut out or removed by ligature,—two or more threads being passed under its base, as will be more particularly explained immediately, and tied tightly so as to effect complete strangulation. The application of pressure and astringent washes, and also local irritation, such as that produced by vaccination, in order to cause absorption or the ulcerating and the scabbing process, are not only very uncertain and ineffectual, but apt to leave unseemly marks, hardly less objectionable than that for the removal of which

* Med. Chirurg. Trans., vols. ii. and vi.

they are employed. When the nævus is small and superficial, it may be removed by punctures with a pin dipped in nitric acid.

The subcutaneous nævus is a disease similar to the one last mentioned, but more deeply seated. It exists either alone, or, more generally, along with the superficial nævus ; like which, it seems to depend more upon the veins than the arteries. It occurs in the same parts of the body, and is always congenital. At the time of birth it occasionally has attained a large size, and soon afterwards begins to bleed profusely. But much more frequently it increases slowly from a very small commencement, and may not prove troublesome until a pretty advanced period of life. It is recognised by its bulk and extension under the skin, together with the negative character of wanting pulsation. Like the superficial nævus, it occasionally shrinks or ulcerates away.

When this tumour is seated on the face, is rapidly increasing, or threatens to bleed, it ought to be removed without delay ; and though excision may, in some cases, be practised with advantage, as when the base is small, so that the wound required admits of healing by the first intention, in general, or rather nearly always, the ligature affords the most eligible means of removal. If the disease can be completely embraced in two ligatures, nothing more is necessary than to pass a needle carrying a double thread from one side of the base to the other, and then tie the two halves as tightly as possible. It frequently happens, from the extent or form of the nævus, that four ligatures are required, and then two needles should be employed,—one being passed through the base, but not carried further, until the other conveys its thread fairly through, by which means any risk of cutting the ligatures by the sharp edge of the second needle is avoided. In this case the tying of the threads, though facilitated by the morbid surface being divided into smaller portions for inclusion, is rendered complicated and troublesome by their numbers, as well as the circumstance that any two cannot be rendered secure until they are tied on both sides, whence it is necessary that, while one of the knots is made, the other ends of the threads must be either held or tied at the same time by an assistant. The ligatures should be tied in what is called the surgeon's knot—that is, by having the ends crossed twice, which prevents slipping until the fastening is made good. If still more ligatures are required, they must be introduced and secured on the same principle. Thus in a case of large pendulous nævus, occupying nearly the whole of one side of the face, I employed

upwards of twenty. On such occasions, the best way of proceeding is to pass successive portions of a long thread again and again by means of a needle with an eye in its point, and fixed in a handle.

Mr Liston has recommended, that, in applying ligatures for the removal of erectile tumours, the integuments covering them should be divided by a crucial incision, and reflected so as to let the diseased structure alone be removed, in order to hasten the process, and save the sound skin, — a modification of the operation very seldom practicable.

In a case of this disease in an infant, where the tumour was large and bleeding, Mr Wardrop, in order to save the life of the patient from immediate danger, tied the carotid artery; and with success. He was induced to follow this course by the unfortunate result of an attempt to cut out the nævus in a similar case, where the child died during the operation.* It would probably be safer practice, in such circumstances, to apply ligatures.

Osseous Aneurism.

There are various detached cases on record of tumours occurring in bones, and presenting several of the characters of aneurism. In 1826, M. Breschet published an essay on this disease;† and in the same year, without any knowledge of his views, I introduced the title of Osseous Aneurism into the Syllabus of my Lectures on Surgery.

The tumour in question has been met with, out of all proportion, most frequently in the tibia, at its upper extremity. It has been observed also in the femur and scapula, and the wrist and ankle. The predisposition to it seems strongest in the male sex, and at the time of life between puberty and middle age. The enlargement is attended with severe pain from the commencement. It is at first equally firm and resisting with the other parts of the bone, but, on increasing, becomes more soft and yielding, not over the whole surface, but at some points of its extent, where an obscure pulsation or throbbing can generally be perceived. If other parts of the sac be subjected to pressure, they often give way with a crackling sort of sensation. As the disease increases, the limb affected becomes weak and œdematous, the superficial veins over the swelling are greatly enlarged, and the pain is extremely distressing. At last the sac gives way, and the profuse hemorrhage which ensues,

* Wardrop, Med. Chirurg. Trans., vol. ix. p. 203.

† Répertoire d'Anatomie, t. ii. p. 142.

renders immediate amputation necessary. When the tumour is then examined, it is found to contain fluid and coagulated blood, to be hollowed out of the bone concerned, and to have for its cyst the periosteum, more or less strengthened with a lining crust of bone, not dense and compact, but possessing a honeycomb structure, the laminæ of which are directed towards the centre of the cavity. If the arteries of the limb be injected, it is found that their trunks are entire; but that their branches which enter the substance of the bone communicate so freely with the cavity of the swelling, that the matter used for injection, however coarse, readily flows into it.

The precise nature and origin of this disease have not yet been satisfactorily ascertained. The only effectual remedy for it is amputation. There is one case recorded, where ligature of the femoral artery proved sufficient to cure an aneurismal tumour of the tibia;* but this must be regarded merely as an exception to the general rule. In amputating, it is always desirable to remove the whole of the bone in which the disease originated; since, though part of it may be apparently sound at the time, it tends to renew the morbid action.

VEINS.

Inflammation of Veins.

The veins are more numerous and capacious than the arteries, whence the blood moves through them more slowly and less forcibly. The veins not only communicate by capillary anastomosis of their neighbouring branches, but are frequently united in their course; and hence occasion less inconvenience by their obstruction than that of the arteries does. When the principal trunk of a limb is concerned, the resistance which is opposed to the return of the blood causes more or less œdema. The coats of the veins resemble those of the arteries, but are thinner, more closely connected, and tougher, so that a ligature merely draws them together without cutting the internal ones.

The veins are prone to inflammation, which is very much disposed to spread, and chiefly in the course of the circulation. The vein affected feels hard and painful, especially when extended. The surface of the skin which covers it is often red, from the adjacent tissues taking on the same action. The pain is of a peculiar, oppressive, sickening kind, similar to what attends inflammation of

* Lallemand, ibid., p. 138.

the glands and absorbents. When these local symptoms are at all acute, they are accompanied with more or less fever, which is distinguished by what is called the typhoid type or character, indicative of extreme irritation, whence it is also usually named Irritative Fever. The pulse is quick and small; the respiration hurried and anxious; the countenance dark, contracted, and expressive of much distress; the tongue dry and brown. There is great prostration of strength, and often, especially in the progress of the disorder, delirium. Acute inflammation of the veins, and more especially those of large size, almost always proves fatal. Death may ensue in a very few days, but seldom before the end of a week. On dissection, the vein is found thickened in its coats, and containing coagulated blood, or pus, or a mixture of both. There are also very generally purulent effusions, in the cavities of the chest, those of the joints, or in the subcutaneous cellular texture, together with deposits in the substance of the lungs, very similar in appearance to tubercles. The explanation of these effects has not yet been well made out, but, on the whole, their cause seems most probably to be the violence of the constitutional disturbance; though the opinion most generally received at present is, that the pus suffers absorption into the mass of circulating fluid, and thus produces the effects in question. In proportion as the inflammation is chronic, the danger is small. The local effects are, in the first instance, redness and thickening of the vessel, then suppuration into the cavity, or the effusion of lymph, which, together with coagulation of the blood, just as happens in the arteries in similar circumstances, impedes the circulation, and obliterates the channels affected. The veins are induced to take on the adhesive action by compression, and the other kinds of irritation which occasion it in the arteries, but they are much more readily excited by these means to inflame. The atheromatous and calcareous degenerations occur so rarely in their coats, that they may almost be said never to affect them.

The causes which have most effect and are most frequently concerned in the production of inflammation in the veins, may be referred to three heads:

1. The application of a ligature.
2. Immoderate or long-continued distension.
3. The infliction of wounds which do not heal by the first intention.

John Hunter, who had the merit of directing attention to the

causes and important consequences of venous inflammation, when they were almost entirely overlooked,* observed that the veins running near parts which had suffered inflammation and suppuration took on a similar action, and effused pus or lymph, or both, into their cavities. Succeeding inquiry has ascertained that this is not a constant, or even very common occurrence; and it is possible that he may have sometimes mistaken the effect for the cause, the abscesses in the cases he observed being perhaps the consequence of venous inflammation, and not the origin of it. Of all the causes which induce inflammation of veins, there is none more certain than the infliction of a wound which does not heal by the first intention. When the wound does not heal by the first intention, it must of course inflame; and the morbid action thus instituted is apt to follow its characteristic tendency to spread. John Hunter shewed that many of the bad consequences of venesection, which used to be referred to pricks of the nerves or tendons, really depended on the wound not healing, and the veins inflaming.† It is of great consequence to notice that the tendency to venous inflammation varies with the state of the system; so that while very slight causes may prove sufficient to induce it, very severe ones may fail in doing so. Thus in crowded hospitals or other unhealthy situations, a large proportion of operations terminate fatally from inflammation of the veins; and wherever erysipelas abounds, phlebitis is apt to be associated with it.

With regard to the treatment, it must be admitted, that when the inflammation is acute, and attended with much constitutional disturbance, it hardly yields to any remedy. In such cases, therefore, the prognosis should be very unfavourable. General bleeding seems to do no good; and, on the contrary, rather to increase the irritability of the system, which more requires calomel and opium. Local bleeding and fomentations are useful when the inflammation is acute. Warm solutions of acetate of lead with opium, and the *tinctura saponis cum opio* with camphorated mercurial ointment, and the pressure of a flannel bandage, constitute the best local applications when the affection is chronic.

Wounds of Veins.

When veins are cut across, their orifices are closed by the same

* Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. i. p. 16.

† Op. et loc. cit.

process which effects the obstruction of arteries in similar circumstances; and the smaller moving force of their contents favours this occurrence on one side of the aperture, while the valves still more effectually prevent any disturbance of the adhesive process at the other. If the vein concerned is one of the great trunks, and devoid of valves for preventing a retrograde motion of the blood, pressure ought to be preferred to ligature for restraining its hemorrhage, and a very slight resistance will be found sufficient. When veins are not divided, but merely wounded through a part of their circumference, they do not necessarily or usually either remain open or suffer complete obstruction, as the arteries do, but heal, and regain their original condition. This difference is owing to the smaller distension of the venous coats, which allows the effusion of lymph that takes place from their cut edges to become organised. If the lips of the wound continue *in situ*, they unite at once with each other; but if they are displaced, owing to their transverse direction, or any other cause, there is, in the first instance, injection of blood into the surrounding cellular substance; then the formation of a firm, round, smooth coagulum, exterior to the wound; and, *lastly*, an exudation of lymph from the vessels of the vein, which, resting upon this clot, extends from one cut edge to the other, and gradually unites them together, after which, the clot being absorbed, the cure is completed.

Varix.

Varix consists in a dilatation and thickening of the veins, which become at the same time elongated, and thus constitute a tortuous swelling. It occasions deformity, weakness of the part concerned, by impeding the circulation, and uneasy sensations from the same cause. It also renders the vein liable to chronic inflammation, ulceration, and hemorrhage. The saphena, spermatic, and hemorrhoidal veins are most liable to the disease. It seldom appears in the limbs before maturity, but occurs in the other situations which have been mentioned at a much more early age. Tall stature, and largeness of the veins, predispose to the disease; constipation, pregnancy, hepatic derangement, and sedentary occupations, favour its actual commencement.

The treatment of varix consists in obviating the exciting causes, for which purpose the bowels ought to be kept open, the testicle ought to be suspended, and the leg ought to be supported with a bandage or laced stocking. The horizontal posture ought to be

preferred and the erect one avoided. When the vein inflames, it ought to be treated according to the rules already explained; the symptoms are almost always subacute or chronic, and local remedies merely are required. When it bleeds, pressure must be applied. When ulceration occurs in connexion with it, which most frequently happens in the case of varix of the saphena, and affects the inner side of the leg a little above the ankle, the surgeon should be guided in his practice by the indications of indolent or irritated action which the ulcer may exhibit. If there appears not to be any obstacle to the cure on either of these accounts, he may simply use the black wash and a bandage, under which cicatrisation is in general speedily accomplished.

In order to effect a radical cure of varix, it has been proposed to obliterate the vessel above the diseased part, so as to take off the dilating effect of a superincumbent column of blood, and this has been done in various ways. The ligature, which had been long before tried and rejected on account of the danger attending its use, was recommended by Sir Everard Home, and on his authority tried rather extensively, but with such troublesome and even fatal consequences, as effectually prevented it from being employed in future. Sir B. Brodie revived a still older method—viz., obliterating the vein by incision. Instead of cutting out the varicose portion, which was the ancient practice, he merely divided the vessel, using a narrow knife, and making a small puncture of the skin. The consequences of this practice, though not so disastrous as those of the ligature, were still occasionally disagreeable enough to overbalance the chance of benefit. Another proposal was made by Mr Mayo—viz., to make an eschar with caustic over the vein at a sound part of its course above the varix, and thus excite such inflammation of the vessel as might be sufficient to occasion obliteration of its cavity by the effusion of lymph. This method has the recommendation of being an imitation of a natural process of cure, for it sometimes happens that the varicose vessel, in consequence of spontaneous inflammation, becomes completely impervious. In exciting this action artificially, however, there is great difficulty in avoiding the opposite extremes of deficient and excessive irritation, and alarming inflammation has in consequence been repeatedly induced. M. Velpeau has more lately introduced a method of great simplicity and perfect safety, which consists in passing a common pin through the skin, under the vein, while it is compressed and pushed outwards by a finger and thumb, and then tying a thread tightly round it. A little redness and

swelling follow, and ulceration soon succeeding detaches the pins with hardly any pain, and no danger. It is still questionable, however, whether obstruction of the vein merely at a part of its course is adequate to afford permanent relief; and in the present state of information upon the subject, it seems that the most judicious course in treating varix is to be satisfied with remedying its bad consequences, and using means for preventing their occurrence.

Aneurismal Varix.

When a contiguous artery and vein are wounded together, it occasionally happens that the orifices of the vessels remaining undisturbed, the blood is allowed to pass from the artery into the vein; the consequence of which is, that the latter vessel becomes large and tortuous, communicating a jarring sort of sensation to the hand which examines it, and a peculiar thrilling sound, like the purring of a cat, or the prolonged articulation of the letter R (*bruit de râpe*), is heard when the ear is brought near the injured part. The limb becomes œdematous and cold owing to the want of its usual supply of nutritious fluid, the greater part of which, instead of proceeding onwards to its destination, flows back to the heart, and also to the obstacle opposed to the return of the blood from the veins below, by the distension of those above, which is caused by the forcible current of the artery. From the same cause there is hardly any pulsation of the artery below the part where it is wounded, while it pulsates above more forcibly than it did before.

Dr Hunter first described this disease (1756*), but Dr Cleghorn of Dublin suggested the name which is used to denote it† (1765). It is most apt to occur at the bend of the arm, where the median basilic vein lies over the humeral artery, but may do so in any part of the body where a large artery and vein are contiguous. Instances of it have been observed in the femoral, popliteal, carotid, and subclavian vessels, from wounds.

Aneurismal varix is generally more inconvenient than dangerous, the veins, after they become fully distended, usually remaining without any further change. It is, therefore, seldom necessary to do more than apply a bandage to the limb, with a compress over the injured part. Should the swelling, pain, or other symptoms of the case be so severe as to warrant an operation, a radical one may be performed by tying the wounded artery both above and below the opening.

* Med. Obs. and Inquiries, vol. i. p. 340. † Ibid. vol. iii. p. 110.

Varicose Aneurism.

When, in the case of a vein and artery communicating, the blood issues from the latter vessel into the cellular substance, so as to constitute a false aneurism, and at the same time continues to gain access to the vein, a combination of aneurism and aneurismal varix results, which has been named Varicose Aneurism. More correctly, this condition would have the title of Aneurismal Varix, since its peculiarity is not in the aneurism, but in the complication of venous distension by the force of arterial blood. In 1831* I put upon record a remarkable case, in which an aneurism of the abdominal aorta communicated with the vena cava; and similar cases of spontaneous injury have since been observed. With few exceptions, the bend of the arm has been the seat of this occurrence, in consequence of wounds. Owing to the free passage which remains for the blood, and the absence of regurgitation or stagnation, there is little or no tendency to coagulation; and in operating here I have found the interior of the sac perfectly white and smooth, like the inner surface of an artery. No benefit, consequently, would be derived from the simple ligature of the humeral; and the proper course is to lay open the cavity, and apply two ligatures to the vessel, one above and the other below the aperture. But so little inconvenience is usually experienced from the disease, that the better course in general is to abstain from interference.

* Contributions to the Pathology and Practice of Surgery, p. 286.

CHAPTER IX.

EXTERNAL INJURIES.

Bruises.

By a Bruise is understood an injury caused by a blow, or by violent compression, without division of the integuments. Its effects vary according to circumstances, but the most common one is Ecchymosis, or the injection of blood into the cellular tissue, which occasions more or less swelling, and discoloration of the skin. The blood after being thus effused is gradually removed by absorption, during which the colour of the part passes through various shades of red, green, and yellow, that have been differently explained, but not as yet satisfactorily. To promote this absorption, some gently stimulating lotion, containing the salts of ammonia, spirits, and vinegar, ought to be applied, together with moderate pressure. It is usual to apply leeches in the treatment of ecchymosis, but as the blood is not contained within its own vessels, and, on the contrary, is extravasated into the cellular texture, bleeding from the surface cannot possibly be of any service, and may even do harm by increasing the weakness which the skin has previously suffered, both from the immediate effect of the injury, and also by its separation from the parts beneath which attends the bloody effusion, and thus causing sloughing.

The blood is sometimes effused in larger quantity, and collected in a cavity formed by the torn and distended cellular substance. In this kind of bruise there is usually the same sort of discoloration of the skin as in the former, but the size and fluctuation of the tumour readily distinguish it. This condition is comprehended under the title of ecchymosis; but it is necessary to make a distinction between the two, though doubtless merely different degrees of the same injury, since the process of recovery is apt to be considerably different.

It is always desirable to promote absorption, and for this purpose

the same means as those employed to discuss superficial ecchymosis are proper, especially lotions and pressure. Sometimes the clot, greatly contracted and indurated, remains after the serum has been removed, without suffering any further change. At other times, the serum continues little or not at all diminished, in which case blisters, succeeded by pressure, ought to be used, and if these means fail, the fluid may be drawn off by a trocar. The contents of these effusions are also apt to shift from one part of the body to another, according to the tendency of their weight.

When the effusion is large, or the parts about it have been much injured, or the patient is of an irritable habit, the parietes of the cavity are apt to inflame and convert it into an abscess. Any tendency to this ought to be allayed or prevented by cold applications; but, so soon as there is reason to believe that matter has actually been formed, free vent should be afforded to it and the remaining blood by an incision; after which pressure and some stimulating wash will promote contraction and closure of the cavity.

The appearance of ecchymosis so regularly attends the infliction of bruises, that much importance is frequently attached to its presence or absence in medico-legal investigations. The discoloration of the skin caused by it must be distinguished from the *livor*, which generally appears on the dependent parts of the body after life becomes extinct. This may be readily done by making an incision through the part in question, as the blood in ecchymosis will be found coagulated in the seat of its effusion, while in livor there is merely congestion of the cutis. The time required for ecchymosis shewing itself is also an important point. The more superficial the effusion is, the more quickly will the discoloration appear—and according to the difference in this respect, three or four hours, or as many days, may be necessary. It should be recollected that the effusion and discoloration are two distinct things; that the former happens immediately after the injury, and may be certainly discovered by dissection; but that the latter, though, when present, affording evidence of violence having been sustained, does not prove by its absence that no effusion has taken place. Persons labouring under the disease named *Purpura hemorrhagica* have often discoloured marks on the skin resembling those of ecchymosis. Blood may be effused into the cellular texture, in consequence of violence sustained soon *after* death — but in this case it proceeds from rupture of the larger vessels, and is not coagulated. Finally, it is

necessary to notice, that the presence of a wound in a bruised part may prevent any discoloration by allowing the blood to escape.

Wounds.

By Wounds are understood solutions of continuity in the surface of the body effected by violence. They are divided according to the injury which the parts concerned sustain in addition to the wound, and also the form which it possesses, into Incised, Punctured, and Contused.

In incised wounds, there is merely a solution of continuity inflicted by a cutting instrument, without any other injury of the part concerned, and the superficial extent of the aperture bears a considerable proportion to its depth. The great object in treating such wounds is to induce union by the first intention, and the general observations which have been already made on that process suggest the practice to be followed with this view. All foreign matters should be removed from between the cut surfaces; blood and serum should be prevented from collecting, by avoiding close dressing; and the actions of the system should be kept within proper bounds by suitable diet, with perfect quiet of the part affected. Wherever pressure is sufficient to keep the cut edges in contact, it ought to be preferred for the purpose. Plasters are apt to approximate the lips of the wound merely, and, so far from pressing the deeper parts of the wound together, rather render them more separable by relaxing the superjacent integuments. Stitches introduced at the distance of about an inch from each other generally answer better; but if the edges of the wound require to be kept in very nice contact, they must be introduced more closely, or the twisted suture, as it is called, may be employed. This consists of a needle or pin passed through the edges of the wound with a silk thread, such as that employed for stitches or ligatures, twisted round it in the figure of 8, so as to draw the cut surfaces together. The needles may be withdrawn on the third day, but the recent union ought not to be subjected to any strain for some time afterwards. This kind of suture was formerly much practised, but is now almost confined to the treatment of wounds of the lips and cheeks, and even here may be abandoned with advantage in favour of the simple stitch, except at the margin of the lip or other natural aperture.

When the superficial extent of a wound is very small in proportion to its depth, it is said to be punctured; such wounds being caused by instruments which have small points and blunt edges.

They are not formidable in their appearance, but usually turn out much more troublesome than incisions of far greater size, being apt to occasion extensive inflammation, and widely diffused suppuration. These bad consequences of punctures are usually ascribed to their penetrating some fascia, which inflames and gives rise to the effects in question; and there can be no doubt that they are generally most productive of bad consequences when they do penetrate such a structure. But it seems more reasonable to refer the diffused inflammation occasioned by them, to the confinement of the discharge which necessarily results from their narrow aperture, and the resistance of the fibrous expansions which have been injured.

The most effectual method of checking the inflammation which proceeds from punctures, consists in dilating the orifice of the wound, and it is, therefore, often recommended to do this immediately after their infliction, to prevent bad consequences. It does not appear, however, that the chance of these is thus diminished; and, therefore, the most prudent course is, in the first instance, merely to apply cold water or other lotions proper for moderating action and preventing inflammation. Should it actually commence, dilatation ought to be performed without delay, and then fomentations with poultices are proper for a few days, or until the suppurative action is fully established, when compression and washes must be substituted in their stead.

Contused wounds are solutions of continuity, in which the surfaces are injured by the violence that occasions them,—the agent being usually some blunt surface, which strikes, or on which the body is impelled, with great force. Contused wounds in general bleed less than incised ones; their surface is ragged or lacerated; and sometimes of a dark colour, owing to effusion of blood into the cellular substance. When the contusion is considerable, it renders the wound incapable of uniting by the first intention, and excites inflammation, which either terminates in mortification or leads to suppuration, according to the extent of the injury and the irritability of the patient. It was formerly the custom to cut away the contused and lacerated edges, to supersede the more tedious process of sloughing; but nature is now allowed to determine what portion is incapable of recovery. All foreign matters ought to be carefully removed from the wound, and its edges should then be placed as nearly as possible in contact. If there is no great degree of contusion, stitches may be employed for this purpose; but, generally speaking, it is better to abstain from them; and if they are used,

any appearance of inflammation should be the signal for their removal. Cold applications are proper in the first instance, and ought to be continued until the wound either unites or inflames. In the latter case, warm fomentations and poultices are required; but they must be laid aside as soon as the sloughs have separated and the granulating action is established. If continued longer than this, they induce relaxation of the parts concerned, already weakened by the injury, render the granulations large and flabby, and prevent the sores from contracting. The ulcer always tends to weakness of action, and therefore, instead of these enfeebling applications, requires lotions with pressure.

Gun-shot wounds are solutions of continuity effected through the agency of substances impelled by fire-arms. They are generally punctured as to their form, and always contused as to their surface. They are consequently apt to occasion extensive inflammation, and sloughing of the parts more immediately concerned. The orifice by which a ball enters is small, round, depressed, and livid; that by which it escapes, larger, more elongated, and everted at its edges. These appearances vary with the velocity of the ball, the entrance being most, and the exit least distinctly characterised when it is greatest, and *vice versâ*. The wound when first received occasions a numb sort of sensation, but before long becomes acutely painful. It bleeds less than an incised wound in the same situation would do. When of any considerable extent, it is apt to cause, immediately on its infliction, more or less mental alarm, despondency, and prostration of strength. This constitutional effect is proportioned to the importance of the injury, the weakness of the patient, and his apprehension of danger.

The bad consequences of gun-shot wounds were formerly ascribed to a poisonous agency of the gunpowder; and upon this belief was founded the practice of scarifying or excising the wounded surfaces, and dressing them with scalding oils. Paré introduced a milder method, which he was led to, in the first instance, by necessity, and was afterwards confirmed in by experience and reasoning on the subject. He used merely simple unctuous applications, and with such success, that his example was soon generally followed. The treatment of gun-shot wounds, though so far improved, still continued unnecessarily severe, since the scarification, which was formerly practised to remove the poison, still remained in use, to prevent tension and inflammation from the fistulous shape of the wound. John Hunter exploded this system of dilatation, as it was

called, by shewing that it did not prevent the effects in question, and was performed soon enough if delayed until they actually appeared. The best application at first is a pledget of oiled lint, placed on the wound, and covered with cold wet cloths. Should inflammation supervene, free dilatation, including any fascia that has been wounded and lies within reach, with fomentations and poultices, become proper; when the sloughs are detached, pressure, with the usual lotions, must be carefully employed, as there are apt to be extensive sinuses; and if these have not a sufficiently dependent opening, it ought to be afforded by the knife.

When the ball, or any other foreign matter introduced into the wound, is not carried through, but remains, it ought to be removed, if this can be done without any very serious cutting or searching; for, though it is no doubt true that such extraneous substances often acquire a fibrous cyst, and cause no disagreeable symptoms, they more frequently excite inflammation, which leads to various troublesome consequences, and may do so after lying for a long while without causing disturbance. The finger is the best probe for detecting the ball or other foreign body; and when further search is requisite to find it, the nature of the tissues concerned ought to be carefully considered, since the direction of its course is much affected by those of dense and unyielding structure, as the bones, fasciæ, and even the skin. The velocity of the ball, and the position of the body when it entered, ought also to be taken into account.

When the injury is so severe as to render amputation necessary, it has been disputed whether the operation ought to be performed immediately, or be delayed until the primary inflammation subsides, and suppuration is established. In reference to this question, the effects of gun-shot wounds may be divided into four stages: — 1. Confusion and prostration of strength, commencing immediately after the injury is sustained, and lasting seldom less than one, or more than six hours, unless it terminates in sinking. 2. Return of strength, attended with more composure of mind, and sensation of the injury. This continues until inflammation begins, which is hardly deferred beyond twenty-four hours. 3. Inflammation, ending in death, gangrene, or suppuration, and occupying from one to several days. 4. Suppuration, which continues until the patient recovers, or has his strength completely exhausted, and dies, — which may be in a week or two, or not until the end of months. Amputation may be performed with most advantage in the second

and fourth of these stages. Different opinions were formerly entertained as to which of them was preferable; but the extensive experience of the military surgeons who were engaged in the Peninsular War decided the question; and it is now admitted that amputation during the second stage is out of all proportion most successful; to say nothing of the risk which men wounded on the field of battle must run, if permitted to go through the inflammatory stage, while their shattered limbs are subjected to the irritation of rough carriages, and their constitutions injured by the unwholesome air of crowded hospitals. Should the surgeon find that his patient does not rally within the period usually occupied by the first stage, though assisted by the stimulating effect of wine or spirits, he ought still to afford the chance derived from removal of the limb, unless the strength seems at so low an ebb that it would certainly sink under the shock of an operation; and, on the same principle, when inflammation has been allowed to come on, and proceeds to gangrene, amputation ought to be performed, as giving the patient a chance, however small, of escape from otherwise certain death.

Cannon-balls not unfrequently occasion contusions without any breach of the surface, varying from the slightest ecchymosis to complete destruction of the subjacent tissues, so that they are reduced to a gelatinous pulp. Sometimes when the contusion is sustained on the trunk, it causes instant death, in consequence of important organs being ruptured or otherwise injured. These effects used to be ascribed to the *wind of the ball*, or the air violently agitated by its motion. They are now more correctly referred to the action of the ball itself, which has had its velocity so far spent as to bruise merely without wounding.

Extremes of Cold and Heat.

The first effect of cold is to diminish the vital action of the part to which it is applied. This state of depression, when not carried too far or continued too long, is succeeded by more than usual activity, or what is called reaction, especially if heat or any other stimulus co-operates with the natural tendency to excitement. If this alternation be frequently repeated, the part concerned becomes permanently weakened, being slightly swelled, of a purple colour, and not so warm as usual. It is then easily affected by cold, becoming pale, contracted, and numb, and reacts with so much violence as to shew symptoms of inflammation, becoming red, hot,

itchy, and painful; not unfrequently vesicated and ulcerated. A part thus injured by cold is named a Chilblain.

Chilblains are most apt to occur in persons who possess weak powers of circulation, especially young females, and on the same principle take place chiefly at the extremities of the body, viz., the hands and feet. They ought to be guarded against by avoiding sudden and severe alternations of cold with heat. When formed, they should be protected from cold, and supported in their actions by stimulating embrocations, such as camphorated oil, strong spirits, or a mixture of *tinct. sap. c. opio,* with *tinct. lyttæ,* in the proportion of six of the former to one of the latter. The ulcer of chilblains presents the appearance of a smooth superficial excavation, with thick white edges, and a peculiar viscid slimy discharge. It heals most readily under the *unguentum oxydi hydrargyri rubri.*

More intense cold not only weakens, but entirely suspends vital action. The part becomes pale, insensible, and shrivelled, and is said to be *Frost-bitten.* The extremities of the body, such as the fingers and toes, the ears and the nose, are most liable to be thus affected, both from their situation and comparatively languid circulation. A frost-bitten part is not dead, and when freed from the influence of the cold, regains its power of action. It is difficult to determine how long the torpor may last without permanently depriving the part of life; but there is reason to suppose that the period is considerable; and it appears from the relation of Sir John Franklin, that an animal may be restored to its usual actions even after its whole body has been frozen.*

In treating frost-bite, the great object should be to moderate the reaction, since, if it proves excessive, mortification readily occurs, both because the part is weak, and because its irritability being consequently increased, the inflammation is apt to be intense. The best method is to use friction without any external heat, or even to effect it through a cold medium, such as that of snow, in order to promote the return of circulation, and at the same time guard against excitement. If inflammation comes on, the part ought to be soothed with poultices, or anodyne and astringent applications, such as warm solutions of acetate of lead with opium; the liniment of soap and opium, &c. Local bleeding would increase the weakness, and consequently render the diseased action more unmanageable; but general depletion will be proper

* Franklin's Journey to the North Coast of America, p. 248.

if the patient is plethoric. Should mortification ensue, the best dressing will be a soft poultice until the sloughs separate.

Burns.—When a part is exposed to higher temperatures than usual, its actions are increased. It becomes red, more or less swelled, and hot. If the heat applied is moderate, or of short duration, these symptoms disappear when it is removed; but when it is intense, or longer continued, the redness caused by it is bright and permanent, and there is a painful sensation of burning. The part is then said to be burnt, while in the former case it was merely excited. The inflammation thus induced generally terminates in effusion of serum from the surface of the cutis, which detaches the cuticle, and elevates it into blisters. When the heat is still more intense or prolonged, it destroys the life of the part. The cuticle is then detached and thrown into irregular folds, exposing the subjacent cutis discoloured and dry. When the heat operates through the medium of fluids, its effects are named Scalds. Burns and scalds are always painful,—often long in healing, owing to the feeble action of the resulting ulcer, which is seated in parts that have been more or less injured by the heat,—and sometimes fatal by the shock to which they subject the constitution, by the profuse suppuration which they occasion, or by exciting inflammation of some internal parts.

In treating burns, it is necessary to consider whether the injury is so severe as to destroy the vitality of the part affected, or merely sufficient to induce inflammation of it. In the latter case cold applications afford great relief, and if employed immediately after the accident occurs, may prevent the inflammation and vesication altogether. Another mode of treatment which answers extremely well, though it is difficult to say on what principle, consists in enveloping the burnt part with cotton. This practice was introduced from America, and is now in very general use. It appears that its good effects are most conspicuous when pressure is conjoined with it; and a bandage, therefore, ought to be applied with moderate firmness. When blisters rise, the detached cuticle should be not only laid freely open, but taken away altogether, as its presence seems to increase the irritation. If ulcers remain, lotions of sulphate of zinc, or acetate of lead, are required to stimulate the granulating surface. It was formerly the custom to dress burns with unctuous matters, such as the carron oil, or *linimentum aquæ calcis;* but these applications are now almost entirely superseded by the means which have been mentioned.

When the burn is so severe as to destroy the life of the part, it must always be regarded as a severe injury. In very young or very old subjects, or those who on any other account are very weak, it is apt to induce immediate sinking; especially when it affects the trunk, and more particularly the abdomen. In patients whose powers of action are stronger, the local irritation generally occasions very smart symptomatic fever; and when the integuments of the thorax or abdomen are affected, there is a risk of the membranes, lining these cavities internally, inflaming from their contiguity. The constitutional treatment must depend upon the circumstances of the case. If the patient is drowsy, with cold extremities and a weak pulse, spirits, wine, and other cordials should be assiduously administered, while the body is warmly covered and sources of artificial heat are applied to the feet. If, on the other hand, the ordinary symptoms of inflammatory fever should be present, the tartrate of antimony ought to be freely employed, and even the lancet may be required. The local treatment of burns has afforded a fruitful field for diversity of practice and opinion; some using cold applications and means of a sedative kind; while others, as Dr Kentish, have insisted upon the advantage obtained from employing oil of turpentine, and different stimulants of this sort. It will be found, however, that there is not so much room for doubt and question as may at first appear, since it is only in what may be called the first stage of burns, or that part of their progress which intervenes between infliction and ulceration, that any uncertainty exists as to the proper mode of treatment. If the injury is slight, that is to say, if the part affected still retains its vitality, I believe that cold applications and cotton will in general prove most useful; and if the texture of the part be destroyed, there can be nothing better than a poultice, until the sloughs separate. In either case, ulceration sooner or later is established, and then the treatment will be the same for both.

Should the patient's strength prove inadequate to support the tedious and exhausting process of cure, if the part affected is seated on a limb, it ought to be amputated.

Poisons.

By poisons are understood agents which have the power of destroying the structure, or inducing disturbance in the actions of the body, independently of mechanical violence and temperature.

Those which directly affect the structure are named Escharotic Poisons, or simply escharotics. Of these the most powerful are potass, the concentrated mineral acids, and some metallic salts, as the nitrate of silver, oxymuriate of mercury, and chloride of zinc. They are frequently used intentionally to remove morbid structures, &c. and are then named Caustics. Occasionally, whether from accident or design, they are applied so as to produce serious injury. In such cases, as their effect is generally completed before surgical assistance can be procured, the only treatment admissible is that which promotes separation of the slough and healing of the sore. Poultices, until the first of these stages is completed, and then lotions with pressure, afford most benefit.

Poisons, more strictly speaking, are those agents which produce their effects independently of chemical properties, as well as mechanical force and temperature; they do not directly alter the structure to which they are applied, but produce such changes in its natural actions as frequently give rise to the most important local and general consequences. A very large proportion of the articles comprehended in this class are employed to produce their effects in order to relieve the system from other diseases, whence they are named, not poisons, but medicines,—the former title being reserved to denote those which are distinguished by the potency of their action. The only poisons which present subject for surgical consideration are afforded by the animal kingdom, and may be divided into—1. Those which exist naturally in the animals that yield them; 2. Those which are the results of diseased action; and 3. Those which depend on changes after death.

Natural animal poisons are afforded chiefly by the two classes of Insects and Serpents. In this and other temperate climates, the effects of those of the former are hardly more than local, consisting of pain, swelling, and redness of the part injured. The treatment, when any is judged necessary, should also be local; and the solution of muriate of morphia, or that of acetate of lead with opium, *aqua ammoniæ*, and other preparations of ammonia, afford most relief. There is considerable variety in the effect of these poisons, according to the irritability of the individual on whom they operate; and habit has a very remarkable influence in lessening it.

The poison of serpents produces more serious consequences, which vary according to the species which affords it. The most deadly sort occasions intense local pain, speedily followed by swell-

ing of the limb, rapidly extending, and attended with mottled livid discoloration of the skin. The patient, almost immediately upon being bitten, feels sick, weak, and confused. He appears as if intoxicated, vomits, becomes quite insensible, and dies within a few hours, or it may even be minutes, after sustaining the injury. The viper, which is the only poisonous serpent in this country, hardly ever produces fatal effects; but the pain and swelling caused by its bite are often extremely distressing.

The treatment must be both local and general. The former consists in opposing the entrance of the poison into the circulation; the latter in counteracting its depressing effect on the vital powers. In accomplishing the first of these objects, the means of most use are—1. Removing the poison from the body, either by cutting away the part, or destroying it with caustics or cauteries;—the application of ammonia also seems to have some effect in preventing it from producing its characteristic effects; 2. Applying a tight ligature on the limb to compress the veins and other absorbent vessels; and 3. To direct the current of the fluids towards, instead of from, the injured part, by causing suction over it, which may be effected with the mouth, or a cupping-glass. One or other of these proceedings may be trusted to chiefly, according to circumstances, but in severe cases it is proper to combine the operation of the whole. The general remedies are such as tend to prevent sinking, by creating a sort of artificial strength through their stimulating property. Ammonia, given pure or in the state of carbonate, with spirits, and warm water, sufficient to make the mixture palatable, ought to be administered every five minutes. Arsenic has been strongly recommended also, as a remedy in such cases; and although it might be difficult to account for its salutary operation, the facts in proof of it are so striking and well authenticated, that when circumstances permit, this means should certainly be combined with the others. The arsenite of potass, or Fowler's solution, is the most convenient preparation for the purpose, and it has been said that very large doses, even to the extent of two drachms, may be given every half hour.*

The morbid poisons originating in diseased action, which affect the human species, may all be produced by the human body; but two of them, cow-pox and hydrophobia, were in the first instance derived from the lower animals. They exist both in the liquid and in the gaseous state. In the former, they hardly act unless inserted

* Ireland, Med. Chirurg. Trans., vol. ii. p. 396.

or inoculated into the texture of the body. In the latter, they produce their effects when received into the lungs during inspiration. It is only the first or inoculated poisons which belong to the surgical department. They always occasion more or less irritation of the part to which they are applied, and generally afterwards more or less constitutional disturbance. Their *modus operandi* is not at all known. They seldom cause any immediate local alteration; and days, or even weeks, may elapse before there is any indication of their action. The constitutional disturbance follows, and after being fairly instituted, it cannot be subdued by removing the part on which the morbid matter primarily acted. The effect of some of these poisons will be more particularly considered hereafter. At present it may be observed, that the treatment proper for them in the first instance requires to be merely local, and should be conducted on the same principles of prevention, as that of natural poisons. In regard to hydrophobia, it is believed that, if the injured part be cut out, or otherwise removed, any time before the constitutional symptoms appear, the patient will be certainly protected from them.

The poisonous effects of dead animal matter are involved in considerable obscurity. It frequently happens that wounds received in the dissection of animals after death, whether for anatomical investigation or the preparation of food, are followed by troublesome consequences, both local and general. It is observed that those which have a punctured form are most apt to be so. Sometimes there is violent inflammation of one or all the tissues in the neighbourhood, from the skin to the bone, terminating speedily in suppuration or sloughing. In the finger this constitutes what is called paronychia or whitlow. The absorbent vessels leading from the injured part often inflame, and by propagating their morbid action to the surrounding tissues, occasion hard painful cords under the skin, and red lines on its surface. Still more frequently the lymphatic glands in the course of the absorbents inflame and suppurate. At other times the patient first complains of cold shivering, headache, and vomiting of bilious matter, after which the usual symptoms of fever come on, and are generally characterised by extreme irritation—the pulse being excessively quick—the respiration very hurried—and the countenance unusually expressive of anxiety. Along with this derangement of the system, a diffused inflammatory blush appears in the neighbourhood of the injury, from which it soon extends itself irregularly in various directions,

and, terminating in mortification, proves fatal within a week or little more; or the patient may die, as it seems, merely from the exhausting effect of the irritative fever, with very little local appearance of disease.

Since the effects of punctures now mentioned differ from each other very much in kind, and are subject to no less variety in the degree of their severity, while they are all occasionally produced, so far as can be ascertained, by the same circumstances, it has been inferred that they depend not so much upon a poisonous influence in the subject dissected, as on peculiar irritability of the individual injured.

In regard to the treatment it may be observed—1. That when punctures occur in suspicious circumstances, they ought to be converted into incisions, sucked, and touched with an escharotic. 2. That persons exposed to such injuries ought to lessen, so far as possible, the irritability of their systems. 3. That when the effect is an acute and local inflammation, a free incision through the affected part affords most relief. 4. That when the absorbents inflame, warm solutions of acetate of lead with opium have the most soothing influence. 5. That when the lymphatic glands become affected, warm fomentations are the most powerful means of relieving the patient, which they do either by inducing the inflammation to terminate in resolution, or by hastening suppuration if it be inevitable. 6. That when the constitutional disturbance precedes the local affection, and there are signs of great irritation, scarifications of the inflamed part, followed by hot anodyne fomentations, and accompanied with the internal administration of calomel, opium, and cordials, though they may seldom succeed in curing this most dangerous condition, seem to have more tendency to do so than general bleeding and the antiphlogistic regimen, which usually, by increasing the weakness of the patient's system, increase its irritability, and render its treatment more unmanageable.

CHAPTER X.

AMPUTATION.

THE expression Amputation, though sometimes applied to the excision of parts from the trunk, is generally confined in its meaning to the removal of limbs by the knife. In performing this operation, it is not sufficient merely to cut away what is diseased or injured, since the surface that remains ought to be left in such a state as will favour the healing of the wound, and afford a comfortable stump to the patient. Many different modes of operating have been contrived, with the view of attaining these objects; and there is no department of practical surgery into which more improvements have been introduced in recent times.

Amputation was anciently performed by the direct and simple process of cutting down at once to the bone, and sawing it through on a level with the soft parts. But as in this way there was no covering provided for the bone, whence followed a tedious and imperfect cure, various modifications were introduced to supply the defect. The muscles were drawn up by metallic plates, or pieces of cloth and leather, called retractors. Cheselden (1720) drew back the skin after it was cut, and then divided the muscular parts higher up. This method of *double incision* was carried further by Mr Mynors of Birmingham, who dissected the skin, and turned it back like the sleeve of a coat. Louis cut the muscles by two circular incisions, so as to divide the portion nearest the bone higher up than the external layer. Alanson, by holding his knife obliquely, while he made the circular sweep through the muscles, cut them at once in the same form that resulted from two successive incisions.

The object of all these contrivances was to leave the soft parts sufficiently long to cover the bone; but this they failed in accomplishing, excepting so far as concerned the skin; for the muscles being in the first instance cut higher than the integuments, and subsequently becoming still more diminished in length by the unopposed effect of their contractility, could hardly be made to meet

over the bone, which often protruded during the cure, and required to exfoliate or to be shortened by the saw. The most simple and effectual plan for covering the bones was obviously to form one or more flaps from the part of the limb most able to supply them; and there can be no doubt that this mode of operating would have come earlier into general use, had it not been that prejudice in favour of the circular incision directed the attention of practitioners to its improvement. The operation by flap was performed occasionally during the last century and a half, and recommended by various surgeons who practised it more or less extensively. Lowdham of London seems to have been the first of these (1696), and he was followed by Verduin (1697), Koenerding (1698), Sabourin (1702), and Vermale and Ravaton (1703). Towards the conclusion of last century, it was advocated by several of our countrymen in amputating the leg, of whom may be particularly mentioned Messrs White (1760), O'Halloran (1765), Hey (1770), and Alanson (1780).

The alleged advantages of this method are—1. That it is much more quickly performed, and consequently much less painful to the patient, than the circular incision; 2. That it cuts the parts smoothly, and leaves them in a state favourable to union; and, 3. That it affords a better covering for the bones than can be obtained from any modification of the other operation.

The flaps may be formed by cutting obliquely inwards to the bone,—by transfixing the limb and cutting outwards,—or by first cutting inwards, so as to obtain one flap, and then outwards to form a second. The particular circumstances of the case often render one of these modes preferable to the others; but when the surgeon has his choice, he will generally find transfixion the easiest method. The size of the flaps, and proportion of muscle and integument composing them, must be regulated by the thickness of the bone and laxity of the soft parts. The flaps ought to be cut longer than would be sufficient to constitute a well-formed stump in the dead body, to compensate for the contractility of the muscles. When the skin is loose, and the muscles attenuated, the surface of the flaps should be convex, to preserve the latter, and diminish the extent of the former tissue. When, on the contrary, the limb is muscular, and the skin tense, the knife should be made to describe a concave line, to prevent redundance of muscle.

For restraining hemorrhage during the operation, there are three means which may be used. The first of these is the tourniquet or turn-stick, invented by Morel (1674), consisting of a strap or

bandage carried twice round the limb, encircling a firm roller, or other suitable compress placed in the course of the artery, and a piece of wood, which, being inserted between the turns of the bandage, when twisted, effects any degree of constriction that may be required. The second is a modification of this apparatus, contrived by Petit (1716), who, instead of the turn-stick, used a screw and couple of plates, which, being separated by turning the handle, effected the pressure more gradually, and so as to dispense with the services of the assistant who was employed to hold the turn-stick. This screw tourniquet, variously modified and improved, is the instrument still generally used for the purpose. The third mode of commanding the vessels, is by simply compressing them with the hands. In certain amputations this is the only means that can be used, owing to the proximity of the operation to the trunk; and some surgeons, from the facility and dispatch attending it, never employ a tourniquet on any occasion. In cases where the tourniquet can be applied without doing harm, it ought to be preferred, as it relieves the assistant from a fatiguing duty, and prevents the patient from losing so much blood as he is apt to do when the vessels are subjected to manual pressure, if many of them require to be tied. The arteries ought to be pulled out with the catch forceps, and tied quite detached from their neighbouring connexions. After the principal vessels are secured, the tourniquet ought to be entirely removed, to prevent its slackened band from exerting such pressure on the veins as may cause them to bleed, and induce the surgeon to tie them instead of arteries.

The earlier modes of amputation rendered union by the first intention impracticable; and when the operation had been so far improved as to retain the soft parts sufficiently long to meet over the bone, the old system of dressing still continued in use, and the cavity of the stump was stuffed with lint, as all wounds were in those days healed by the granulating process. Mr Alanson had the merit of exploding this practice, and introducing light superficial dressings in its stead, which greatly shortened the cure; and though surgeons on the continent still interpose dressings between the edges of the stump, union by the first intention is always sought for in this country. Stitches, if necessary, ought to be employed to keep the lips of the wound nearly in their proper position; and when the bleeding has ceased, strips of adhesive plaster may be used to retain them in accurate contact.

The bad consequences of the operation are chiefly hemorrhage,

sero-purulent effusion into other parts of the body, especially the cavity of the thorax, suppuration of the stump, and exfoliation of the bone.

Hemorrhage may appear immediately after the operation, either from arteries which have not been tied, owing to their not shewing themselves by bleeding during the state of collapse succeeding the removal of the limb, or from the veins being compressed by too tight a bandage. In the former case, it is necessary to apply as many ligatures as may be requisite ; in the latter, it is sufficient to slacken the bandage. Hemorrhage sometimes commences a few hours after the stump is dressed ; and then depends either upon a general oozing from the cut surface, consequent upon the reaction of the system, or upon some imperfection in the ligature of the vessels, which allows the blood to escape when impelled with more force than it was while the patient remained weak and faint. Cold lotions and pressure will restrain it, if proceeding from the first of these sources ; but additional ligatures will be required, if, resisting such means, it proves to be from the second of them. The hemorrhage occasionally does not occur until the third, fourth, or even seventh day ; and then almost always depends upon ulceration of the artery. In this case, a ligature should be applied to the orifice of the vessel, if the bleeding cannot be arrested by pressure effected through means of compresses introduced into the stump, and a tight bandage applied externally.

When the stump does not unite, but inflames and suppurates, fomentations ought to be frequently applied until the discharge is fully established, when stimulating washes and pressure must be employed to support the weakened action of the granulating surfaces, and make them unite together.

Purulent effusions into internal cavities occur chiefly in weak, debilitated, irritable subjects, and have been accounted for variously. They are known to result in such habits from excited action, whatever be the cause producing it. Inflammation of the veins has also been supposed to be the cause of this occurrence. There are no means of remedying such effusions, and the only way of avoiding them is, in the *first* place, to avoid operating in circumstances which predispose to such occurrences ; and, in the *second*, to control diligently from its commencement the constitutional excitement which precedes them. Exfoliation of the bone is a very troublesome occurrence, not only from delaying the process of cure, but by tending to render it imperfect through the retraction of the soft

parts composing the stump, which gradually takes place in the event of their not uniting over the extremity of the bone. It sometimes depends upon the injured or diseased state of the limb —and may also be occasioned by too free removal of the periosteum, rough use of the saw, or deficiency in the covering left for the bone. The most common form is merely a ring from the circumference of the bone, with irregular spicular prolongations upwards. But occasionally the exfoliation is much more extensive, and extends in a conical form far up the interior of the bone.

Particular Amputations.

The fingers may be amputated with most advantage at the joints. There used to be a strong prejudice against leaving an articular surface, the cartilage of which was thought to exfoliate necessarily, so as to render the cure more tedious and troublesome. Disarticulation was therefore avoided as much as possible, and when, from any circumstance, it appeared inevitable, the precaution was taken of scraping off the cartilage. It is now well ascertained that union by the first intention generally occurs as readily after disarticulation as after amputation through the shafts of bones, and that when it does not take place, the only inconvenience experienced from the cartilage is a little increase and longer continuance of the discharge. Such being the case, though it would be wrong to amputate through a joint by preference, still, when there is any lasting advantage to be gained by doing so, the chance of bad consequences, so trivial as that just mentioned, ought not to be regarded as a sufficient objection to it.

When the distal phalanx alone of a finger is affected, it ought to be removed by cutting into the joint on the dorsal surface, dividing the lateral ligaments, and then carrying the knife forwards parallel with the palmar surface of the bone so as to save a flap to cover the stump: or the operation may be reversed by transfixing the finger, while its palmar surface is turned upwards, forming the flap, and then cutting through the joint. When the finger requires to be amputated above this joint, the operation should be performed by making two semilunar incisions, one on each side, so as to form two lateral flaps, which being dissected back will expose the bone, and allow it to be divided by the saw, or what is better, the cutting-pliers. The flaps are then made to meet together over the face of the stump. The second phalanx might be removed at the joint in the same way as the first; but as the portion of the finger thus left

would be neither useful nor seemly, it is better, unless the patient refuses his consent, to take away the whole of it at its metacarpal articulation. In doing this, while the other fingers are held aside, the surgeon should place the point of his knife exactly over the summit of the joint, and cut first on one side and then on the other, obliquely into the palm of the hand to the point opposite that from which he set out, taking care to keep exactly in the angle formed by the integuments connecting the fingers. The flaps being detached, he may readily pass the point of his knife round the head of the bone. Lisfranc made one flap first, then carried his knife through the joint, and completed the operation by cutting outwards. When the parts retain their natural laxity, this proceeding is equally easy and expeditious; but if they are thickened and indurated, as is generally the case, the second flap is very apt to be injured in detaching the head of the bone; and even in the most favourable circumstances it is much more difficult to adapt the flaps properly to each other in this way, than in the one just described. One or two stitches are often useful in keeping the edges of the skin in contact. Of all the operations for amputating fingers this is the most important, from the frequency of cases requiring its application. The *distal* phalanx, indeed, almost never stands in need of removal by itself, since all the morbid conditions to which it is subject from injury or disease admit of reparation; and it is of course always advisable to retain the extremity of the finger with its protecting nail, even though the bone, in whole or part, may be taken away. And when more than the distal phalanx must be removed, it is almost always better, in respect to appearance as well as use, to amputate the whole finger.

When a portion of the metacarpal bone requires to be removed, the best method is to apply the point of the knife at the part where the bone requires to be divided, and cut down on each side of it, in the angle formed by the integuments between the fingers, so as to make the incisions meet below, opposite the metacarpo-digital articulation; and then divide the bone by means of the cutting-pliers, which were introduced into surgery by Mr Liston at an early period of his practice,—and from their extensive utility may be regarded as the most valuable addition that has been made to the modern armoury of the profession. When the metacarpal bone of the thumb is the one concerned, a portion of it may be removed by making two incisions, commencing where the bone requires to be divided, inclosing the thumb, and meeting together

at the angle of union between it and the fore-finger. If it is necessary, the whole bone may be easily disarticulated. The thumb and fore-finger being held separate, the surgeon should cut upwards in the angle between them as far as the bones will allow him, then, turning the edge of the knife laterally, he will at once enter the joint, and having cut through it, may readily form a sufficient flap to cover the raw surface in carrying his knife outwards. The same processes are proper for removing the metacarpal bone of the little-finger in part or in whole; but in this case the external flap must be formed previous to the disarticulation, which is most readily effected by introducing the knife into the joint from the ulnar side.

The toes ought to be amputated on the same principles; but, with the exception of the great one, which may be removed through the joint of the first and second phalanx, it is always proper in removing them to perform disarticulation between the first phalanx and metatarsal bone, since the small portion that might be allowed to remain could be of no use, and in all probability would occasion lameness. When more of the great toe than the distal phalanx requires removal, the operation should be performed through the metatarsal bone, in order to prevent its large articulating extremity from impeding recovery, and rendering the foot unseemly as well as inconvenient.

The disease requiring amputation sometimes extends to the tarsus, but is limited to the bones on one side of the foot—namely, the internal cuneiform and navicular on the tibial, and the cuboid on the fibular side. In this case, instead of amputating the foot, it is better to make a free removal of the diseased parts by taking them away, together with the metatarsal bones articulated to them. The operation should be conducted on the same plan as for the removal of a metatarsal bone by itself, and will be found hardly more difficult or serious. Partial amputation of the foot may also be performed transversely through the metatarsus, between the metatarsus and tarsus, and through the tarsus. The first and second of these methods are very seldom admissible, owing to the disease which requires removal of a part of the foot, generally extending so far as to encroach upon the bones where they would need to be divided; and they are also objectionable from the difficulty which attends their execution, while there is no counterbalancing advantage in their favour, since, when once the anterior extremity of the longitudinal arch of the foot is taken away, no

additional inconvenience results from removing a larger portion, so long as the posterior extremity or heel is allowed to remain. It has been objected that the extensor muscles of the ankle-joint having no opponents left attached when amputation is performed through the tarsus, must draw up the heel and point the cicatrix to the ground. But experience has proved that this unpleasant consequence is considerably opposed by the flexor tendons adhering to the cicatrix.

The operation through the tarsus, which was invented by Chopart, had been entirely neglected in this country, but has come into more general use since I performed it for the first time in 1829, and frequently afterwards.

The blade of the knife employed should be about six inches long, and half an inch broad, sharp at the point, and blunt on the back. The tourniquet ought to be applied immediately above the ankle, having compresses placed over the posterior and anterior tibial arteries. The surgeon should measure with his eye the middle distance between the *malleolus externus* and the head of the metatarsal bone of the little toe, which is the situation of the articulation between the *os cuboides* and *os calcis*. Placing his fore-finger here, he ought to fix his thumb on the other side of the foot directly opposite, which will shew him where the *os naviculare* and *astragalus* are connected. An incision somewhat curved with its convexity forwards is then to be made from one of these points to the other, when, instead of proceeding to disarticulate, the operator should transfix the sole of the foot from side to side at the extremities of the first incision, and carry the knife forwards, so as to detach a sufficient flap, which must extend the whole length of the metatarsus to the balls of the toes. The disarticulation may finally be completed with great ease, as the shape of the articular surfaces concerned is very simple, and nearly transverse.

The plantar, anterior tibial, and any other arteries that require to be secured, must then be tied, and the flap having been secured in its place by a few stitches, some light dressing ought to be applied. During the cure the knee ought to be kept bent to relax the *gastrocnemius*.

As disease of an incurable kind frequently affects the joint between the *os calci* and the *astragalus*, and also the ankle-joint itself, beyond the reach of any partial amputation of the foot, some attempts had been made to remove it at the ankle, by making a flap from the integuments of the instep, but with results so little satis-

factory, that amputation of the leg continued to be the established means of remedy in such cases. In 1842, I accomplished the object in a different way, by preserving the thick integuments of the heel for covering the ends of the bones, and this may now be considered the proper procedure for effecting removal of the foot when practicable.

When the operation is to be performed, pressure should be made on the tibial arteries by the fingers of an assistant, or a tourniquet applied above the ankle. The only instruments required are a knife, of which the blade should not exceed four inches in length, and a saw. The foot being held at a right angle to the leg, the point of the knife is introduced immediately below the maleolar projection of the fibula, rather nearer its posterior than anterior edge, and then carried across the bone, slightly inclining backwards, to the inner side of the ankle, where it terminates at the point *exactly opposite* its commencement. The extremities of the incision thus formed are then joined by another passing in front of the joint. The operator next proceeds to detach the flap from the bone, and for this purpose, having placed the fingers of his left hand over the prominence of the *os calcis*, and inserted the point of his thumb between the edges of the plantar incision, guides the knife between the bone and nail of the thumb, taking great care to cut parallel with the bone, and to avoid scoring or laceration of the integuments. He then opens the joint in front, carries his knife outwards and downwards on each side of the astragalus, so as to divide the lateral ligaments, and thus completes the disarticulation. Lastly, the knife is carried round the extremities of the tibia and fibula, so as to afford room for applying the saw, by means of which the articular projections are removed, together with the thin connecting slice of bone covered by cartilage. The vessels being then tied, and the edges of the wound stitched together, a piece of wet lint is applied lightly over the stump, without any bandage, so as to avoid the risk of undue pressure in the event of the cavity becoming distended with blood, which would be apt to occasion sloughing of the flap. When recovery is completed, the stump has a bulbous form, from the thick cushion of dense textures that cover the heel, and readily admits of being fitted with a boot.

The advantages which I originally anticipated from this operation were—*first*, the formation of a more useful support for the body than could be obtained from any form of amputation of the leg; and, *secondly*, the diminution of risk to the patient's life, from

the smaller amount of mutilation, the cutting of arterial branches instead of trunks, the leaving entire the medullary hollow and membrane, and the exposure of cancellated bone, which is not liable to exfoliate like the dense osseous substance of the shaft. From my own experience, and that of many other practitioners who have adopted amputation at the ankle, I now feel warranted to state that these favourable expectations have been fully realised, and that, in addition to its other advantages, this operation may be regarded as almost entirely free from danger to life. It also has the grand advantage of removing not only the bone already diseased, but the whole of that spongy portion which may be disposed to suffer in the same way, as not unfrequently happened after the operation of Chopart.

Some attempts have been made to improve this operation by varying the form of the flap, and by retaining the astragalus or tuberosity of the os calcis. But all of these modifications seem to lessen the simplicity, facility, and efficiency of the operation; more especially the one last mentioned, which was proposed by M. Perigoff of St Petersburg, appears objectionable, by complicating the process, displacing the integuments of the heel from their proper position at the extremity of the stump, exposing to the risk of relapse, by retaining a portion of the tarsal bones, and impeding the use of an artificial foot by rendering the limb inconveniently long.

The circumstances which were formerly held to require removal of the leg so generally admit of relief through amputation at the ankle, that the former operation is now rarely necessary in practice. Indeed, I have of late years performed it chiefly for the remedy of useless or uncomfortable stumps, resulting from amputation by flap at the middle or higher part of the leg. There can be no doubt that in these situations the flap method is very apt to leave a mass of redundant substance, affording no protection to the bone, which, having nothing to cover it except an imperfect cicatrix, is a perpetual source of discomfort and suffering. In order to prevent the risk of such unpleasant occurrences, and also to afford relief from them when they have unfortunately taken place, I think amputation of the leg should always be performed on the following principles :—

In the first place, it does not seem desirable for any useful purpose to retain a longer stump than when the tibia is divided at the distance of an inch below the tuberosity; and as the cancellated texture of this part is less prone to exfoliation than the dense sub-

stance of the shaft, it is therefore improper to operate lower in the limb. Secondly, since a covering of muscle is not essential to the formation of a good stump, as may be seen from the results of amputation at the ankle, and since the attempt to retain a muscular cushion below the knee is, as has just been mentioned, apt to leave the bone in an exposed state, the operation should be so conducted as to make sure of obtaining a sufficient protection from the integuments. On the whole, I believe, from ample experience, that the following mode of procedure, founded upon these principles, is the most eligible that can be adopted :—

A tourniquet having been applied above the knee, two semilunar incisions are to be made through the skin, from side to side of the limb, with their convexities downwards, and their extremities meeting about two inches below the tuberosity of the tibia. The flaps thus formed are then to be detached from their subjacent connexions, so as to expose the bones at the distance of an inch below the tuberosity. The muscles are next divided behind about the middle of the extent to which their surface has been exposed, and then on the other side on a level with the line where the saw is to be applied. Allowance having thus been made for the unequal retraction of the anterior and posterior muscles, the surface of flesh and bone presented after the operation is perfectly even, and admits of being covered by the flaps of integument without either straining or redundance.

The stump thus formed may either be rested on the skin, or employed so as to retain the use of the joint, by means of an apparatus consisting of a hollow cone secured by straps buckled round the knee.

The advantages which had been experienced in amputating at the ankle from the cancellated texture of the bone exposed not being liable to exfoliation, and from the medullary canal of the shaft not being opened, suggested to me the expediency of operating for disease requiring removal of the knee-joint by sawing through the condyles of the thigh-bone, and securing an adequate covering of soft parts by forming a short anterior and long posterior flap. The results of this procedure in my own practice, and that of various surgeons who adopted it, were very encouraging; and if the choice in such cases lay merely between amputating at the knee and doing so at the middle of the thigh, I should feel inclined to maintain the importance of the former operation. But having for some years past been satisfied that amputation admits of

being performed immediately above the knee, so as to provide a stump fully more convenient for the patient than when it is of greater length, I think this method should in general be preferred when practicable. In a letter lately received from my friend and former pupil, Dr Charles Campbell of Jamaica, he says,—"It is admirably adapted to the cases of chronic ulcer of the leg, so common among the negroes, in which the skin and cellular tissue become enormously hypertrophied, and the muscles undergo fatty degeneration. In such cases, a good flap is always readily formed from the ham, and the resulting stump is, I think, superior to any that can be formed in the thigh. I have had occasion to operate in seven or eight cases, and have always been satisfied with the results." It thus appears that there may be peculiar conditions making this mode of amputation eligible.

The unqualified preference for the flap method in amputating the thigh which I formerly expressed, has been considerably modified through the experience of more extended observation. I still think that when the limb requires removal at the middle or any higher point of the thigh-bone, the operation should be performed by the formation of two flaps, one being anterior and the other posterior. But when circumstances permit amputation at the lower third of the limb, and especially if it be muscular, I am fully satisfied that great advantage results from operating by circular incision, or, in other words, by providing a covering of integuments for the bone, instead of the muscular cushion, which in this situation is so apt to retract and leave it exposed.

The incision through the skin should not be *circular*, but describe two semilunar lines from side to side, with the convexity towards the knee. The integuments having been separated from their subjacent connexions, and retracted to the extent of at least two inches, the muscles are to be divided as high as they are exposed in front, and as low behind so as to compensate for the inequality of retraction. The bone is then to be exposed at least two inches higher than where it has been brought into view by the anterior incision, and divided there while the muscles are carefully held up by a linen or leather retractor.

If the limb is not muscular, but soft or relaxed, as after protracted illness, or in females and children, the process may be conducted more simply, and with much the same effect, by making two short flaps, extending through both the skin and muscles, and then exposing the bone with great care, so as to let the saw be

applied sufficiently high to prevent any risk of the extremity being subsequently protruded.

The thigh may be amputated at the hip-joint; but in this case the shock inflicted on the system is so great, and the wound which remains to be healed is so extensive, that the operation ought never to be performed unless the patient's situation affords him no other chance of escape from certain and speedy death. There are various modes of operating, the choice of which must be regulated by the circumstances of the case, but in general the following one will be found the most eligible, in respect both to the ease of its performance and to its result :—

An assistant should grasp the limb as high as possible, pressing with his thumbs upon the artery in the groin, where it lies on the brim of the pelvis, and with his fingers upon the hip. The surgeon introduces the point of a narrow knife about ten inches long, nearly half-way between the spinous process of the ileum and *trochanter major*, thrusts it through transversely before the bone, so as to form an anterior flap, which, being held up by an assistant, he makes another from the posterior parts, then desires the limb to be abducted, opens the joint, and completes the disarticulation.

This operation can be performed very rapidly, affords plenty of room to the assistants for compressing the vessels, renders the previous ligature of the artery unnecessary, and leaves ample materials for a good stump.

The fore-arm ought to be amputated by making two equal flaps, from before and behind; the arm being held while this is done in the middle state of supination and pronation, in order to relax the muscles equally, and thus facilitate the operation. The hand may be removed at the wrist-joint by transfixing the limb laterally and forming a flap from the palmar aspect; but the longer stump thus obtained is not found to facilitate the adaptation, or increase the utility, of an artificial hand; and the large articular surface which remains, though it may not materially delay the cure, must always cause deformity.

The arm may be amputated above the elbow, either by double flap or circular incision; but the former mode is greatly preferable. A tourniquet is here quite unnecessary, as the vessel can be compressed easily and effectually by the hand placed over it at the inner edge of the biceps.

Amputation at the shoulder-joint is not unfrequently required, and may be performed in various ways, with three of which the

surgeon should be familiar, as the state of the parts concerned sometimes leaves no room for choice.

1. The circulation through the subclavian artery being arrested by pressure with the thumb above the clavicle, where the vessel issues from between the *scaleni*, and rests on the first rib, the surgeon thrusts a sharp-pointed knife down to the head of the humerus, immediately below the acromion process; and cutting downwards in a semilunar direction, first on one side, and then on the other, so that the two incisions meet in the axilla, he forms two lateral flaps, which, being dissected back, expose the joint, and enable him to effect the disarticulation very readily, by pushing his knife through the capsular ligament, and then cutting round the glenoid cavity.

2. The surgeon introduces the point of a long narrow knife a little nearer the clavicle than the middle space between the acromion and coracoid processes, thrusts it downwards and backwards until it issues at the inferior margin of the axilla, and then cuts in the same direction, so as to form a large external flap. Having, in doing this, cut through part of the capsular ligament, he has no difficulty in passing the knife round the head of the humerus, and making a suitable flap from the remaining parts, the assistant introducing his finger as soon as sufficient room is afforded for the purpose, and compressing the vessel. If the left arm is the subject of operation, the knife may be introduced at the lower margin of the axilla, and brought out at the point where it is entered in the former way.

3. The surgeon cuts in a semilunar direction from one side of the deltoid to the other, so as to form a large flap of this muscle, which, being dissected from its subjacent connexions, and held up, exposes the joint, allows the disarticulation to be completed, and permits the fingers of the assistant to be introduced to compress the vessels before they are divided, together with the remaining muscles and integuments, by a transverse incision.

After all of these operations, of which the one first mentioned should be preferred when circumstances permit its performance, which is generally the case, the arteries ought to be tied, the edges of the flaps stitched together, and a proper bandage applied.

CHAPTER XI.

BONES.

Fractures.

THE osseous tissue resembles, in general, the other vascular parts of the system as to the healthy and morbid actions of its nutritious system, but is remarkably distinguished by its power of reproduction. It is not possible to explain on what this difference depends, but its existence is of great consequence in remedying the accidents to which bones are most exposed by their rigidity—viz., Fracture.

Bones may be fractured in three ways—1. By external violence operating directly upon the injured part; 2. By external violence causing a strain upon the bone so as to break it, not where the force is applied, but at some other part of its extent; 3. By inordinate action of the muscles. Fractures result most frequently from the first and second of these causes, and very rarely from the third. They occur at all periods of life, but are more frequently met with in particular bones at one age than another. In children, the femur, humerus, and clavicle; in adults, the bones of the leg and fore-arm, the shaft of the femur, the humerus, clavicle, and ribs; and in old people, the neck of the femur, are the bones most liable to be broken. Independently of diseased conditions to be mentioned afterwards, which render the bones more subject to fracture, it would appear that the bones of some individuals are more easily broken than those of others. Fractures may be transverse or oblique in respect to the axis of the bone—they may exist at one part of it, or in several, whence they are distinguished into single and comminuted—and they may be attended with a wound exposing the bone, or without one, whence they are divided into Compound and Simple. In explaining the symptoms and treatment of fracture, it is necessary to consider separately the two departments of this last division, which is of great importance.

Simple Fractures.

The symptoms of simple fracture are—1. Distortion or change of shape, owing to the broken bone being unable to counteract the displacing tendency of the surrounding muscles and the weight of the limb itself; whence are caused shortening or retraction, the extent of which depends upon the obliquity of the fracture, and rotation. 2. Diminution or total loss of voluntary motion. 3. Preternatural mobility by external forces. 4. Swelling from the effusion of blood by ruptured vessels, and from the same source the discoloration of ecchymosis appearing some time after the accident. 5. Pain and spasmodic starting of the muscles, owing to the irritation of the sharp extremities of the bone. 6. Crepitus, or a grating sensation when the limb is moved, from the rough osseous surfaces rubbing against each other.

When the extremities of a broken bone are allowed to remain at rest they unite together, and if examined by a section afterwards, exhibit a mass of new osseous matter, which serves as their bond of union. The old surgeons believed that this *callus*, as it was called, resulted from an effusion poured out by the surrounding soft parts, in consequence of the irritation of the injury, which concreted about the broken bones, and united them together. The great object of treatment, according to this view, was by local pressure, to restrain the effusion from going beyond due bounds. For this purpose short splints, or pieces of wood, pasteboard, or iron, were tightly bandaged to the limb over the injured part. Mr Pott had the merit of exposing to the surgeons of this country the impropriety of such a practice, and introducing another more scientific as well as practically useful.

Mr Pott attributed exuberance of the callus to imperfect adjustment of the broken bones, which causing irregularity and projection of their extremities, consequently rendered their union large and clumsy. He therefore insisted upon carefully setting or replacing the fracture, and in doing this pointed out the importance of relaxing, by proper position of the limb, those muscles which by their contraction caused or increased the distortion. Here he remarked very justly, that what is usually called the riding or rising end of the bone, from its seeming to project, is, with some few exceptions, really in its place, and appears prominent merely because the other is drawn back by the muscles. He shewed the folly of attempting to squeeze down the projection by local pres-

sure, and discarded the short splints which were employed for this purpose. But in order to retain the proper position after obtaining it by due relaxation of the muscles, and prevent the weight of the limb, the movements of the patient, and the spasms of the irritated muscles from causing displacement, he recommended the use of splints long enough to extend beyond the joints at both extremities of the broken bone.

The process by which reunion is accomplished can seldom be inspected before its completion, and experiments on the lower animals are not to be regarded as affording unexceptionable evidence; it has therefore been very variously explained, and still remains in some points rather obscure. The following steps seem to be well ascertained. In the first place, the parts which form the cavity that encloses the fractured extremities of the bone, become thickened and consolidated by the interstitial effusion and organisation of lymph. The medullary membrane undergoes a somewhat similar change, while the surface of the bone acquires a covering of gelatinous-looking lymph. The sort of capsule which is thus formed by the indurated periosteum, muscles, fat, or whatever other tissue happens to be concerned, gradually becomes firmer, and has ossific matter deposited in its substance, generally in largest masses where the periosteum still adheres to the bone. The broken extremities are thus by degrees joined together and rendered immoveable, but still remain unable to resist any considerable force which tends to separate them. The process of ossification then proceeds inwards from all the surface, both of the old bone and of that newly formed. A gelatinous sort of mass, or sometimes blood, fills the cavity that exists while this is going on, and when the cure is completed, the bone, if divided, exposes a compact osseous mass, which in the course of time acquires a cancellated texture, but has not the medullary canal perfectly restored.

The time required for this process varies with the size of the bone, being performed most quickly when it is smallest, and *vice versâ*. The shaft of one of the large bones, such as the femur or tibia, generally acquires rigidity in the course of four or five weeks, but does not regain sufficient strength for supporting the body or performing locomotion until several weeks afterwards; and, so far as can be judged from the opportunities of observation occasionally afforded, is not completely ossified at the fractured part before the lapse of several months. The age, constitution, and peculiar circumstances of the patient also cause variations in the process of

cure. It is most speedy in youth and health. In pregnancy it is performed in general with less energy than usual. Rest of the limb promotes it, and motion not only retards, but if considerable or long-continued, altogether prevents it; in which case the substance that ought to have formed the callus acquires the appearance and properties of ligament, so as to render the limb flexible, and constitute what is called an artificial joint, the different kinds and treatment of which will be more particularly considered afterwards.

In treating fractures, it is of great consequence to set or replace the extremities of the bone as soon as possible after the injury is sustained, in order to prevent the bad effects of their continued irritation, to effect the adjustment before it is impeded by swelling of the limb or thickening of the parts which surround the bones, and to avoid disturbing the process of reunion by altering the position of the broken surfaces at a later period. When swelling and tension are actually present, it is sometimes thought proper to delay the adjustment until these symptoms are subdued by leeches and fomentations; but as such means can have little effect while the cause of irritation continues in operation, it is always better to reduce the bones into their proper situation as soon as possible, and then keep the limb steady by means of splints. The best material for splints is thick pasteboard or thin wood split longitudinally into narrow portions, and covered with leather. They should be long enough to extend beyond both ends of the fractured bones, and broad enough to equal the diameter of the limb. Those of the former kind must be well softened by immersion in hot water, or being thoroughly moistened with it, and then padded with carded tow, lint, or flannel. There are usually required two splints, one for each side of the limb, and the best bandages for retaining them are the looped bandage, the tailed bandage, and the common roller. The first of these consists of narrow strips of calico, about an inch and a half broad, and long enough when folded double to pass round the limb with a few inches of excess; one of the ends is then drawn through the loop and tied to the other. The number of pieces thus applied varies with the length of the limb, as there ought not to be more than three inches between them. This bandage is useful when the degree of tightness requires to be occasionally altered, and the limb cannot be moved without disadvantage. The tailed bandage consists of a common roller, divided into pieces long enough to encircle the limb somewhat obliquely, and cross over far enough to keep their hold. Six, eight, ten, or whatever number of

these the length of the limb requires, are placed transversely under it, so that each overlaps the one above it about two-thirds. The lowest one is then drawn tightly round the limb, and while its ends are still held by the surgeon or his assistant, the one next above is applied in the same manner, so as to secure the former, and so on until the whole are thus disposed of. This bandage effects a very equable pressure, and can be changed without disturbing the limb; but it does not admit of partial relaxation or tightening. The common roller is the simplest and easiest of all the means for the purpose, but can be only used where the limb may be moved without any inconvenience. There are various contrivances for assisting the splints and bandages in preserving the proper position; but they will be best explained along with the particular circumstances requiring them. Another method of treating fractures has of late years been introduced, though there seems great reason to question its superiority over that previously in use. It consists in closely enveloping the injured limb with pasteboard and bandages, covered with starch. Some practitioners apply this immoveable apparatus, as it has been called, immediately after the receipt of the injury, but others wait a few days until the tension and engorgement of the limb subside. The great advantage contended for is the abridgment of confinement, since the patient, so soon as the bandages become dry and firm, may quit his bed without danger of displacing the broken surfaces. On the other hand, it may be stated, that the process of dressing is not only tedious and requiring great nicety in its execution, but, unless he be carefully watched, must expose the patient to the risk of various bad consequences, from alterations in the size of the limb occurring subsequently to its adjustment. On the latter account, especially, this mode of treatment seems most suitable in hospital practice; and here, again, as the patients have no object but a speedy recovery, there does not appear to be any benefit derived from treating them propped up in chairs, or moving about on crutches, instead of being allowed to lie quietly in their beds.

Compound Fractures.

The wound which constitutes the distinguishing character of compound fractures occasions a most important difference in respect to the danger, and difficulty of cure attending them. There is apt to proceed from this source violent inflammation with fever, terminating in profuse suppuration or gangrene, or death without any remarkable local change, merely from the effects of constitutional dis-

turbance. These consequences used to be ascribed to the admission of air, but are now referred with more reason to the inflammation of an extensive wound implicating important and irritable tissues; for unless the orifice of the cavity heals by the first intention, its surface must necessarily inflame as the first step to granulation. The great object in treating such injuries is consequently to obtain immediate union, and thus convert them into simple fractures.

If the bone projects through the wound, a portion ought to be removed from its extremity by the saw or pliers sufficient for allowing it to be easily replaced. To prevent irritation, which is so adverse to adhesion, the bones ought to be carefully set as soon as possible; and to keep down inflammatory action, cloths wet with cold water should be assiduously applied, until there is no longer any fear of it, or until it actually commences. With the same view, the patient must be depleted according to his strength, and confined to the most strict antiphlogistic regimen. Should inflammation come on, fomentations and poultices must be substituted for the cold applications. Bleeding is to be used with great caution, since the patient, if he survives the immediate danger, will have to support a copious and profuse suppuration; and those means which subdue violent action without permanently weakening the system ought to be preferred. So soon as the inflammatory tension begins to subside, the relaxing applications must be changed for those of a stimulating, astringent, and discutient kind. The lotions of acetate of lead, sulphate of zinc, &c., are the best adapted for this purpose. Counter-openings, if required, should be made to afford the matter free vent, and pressure must be carefully effected by compresses and bandages, while the most unceasing attention is bestowed on the preservation of proper position and perfect rest. The patient's strength requires of course to be supported by nourishing food. Pieces of bone occasionally become detached during the cure, and delay or prevent it, they ought therefore to be diligently searched for and extracted.

When the injury is so severe as to preclude the possibility of recovery, amputation must be performed. The circumstances to be taken into account in determining on this proceeding are—1. The state of the soft parts; 2. That of the blood-vessels and nerves; 3. That of the bones; and, 4. That of the patient's constitution. It is possible that any one of these circumstances may be so unfavourable as to render the measure in question necessary, but it more frequently happens that the surgeon is influenced by several or all

of them in deciding on the operation. In civil practice, unless the state of the limb is manifestly so bad as to render recovery impossible, an attempt ought always to be made to save it. For if the bones are carefully replaced, and the means which have been mentioned are employed to prevent and moderate action, both local and general, the patient will not be exposed to much risk in the first instance; and if his strength should prove unequal to the exertion required of it in the future progress of the case, the amputation may be performed with a more favourable prognosis than in secondary amputations after gun-shot wounds in military warfare.

Particular Fractures.

Hands and Feet.—The phalanges of the fingers and toes, owing to their shortness and mobility, are little subject to fracture. The injury, when it does occur, is readily recognised, and easily treated by means of a narrow wooden splint, padded with lint, and supported by a roller. In treating fracture of the proximal phalanx of the fingers, it is difficult to keep the bone straight in the extended position, owing to the effect of the flexors in drawing the broken ends downwards, and it will be found more convenient to fill the hollow of the hand with tow or some other soft material, and then bind down the fingers upon it. The metacarpal and metatarsal bones are more frequently broken, when there is little displacement, but considerable swelling, pain, and crepitus, with preternatural mobility of the corresponding finger or toe. A compress of tow, supported by a roller, prevents motion of the fractured extremities, which is all that the case requires.

Bones of the Leg.—The fibula is apt to be fractured by twists of the foot outwards, and usually gives way from about an inch to an inch and a-half above its inferior extremity. The eversion of the foot, and its mobility in a lateral direction, with the pain and crepitus caused by the broken surfaces, render the injury very distinct. The best mode of treatment is that devised by M. Dupuytren. It consists in placing on the inner side of the leg a thick cushion, to which, after having been secured in its place by means of a roller, a wooden splint, long enough to extend beyond both the foot and knee, is fastened; and then applying a bandage at each extremity of the splint, so as to draw the foot and upper end of the tibia towards it, and thus effectually counteract the distortion which is caused by the weight of the limb, and the action of the peroneal muscles. Sometimes along with this fracture the

foot is found displaced not to the side but backwards, in which case the heel is remarkably elongated and the instep shortened. After the parts have been adjusted by suitable extension and pressure the same apparatus is to be used, with this difference, that the cushion and splint are placed in front. Dupuytren directed them to be placed behind, but I have not been able to attain the object desired in this way. The lower end of the splint should have the form of a horse-shoe, so as to embrace the instep. When the fibula is fractured higher up, the cause is generally direct violence, and the symptoms are so obscure, that, unless the examination be instituted early, before swelling comes on, it is difficult to decide whether the bone is broken or not. The treatment requires merely a roller applied from the toes upwards, to prevent motion.

The tibia is occasionally fractured, while the fibula remains entire, generally in consequence of falling from a height on the heel, and gives way most frequently a few inches from the lower end. There is usually not much displacement, but great pain, and complete loss of power over the leg. The treatment is easily conducted, since it requires merely the use of means for preventing motion; and a couple of pasteboard or leather splints, secured by the looped bandage, so that they may be relaxed or tightened according to the degree of swelling, will be found sufficient for the purpose, the limb being laid on its outer side, with the knee bent.

The tibia and fibula are very often broken together. The fracture is generally oblique, and seated about the middle, or towards the lower third of the limb. The two bones seldom give way opposite to each other, and frequently do so at the distance of several inches. The accident sometimes results from direct violence, but more usually is caused by strains on the shafts of the bones, from twists or falls. There being in this case no longer any resistance to the distorting tendency of the weight of the limb and the retraction of its muscles, there is always much eversion of the foot and bending of the leg, the upper extremity of the tibia pressing upon the skin, or projecting through it, owing to the lower one being pulled upwards and backwards by the *gastrocnemii* muscles.

Various methods are followed in treating this common and important fracture. It is evident that the extended position is objectionable, from not affording any relaxation to the muscles which produce the distortion, and that, therefore, the knee ought, if possible, to be bent. This may be done either by simply laying the limb on its outer side, properly supported with splints, or by

placing it on a double inclined plane. It will be found, that, owing to peculiarities in the seat and direction of the fracture, the extremities are retained in apposition more easily, sometimes by one of these modes, sometimes by the other. The most convenient inclined plane is that contrived by Mr Macintyre of Newcastle, and improved by Mr Liston. When the fracture occurs very near the knee, the upper fragment becomes subject to the action of the extensors of the knee, and the straight position, consequently, is required to keep the broken surfaces in contact.

The patella is occasionally fractured, both by the direct effect of external violence, and also, as it appears, by inordinate contraction of the muscles attached to it. In the former case, which is more rare than the other, the fracture is generally comminuted, and sometimes longitudinal. In the latter, it is always transverse, and allows the two portions to be widely separated, so that the condyles of the femur can be felt between them. The nature of the injury is consequently very obvious, and is still further indicated by the complete loss of power over the joint which attends it. When the fracture is longitudinal or comminuted, it is distinguished by pain, mobility of the fragments, and crepitus.

Reunion of the transverse fracture is opposed by the following circumstances :—1. The difficulty of approximating the broken surfaces, and keeping them steady. 2. The presence of the fluid of the joint, which is secreted in increased quantity, owing to the irritation of the injury. 3. The want of vascular parts to assist in forming the new bone. Osseous union consequently seldom, or almost never, takes place ; and there is formed merely a sort of ligamentous connexion, varying from a few lines to several inches in extent. The treatment ought always to be conducted, however, as if a complete cure were practicable, so that the flexible medium of connexion may be rendered as short as possible. With this view, the limb ought to be laid out not only straight, but also somewhat elevated by a pillow, to relax the pelvic extremity of the rectus muscle. A wooden splint having been placed under the knee, a single circular turn of a roller should be applied above, and another below the portions of the bone, the broken surfaces of which may then be drawn very nearly into contact by tying two longitudinal bands introduced under the circular ones, alongside of the patella. A more effectual apparatus consists of two pieces of leather, three or four inches broad, and long enough to surround the limb above and below the patella ; they are provided with

straps and buckles for rendering them tight and drawing them together, and their respective edges are cut out in front to receive the bone. Some discutient lotion to promote absorption of the effused fluid may be employed if necessary.

When the fracture is longitudinal, little or no displacement occurs; and all the treatment required consists of lateral compresses with a bandage. In this fracture the union is osseous, because most of the adverse circumstances which operate against bony union in the former case are absent.

The thigh-bone, notwithstanding its great strength, is very frequently broken, sometimes by direct violence, but more commonly by the strain which happens in falling, particularly on the side. In adults, it usually gives way at the lower third; in children, at or above the middle; and in old people, at the neck. When the shaft is broken, the symptoms are those generally characteristic of fracture, and, in particular, more or less shortening of the thigh, according to the degree of obliquity of the surfaces of the bones, the lower extremity being almost always drawn up behind the superior one, together with rotation of the foot outwards, owing to the weight of the limb. The only cases in which I have found the lower end anterior to the upper one, happened from direct violence.

As the thigh is covered before as well as behind with muscles, which extend beyond both the joints at its extremities, and are nearly equal in strength, it is obvious that no position can have the effect, as in the leg, of relaxing them on one side without stretching them on the other. Various mechanical contrivances, therefore, have been invented for permanently extending the limb, of which the long splint of Desault far surpasses all the others in simplicity and efficiency. It is merely a board about four inches in breadth, long enough to extend from the false ribs a few inches beyond the sole of the foot, and having at each end two holes for the attachment of bandages. The patient's bed having been prepared, by being rendered smooth and firm, his limb is extended until it corresponds in length and direction with the sound one; then a pasteboard splint, properly softened and padded, is applied on the inner side of the thigh, extending from the perineum to beyond the knee, and another on the outer side, reaching from the *trochanter major* as far down as the former. These splints being secured by four or five looped bandages, the board, wrapped in a sheet or tablecloth, of which enough should be left to surround the thigh, is placed

alongside the limb, and a handkerchief passed under the perineum is tied to its upper end, while the foot is secured to the lower one. The unfolded part of the wrapper which lies under the limb is then brought over, and fastened to the splint, a handkerchief at the same time being tied round the patient's body to prevent any lateral displacement of the apparatus.

The plan of treatment recommended by Mr Pott, which was to lay the limb on its outer side with the knee bent, and merely apply two pasteboard splints to prevent the ends of the bone from moving, is very objectionable. It affords no extension, and renders a permanent eversion of the limb almost unavoidable, owing to the patient turning on his back during the cure, and thus causing the bones to unite in such a manner as to produce this effect. The double inclined plane, of various forms and materials, is much used, and has the sanction of high authority. It is alleged to relax the muscles by a bent position of the joints, without occasioning the inconvenience last mentioned, and also to effect extension by the weight of the body, which is, as it were, suspended from the injured thigh. But, as has been already observed, the muscles are equally tense when the joints of both the knee and hip are bent, as when they are extended; and effectual extension could hardly be obtained by suspending the body from the knee, without causing injurious and insufferable pressure on the popliteal vessels. The upper portion of the bone, too, must be influenced by every motion of the patient's body, and accordingly the worst cases of retracted and un-united femur are met with in persons treated by means of the inclined plane, by surgeons whose known reputation precludes the objection that the machine might have been carelessly or unskilfully employed. Even granting that its efficiency were equal to that of the long splint, the simplicity and facility of procuring the latter apparatus would render it preferable. Particular circumstances, however, occasionally occur, which render the inclined plane preferable, such as the existence of a wound, or rigidity of the knee-joint from previous disease, or peculiarities in the direction of the broken surfaces, and therefore every surgeon ought to be provided with it.

The thigh-bone is occasionally fractured through one or other of the condyles into the knee-joint, in which case the best treatment consists in placing the limb straight, in order that the head of the tibia may by its pressure assist in keeping the condyles even, and applying lateral compresses with a bandage.

The bone is much more frequently fractured through the trochanters and neck, in consequence, generally, of falls on the side. In persons beyond the age of sixty, the neck is broken by a slight degree of force, and may give way alone ; but it often happens also that the trochanters are split, while the neck remains entire, and is driven into the thick mass of bone at its root like a wedge. The symptoms of fracture in both of these situations are pretty much the same ; the limb is shortened from one to two inches, the toes are everted by the weight of the limb, and by the action of the muscles which perform rotation outwards, as their attachments to the *trochanter major* remain, while the usual resistance to their operation is removed by the fracture. When rotation is performed, the *trochanter major* may be felt moving as if on its own axis, instead of describing the arc of a circle, as it does when the neck is entire ; the shortening of the limb readily yields to moderate extension, and returns when it is discontinued, during which movements an obscure crepitus is sometimes perceived.

It would appear from some cases that if the fracture splits the trochanters, so as to detach the smaller one from the shaft, and also the posterior part of the greater, to which the muscles that perform rotation outwards are attached, leaving the anterior portion of the process which receives the insertion of the *glutæus medius* connected with the body of the bone, the eversion of the limb is prevented, and the toes are turned inwards, but in other respects the symptoms are the same.

The discrimination between fracture of the neck alone, and that extending through the trochanters, is not easily accomplished with accuracy. When the patient is not very old, when the shortening of the limb is considerable, and when the trochanter feels, on examination, larger than usual, it may be suspected that the injury is not confined to the neck of the bone. This distinction is of little consequence, except in respect to the prognosis, since the treatment proper for both accidents is the same ; but the cure is much more readily accomplished when the fracture is through the trochanters, than when it is confined to the neck. In the latter case, most surgeons in this country believe that osseous union is impossible, unless the reflected ligament, or fibrous covering of the neck, which is continuous with the capsule of the joint, remains entire. There is no doubt that the surfaces of the bones are very apt either to continue quite separate, or to be united by a flexible fibrous medium. But none of the arguments which have been adduced to

prove the *impossibility* of osseous junction seem to be conclusive; and though the small extent and mobility of the broken surfaces, the absence of vascular tissues surrounding the fracture, and perhaps also the presence of the synovial fluid, may render the cure very difficult, it ought still to be regarded as a possible occurrence. An attempt, therefore, to unite the fracture ought always to be made, and if it fails, the patient will at least have no ground to reflect on the careless treatment of his attendant. The long splint affords the most effectual means of preserving the proper position, but has been objected to on the ground that the pressure on the instep of the foot and on the sacrum which its use may occasion is very apt to cause mortification in the old people who are subject to the accident. As extension is not required, there should be little risk of this disagreeable effect; but if it does appear, the limb ought to be immediately freed from all restraint, and simply laid over a large pillow or folded bolster, which will tend to prevent displacement of the fractured surfaces. A fibrous connexion will then be gradually formed, with more or less shortening of the thigh; and as strength returns, the patient should, by cold affusion, and gentle exercise, endeavour to regain the use of the limb. In process of time he becomes able to walk with the assistance of a staff and high-heeled shoe. In fracture through the trochanters osseous reunion is certainly and readily accomplished, provided the limb be kept steady in a proper position; and, judging from my own experience, I should say, that the long splint may always be safely employed for this purpose, since it is required merely to prevent motion of the limb.

Of the bones of the fore-arm the radius is most liable to be fractured, and generally gives way about an inch above the wrist. The accident is usually occasioned by falls on the palm of the hand. It is recognised by the ordinary characters of fracture, and is often rendered very obvious by the hand being bent inwards, owing to the *pronator radii quadratus* drawing the broken extremities of the bone towards the ulna; or by the distal end of the radius being driven backwards so as to make the proximal one project under the integuments of the wrist. When there is little distortion the treatment requires merely the prevention of motion; and this is easily effected by applying a couple of splints and a bandage, which may be a simple roller, as it can be readily changed without deranging the fracture. When the hand is inverted, it has been thought necessary to use some counteracting power on

the same principle as for fractured fibula; but it is usually found sufficient to apply rigid splints long enough to reach from the elbow to the fingers, and thus have such a purchase on the hand as may prevent its inversion by the action of the muscles.

The shaft of the ulna also is occasionally broken alone, but not nearly so frequently as the radius. The cause is violence acting directly on the injured part. There is generally little displacement; and the treatment is consequently very easy, requiring merely splints and a bandage.

The olecranon is sometimes broken from the shaft of the bone by falls on the elbow. When the tough ligamentous covering of the process remains entire, the fragment suffers no displacement, and its lateral mobility is the only indication of the fracture, in addition to pain, swelling, and crepitus. But when this fibrous connexion is ruptured, the triceps pulls up the detached olecranon to the distance of an inch or more from its proper place. This fracture, in several important respects, resembles that of the patella and neck of the femur; and accordingly, like them, is generally repaired by a fibro-cartilaginous medium instead of bone. With proper care, however, the broken surfaces may be kept so near each other, that no inconvenience is experienced on this account. The treatment obviously requires that the limb should be extended, and this is best done by placing a splint on the fore-part of the limb, a figure of 8 bandage having been previously applied, so as to retain the fragment in its proper position.

Both the bones of the fore-arm are sometimes broken together, but this is a rare occurrence, and happens either from falls on the hand or blows on the arm. The accident is readily recognised, and easily treated through means of a couple of splints, supported by a roller; and if the patient is thin, a longitudinal compress placed between the radius and ulna on both sides of the limb.

The humerus is very liable to fracture in almost every part of its extent; and in respect to the diagnosis and treatment, it is necessary to consider the accident as occurring through the shaft,—through the neck,—and through the condyles.

The shaft is broken most frequently about its middle, between the attachments of the deltoid and *brachiæus internus* muscles. The fracture is usually transverse, and very readily recognised by the flexibility of the limb at the injured part. It is caused by falls, blows, and inordinate actions of the muscles, as in throwing a stone. The treatment consists in applying splints on the inner and outer

sides of the arm, extending from the axilla and acromion process to the olecranon, supported by a bandage, which may be a simple roller, or, if there is much swelling, of the looped kind ; the elbow ought to be bent at a right angle, to relax the muscles equally, and supported in a sling, if the patient is kept out of bed. When the fracture is seated above the insertion of the deltoid, the lower extremity is apt to be drawn so forcibly upwards as not to admit of being secured by the means which have been mentioned. In this case the patient must lie in bed, with the arm separated from the side so as to relax the deltoid, while it is supported by the splints usually required.

The humerus may be fractured at its lower extremity either obliquely or transversely, so as to detach one or both of its condyles. Such accidents are generally caused by falls on the hand or elbow, and though they not unfrequently occur in adults, are particularly common in children, and very apt to be mistaken for dislocation of the fore-arm backwards. The transverse fracture may be distinguished by the deformity disappearing on slight extension, and returning when the limb is left to itself, but is best detected by extending and bending the fore-arm alternately while one hand embraces the elbow. The oblique fracture is easily recognised if the external and internal tuberosities be pressed backwards and forwards with the two hands. The treatment of this injury is extremely simple, requiring merely compresses of tow before and behind, and a figure of 8 bandage applied while the bones are carefully held in the proper position, the elbow-joint being afterwards kept at a right angle. But the consequences of mistaking the nature of the case, and leaving the limb unsupported after extension has temporarily restored it to proper shape, are most distressing, the arm being always deformed, and generally stiff.

When the fracture occurs above the attachments of the *pectoralis major* and *latissimus dorsi*, it is said to be in the neck of the humerus. In this case the muscles just mentioned draw the lower portion of the bone towards the side, while the *supraspinatus* and other muscles inserted into the tuberosities cause the upper fragment to project forwards and rather outwards. This accident happens from falls on the shoulder, and is easily recognised by placing one hand in the axilla, while the other subjects the humerus alternately to abduction and adduction. The treatment requires a thick compress in the axilla to counteract the effect of the *pectoralis major* and *latissimus dorsi*, with a spica bandage to restrain the

upper extremity of the bone from being everted, and a sling to support the limb.

The clavicle is frequently fractured, by external violence acting directly, and also when transmitted through more or less extent of the superior extremity. The pain, swelling, mobility, and crepitus of the broken part, which is usually about the beginning of the acromial curvature, readily betray the injury, which is rendered still more obvious by the sternal extremity of the bone being drawn up by the sterno-mastoid muscle, and the shoulder being depressed, brought nearer the sternum, and rendered more prominent forwards by the action of the *pectoralis major* and *latissimus dorsi*, assisted by the weight of the limb. In children the displacement is much less observable than in adults, owing to the lightness of their arms, and hence the injury in them is frequently not discovered until the swelling which attends reunion attracts attention.

Great difficulty has been experienced in treating this fracture efficiently ; and Desault's method, though complicated and troublesome, was formerly regarded the best for the purpose. It consists of a thick cushion fixed in the axilla, to serve as a fulcrum for removing the shoulder outwards to its proper position, by means of the humerus when brought close to the side ; a bandage to keep this cushion steady, another to fasten the arm, and a third to elevate the shoulder, by drawing up the affected elbow. But when the cushion in the axilla is secured so high and so firmly as really to serve the office of a fulcrum, it compresses the nerves and blood-vessels beyond endurance ; and if it be allowed to descend so as not to do this, it increases the distortion, by separating the arm from the side. The method which, on the whole, appears to be the most simple and efficient, is to brace back the shoulders by a figure of 8 bandage, or shoulder-straps drawn together by any simple contrivance ; and having thus obviated the distortion, except so far as regards the depression caused by the weight of the limb, to remedy this also, by placing the affected arm obliquely across the chest, with the fingers pointing to the opposite acromion, and securing it in this position by means of a sling or bandage. In difficult cases the patient should be treated in the horizontal posture, which of course greatly lessens the tendency to displacement.

The scapula may be broken through the acromion process, neck, body, and inferior angle. The first of these fractures is the most common, the others being very rare. It happens from direct violence, occasions nearly the same symptoms as fractured clavicle,

but not so well marked, and requires similar treatment. The neck of the scapula is broken by violence, transmitted through the humerus. The symptoms of this fracture are filling up of the axillary cavity by the head of the humerus,—a hollow under the acromion process from the bone being out of its place,—and easy restoration of the parts to their natural position, when the shoulder is gently extended outwards ; during which adjustment there is usually some crepitus perceived. The treatment required is the same as that recommended for fracture of the neck of the humerus.

The nasal bones, though very thin at their extremity, becoming gradually thicker towards their connexion with the *os frontis*, and having a strong support afforded to them by the projecting process of this bone, on which, together with the ascending branches of the superior maxilla, they are firmly placed, suffer fracture less frequently than might be expected from their exposed situation. The fracture, when it does occur, is generally comminuted, and is easily recognised by the striking deformity which arises from the flattening and obliquity of the nose necessarily attending it. A great degree of violence being requisite to occasion the injury, there is usually much swelling, which is apt to conceal the displacement of the bones, if the examination be not made immediately after the accident is sustained. Whence it is proper, in all cases where the injury may be suspected, to search very carefully for it, since the inevitable consequence of its being overlooked would be a deformity equally disagreeable and irremediable. The depressed portions of bone may be easily elevated before they become consolidated by the effusion that ensues, and after being pressed up into their proper places by a pair of dressing forceps, or other suitable instrument, generally remain without requiring permanent support. Should they prove not sufficiently steady, a piece of lint ought to be carefully introduced, so as to distend the upper part of the cavity.

The lower jaw, though much exposed to violence by its situation, is comparatively seldom broken, owing to its mobility and strength. The fracture is usually seated in the base of the bone, opposite the bicuspid teeth. It is sometimes confined to one side, sometimes exists in both. It very rarely happens in the ramus, and is hardly ever met with at the symphysis. The nature and seat of the injury are readily recognised, owing to the thinness of the parts which cover the jaw ; and it is generally observed that the portion of the bone next the chin is depressed, partly by its own weight,

partly by the action of the muscles which connect it with the *os hyoides*.

The broken surfaces are easily retained in contact, by tying up the jaw with a handkerchief, or any similar bandage. A pasteboard splint is sometimes applied along the front and sides of the bone, but is in general quite unnecessary. Another contrivance frequently recommended appears, if possible, still less necessary—viz., interposing a piece of wood or cork between the teeth, grooved so as to receive them in a channel both above and below. This is done to restrain motion of the jaw, and afford room for the introduction of nourishment; but the shape of the teeth effectually prevents any lateral movement when they are held together by a bandage, and there are always sufficient interstices between them to admit the entrance of soups or other fluid articles of food, which kind of nutriment alone the patient is of course able to consume, when deprived of the power of mastication. In cases where, owing to the obliquity of the fracture, or any other cause, it is found unusually difficult to maintain the edges of the bone in contact, a thread or silver wire may be tied or twisted round the roots of the adjoining teeth, so as to draw them together; but this expedient should not be resorted to unnecessarily, since it is apt to loosen the teeth concerned.

The ribs are generally broken by direct violence, but also by pressure applied to their extremities, which difference in the cause has been supposed to modify the consequences of the accident; since, when the fracture is caused by direct violence, the rough spicula of bone are projected inwards, and readily injure the pleura or lungs; but when the rib is broken by being bent outwards by approximation of the sternum to the spine, the parts contained within the chest are less endangered.

The fracture is attended by pain, aggravated by respiration, and by obscure crepitus. It is best ascertained by placing the hand on the injured part while the patient breathes. The diagnosis is frequently far from easy, from the patient's inability to bear the necessary examination; but its accuracy is not very essential, since the treatment proper for fracture is the same with that required for a bruise of the muscles, the only injury with which it can be confounded. A broad bandage ought to be applied tightly round the chest, and bleeding, purgatives, and tartrate of antimony must be used according to circumstances.

Fractures of the cranium and vertebræ being of consequence,

chiefly on account of their connexion with accompanying injuries of the brain and spinal marrow, will be considered most advantageously along with these subjects.

The great strength and arched form of the pelvis enable it to resist all ordinary degrees of violence, and it is only when subjected to the most powerful compression, as from the weight of a loaded carriage or the force of machinery, that the bones composing it give way. They yield most frequently in the horizontal and descending branches of the *os pubis*, and at the same time there is usually a separation of the sacro-iliac synchondrosis on one or both sides. The precise extent of the injury can hardly be ascertained, except by dissection; but the existence of fracture is generally rendered manifest by the pain, mobility, and crepitus which attend it. Sometimes it is made still more obvious by the ramus of the *ischium* or *pubis* being driven through the perineum, or the coats of the rectum.

Such fractures are almost certainly fatal, from the great shock of the system and injury of important organs with which they are accompanied; but the patient ought always to be afforded the chance of recovery, by binding the pelvis tightly with a broad circular bandage, and protecting him from excitement of every kind.

The crest of the ilium is occasionally broken by falls and blows; the accident is easily recognised, produces no serious consequences, and requires merely rest, with a spica bandage.

Diastasis or Separation of the Epiphyses.

Before the epiphyses are united to their respective shafts, they are apt to suffer separation from them by such violence as, in the adult, would occasion fracture of the bones concerned, or dislocation of their articulating extremities. The symptoms resemble those which would result from fracture in the same situation, and the treatment does not in any respect require to be different.

Bending of the Bones.

While the bones are young and flexible, they sometimes bend instead of breaking, when subjected to forces that would occasion fracture in the adult; or rather give way only partially, so that, while altered in form, they still retain some power of resistance. As this accident is not attended with either mobility or crepitus, it is very apt to be overlooked, the distortion of the limb being attri-

buted to swelling of the soft parts, in consequence of the injury. The bones of the fore-arm are most liable to suffer in this way. In order to remove the curvature, and prevent it from permanently deforming and impeding the use of the limb, it is necessary, without loss of time, to employ force sufficient for straightening the bone. If this is done effectually, subsequent mechanical support will hardly be required; but if, from delay or undecided measures in the first instance, the bones should remain bent, they ought if possible to be straightened by force, and maintained so by rigid splints.

False Joints.

Fractured bones sometimes do not unite firmly together, their extremities being connected by a flexible fibrous medium. The most common examples of this occurrence are afforded by the patella and neck of the femur; but there is no bone in the body where it may not take place. Its consequences are in general extremely distressing, since the want of due rigidity renders the limbs very imperfect, and sometimes quite useless, for performing their ordinary duties.

The principal cause of this occurrence is unquestionably the want of due fixture, which prevents the fractured extremities from remaining at rest, it being well ascertained that false joints may be certainly produced by subjecting the bones concerned to frequent motion. The best means of prevention are consequently to set the fracture as early as possible, and afterwards to retain the bones steadily in their proper places.

Before considering the treatment of false joints, it is necessary to ascertain the nature of the structure which constitutes them. It is often said to be similar to that of the natural articulations, being composed of two opposite plates of cartilage, a covering of synovial membrane, and a capsular ligament. But in most cases there is merely a tough, fibrous, ligamentous-looking texture, which extends from one extremity of the bone to the other; and the nearest approximation to a new articulation which almost ever occurs, consists in the existence of cavities more or less extensive, between the fibres of this connecting substance.*

The mildest treatment is to maintain perfect rest by particularly careful employment of the usual means. Should this not prove

* Probationary Essay, on entering the College of Surgeons, by W. Sharpey, M.D., Edin. 1830.

sufficient, an ingenious method, contrived by Dr Physick of New York (1804) may be tried. It consists in passing a skein of silk or cotton between the extremities of the bone, and allowing it to remain until it appears that new bone begins to be formed, when it may be withdrawn, and splints applied. In case these means fail, and the patient is willing to suffer considerable pain, and encounter some danger to obtain a cure, the plan originally devised by Mr White of Manchester in 1760 may be executed. This was to cut down upon the extremities of the bone, and saw them off; after which, the ordinary treatment of compound fracture being employed, the limb regained its firmness, with more or less shortening, according to circumstances. This operation is not always successful; and it must always be attended with considerable danger, especially when the bone concerned is of large size. It, therefore, ought not to be performed until the more gentle means have proved unavailing, and unless the patient suffers so much inconvenience from the want of rigidity as to warrant such a severe proceeding. In the humerus and fore-arm, the muscles are so equally balanced, that the limb, though quite flexible at the injured part, can sometimes be used for most of the purposes for which it is required. In ununited fractures of the thigh-bone, I have succeeded, so late as after the expiry of six months from the date of the accident, in obtaining a complete recovery, by employing the long splint with the following modification. In cases of this kind, the limb is always distorted, from the imperfect resistance opposed by the broken bone to the contraction of the muscles, and there thus results an arched form of the thigh. On the convexity of this arch, which is directed outwards and forwards, a cushion formed of a sheet or table-cloth, folded into the requisite size, is placed, and upon this is made to rest the long splint, which is then drawn tightly towards the knee and pelvis. There is thus not only exerted a constant force, urging the bone into its straight direction, but also the most perfect stability afforded to the fractured surfaces. In one instance, where I advised this plan to be adopted, Dr Peddie succeeded in restoring the use of his limbs to a young man who was admitted into Minto House, on account of both thigh bones having remained ununited, with great distortion, four months after being broken by a fall from the mast-head of a vessel.

Inflammation of Bone.

Inflammation of the periosteum, and that of the bone itself,

frequently occur together, give rise to similar symptoms, and require nearly the same treatment. The former, or Periostitis, is characterised by deep-seated aching pain, and thickening of the integuments, which adhere to the part affected. These symptoms vary much in the degree of their acuteness, and are accordingly accompanied with more or less constitutional derangement. The disease frequently becomes periodically aggravated, and is apt to be increased by all sorts of excitement. It is usually most severe during the night, and after meals. The periosteum is most liable to inflammation where it covers bones near the surface of the body, as the shin-bone, the skull-cap, the clavicle, and sternum.

In the chronic form of the disease, it is generally possible to trace the operation of a predisposing, as well as of an exciting cause. The former seems to consist in derangement of the system from various circumstances, but most frequently from the prejudicial use of mercury co-operating with venereal disease, especially in a scrofulous constitution. The latter includes exposure to cold and wet, and blows. Middle-aged adults are the most common subjects of its attack.

The mode of treatment depends upon the intensity of the symptoms. When they are very violent, and attended with smart fever, the most effectual practice is to make a free incision through the inflamed parts down to the bone. When less severe, they yield to leeching or cupping, warm anodyne fomentations, camphorated mercurial ointment with anodyne liniment, and opium administered internally along with calomel, ipecacuan, tartrate of antimony, or colchicum. When still more chronic, they require repeated blistering, with an alterative course of the hydriodate of potass, or the oxymuriate of mercury,—six grains of the former, or half a grain of the latter, being given daily in divided doses. The decoction of sarsaparilla is generally prescribed, but I believe without any beneficial effect, farther than inducing the patient to conform to dietetic rule. The formation of matter is a very common consequence of chronic periostitis, but, in this case, absorption may be almost always induced by using the means just mentioned; and, therefore, an opening of the cavity ought to be avoided. Should it take place, moist dressing, with occasional blisters, will be found the best means of treatment.

Inflammation of the substance of the bone occurs under similar circumstances, and is attended with nearly the same symptoms. The pain is, if possible, still more deep, dull, and aching; the in-

teguments, though exhibiting the same changes in the progress of the disease, are not so much altered in the first instance; and the swelling affects the shape of the bone more extensively. When acute, it generally terminates in death of the dense osseous tissue, and in suppuration of the spongy bone. When chronic, it expands the texture of the shafts, so as to make them larger and less compact, and in the cancellated texture usually induces either absorption or suppuration.

The treatment is to be conducted on the same principles as that of periostitis. When the inflammation is acute, it terminates very speedily in absorption, suppuration, or death of the part affected, and seems to be hardly influenced by any remedial measure. But when chronic, it is more under control, yielding in the dense bones to blisters, employed along with alterative medicines, and in the spongy bones to the actual cautery. The swellings which are occasioned, both by chronic periostitis and inflammation of the bone itself, are called Nodes.

Necrosis.

The expression Necrosis has been employed to denote different morbid affections of the osseous tissue, and has consequently given rise to much confusion. It literally implies the deprivation of life, and ought to be restricted to this meaning.

All the bones are liable to necrosis, but those which possess a dense texture are more subject to it than the spongy ones. The causes of necrosis are various. It was formerly believed that the mere removal of the periosteum certainly caused the death of a scale of the bone more or less thick, by depriving it of nourishment, and hence it was a rule, with the old surgeons, to hasten exfoliation in all such cases by applying the actual or potential cautery. But it is now ascertained that simply removing the periosteum does not necessarily cause exfoliation, and that when a bone throws off a scale, after being so exposed, it generally does so in consequence of the injury which it has sustained from the violence that occasioned the separation of the membrane. Blows, falls, strains, and exposure to cold, are the causes that most frequently give rise to necrosis, and they act either directly, by at once destroying the vitality of the part affected, or indirectly, by exciting inflammation, which terminates in the death of the bone. The inflammation, when acute, is not confined to the bone, but generally affects all the superjacent tissues; whence it has been erroneously supposed,

from redness of the skin being present, that erysipelas or inflammation of the skin may induce necrosis. There often seems to be a constitutional proneness to necrosis, so that many bones of the same person die together or successively. This disposition exists most frequently in childhood, and is almost always associated with, perhaps dependent upon, weakness of the system.

The dead portion appears as if it had been long and carefully macerated, being hard, white, brittle, and sonorous when struck with a probe. If exposed to the air previous to separation, it suffers various alterations of colour, and generally, in part at least, becomes black; but this depends upon the discharge of the sore, and the action of the air. It is named an Exfoliation, and gradually separates from the living bone by ulcerative absorption. The circumstances which attend the process of exfoliation and its reparation vary much, accordingly as it affects the external surface, internal surface, or the whole thickness of the bone concerned.

External Exfoliation.—The external surface of bones being most exposed to those injuries which cause exfoliation either directly by their violence, or indirectly by exciting inflammation, most frequently suffers from it; and, of the particular bones, those nearest the surface of the body, as the tibia and cranium, are, as might be expected, more especially liable. The separation of the dead portion, being effected by a process of the living system, does not admit of any assistance from the surgeon, whose interference could hardly fail to do harm, by injuring the adjoining sound bone. Free vent ought to be afforded by proper incisions to the matter, which is copiously secreted; and the exfoliation should be examined from time to time with the probe, to ascertain whether or not it has become detached. So soon as it is found to be loose, it ought to be removed by means of forceps, either through the opening which already exists in the integuments, or a suitable extension of it. The remaining surface granulates, and osseous matter is effused under the pellicle, so as to fill up the breach partially, but usually leaving a permanent depression at the part.

Internal Exfoliation.—It is of course only in the cylindrical bones that exfoliation from an internal surface can take place; and those of the largest size are most frequently the seat of it. The cause is almost always inflammation, since the injuries which directly occasion necrosis can rarely operate on the interior of a bone. The exfoliation in this situation is named a *sequestrum.* It separates from the sound bone as in the former case; but having

done so, cannot escape through the walls of the shaft within which it is enclosed, and therefore remains a permanent source of irritation. The living bone, in consequence, becomes greatly thickened, and new osseous matter is copiously effused from its external surface, in the form of irregular projecting tubercles.

At the same time the pus, which is pent up within the cavity, by its pressure on the parietes, induces absorption, and the formation of cylindrical apertures through the shell of the bone. These *cloacae*, as they are named, allow the confined matter to escape, and present itself under the integuments in the form of an abscess, which, if not opened by the surgeon, sooner or later evacuates its contents by ulceration. Thus far during the process, the patient suffers from pain and swelling of the limb, but after the matter obtains free vent, he finds himself greatly relieved. The enlargement, though it does not disappear altogether, subsides very much, and so little uneasiness remains that he is generally able to make some use of the limb. If it should fortunately happen that the sequestrum is not only small, but also favourably situated for escaping through a cloaca, the source of irritation being thus removed, the patient may be restored to health. But if the sequestra do not pass out spontaneously, the surgeon, having ascertained their presence by the probe, must enlarge the opening which leads into the cavity containing them, so as to obtain space sufficient for their extraction. In order to do this, he makes a simple, or, if the part admits of it, a crucial incision through the integuments, having the cloaca for its centre, dissects back the flaps, and applies the trephine over the opening should there be room for doing so, and if not, as is usually the case, he employs the cutting-pliers to enlarge the opening sufficiently. The process of extraction may sometimes be facilitated by dividing the sequestrum into pieces.

Exfoliations of the whole thickness.—Bones die throughout their whole thickness from causes similar to those which induce exfoliation of their external or internal surface, and the dead portion separates from the living by the same process of absorption that occurs in such cases; but the state of the bones, after the cure is completed, requires in this case particular consideration. Sometimes the place of the dead part is not at all, or very imperfectly supplied; at other times its separation could hardly be suspected from any change visible in the shape or size of the bone affected. In order to account for this remarkable difference, it is necessary to inquire into the circumstances of the cases in which it is exhibited.

In some cases, when the dead bone is detached, the remaining surface merely granulates, just as after the separation of an exfoliation which extends only partially through the whole thickness, and effuses sufficient osseous matter to round off the edges, thus lessening the extent of the gap, but still leaving a permanent deficiency at the part. The same result ensues when a portion of bone, including its whole thickness, is removed mechanically. But at other times the dead portion is found to be contained within a more or less complete case of new bone, which is ready to take the place of the old one whenever it is removed, by contracting its sides together so as to become a solid mass.

It was formerly supposed that the death and reproduction of an entire shaft, in this way, was a very common event, all cases of internal exfoliation being regarded as instances of its occurrence, and the expression Necrosis has been generally employed to denote this remarkable process. It might have been supposed that when only small sequestra made their appearance, or were found on dissection, decisive proof would have been afforded of the partial extent of the disease. But the general swelling of the limb, which is caused by the irritation of an internal exfoliation, having led to the erroneous belief that an entire new shell was forming about the old bone, the non-appearance of a sequestrum, adequate to the supposed extent of destruction, was accounted for by attributing its diminution or removal to the absorbing power of the vessels, or the solvent property of the pus. It is now well ascertained that the sequestrum cannot be acted upon in either of these ways ; and that its size may, therefore, be safely taken as a measure of the extent to which the bone has died. According to this test, it is found that the death and regeneration of an entire shaft, so far from being a very common occurrence, is an extremely rare one ; and some pathologists, as Leveillé, have gone so far as to deny it altogether, alleging that more or less of the external part of the old bone always remains, and becomes expanded into the new shell. There can be no doubt, however, judging from the size, shape, and smooth surface of the sequestrum, that it sometimes, though certainly very seldom, comprehends the whole thickness and circumference of the shaft.

The origin of the substitute in cases of this kind has been variously explained. It must evidently proceed—1. From granulating action of the portion that remains. 2. From the old bone previous to its death. Or, 3. From ossification of the periosteum or other surrounding tissues. The first of these opinions has been

supported by Richerand and others, who regard as strongly in their favour the fact, that more or less of the old shaft, and at all events the epiphysis, always remains. But in external exfoliations the granulating action seldom, if ever, fills up the breach; and when a considerable portion of the whole thickness of a bone is destroyed suddenly by inflammation, or is removed by mechanical means, the loss of substance is in general not fully restored, which it ought to be, according to this view of the matter. In cases where no permanent deficiency remains after the separation of the dead bone, it is generally noticed that the limb becomes enlarged previously to this event; and experiments on the lower animals, as well as observations of what happens in the human body, have been thought to shew that the new shell may begin to be formed before the death of the old shaft. Dr Macdonald remarked (1799), that the new bone, when first formed, adhered inseparably to the old one; and the late Professor Russell injected the vessels of the old shaft, while its substitute was in progress of formation. It has hence been concluded, that the ossifying process originates from the old bone; and that unless the foundation of a new one be laid by it, previously to its own death, the loss of substance will not be replaced. But it has been fully ascertained, as well by experiment in the lower animals as from observation of disease in the human body, that a bone, though suddenly deprived of life, may still be reproduced; and, on the whole, it seems clearly established, that the periosteum must be regarded the main source of reproduction. The views which I entertain on this subject will best appear from the following extract from the *Transactions of the Royal Society of Edinburgh.**

"The property of forming new bone was first attributed to the periosteum by Duhamel, about a hundred years ago. Having been engaged in the study of vegetable physiology, and more particularly in regard to the formation of wood, he imagined that there might be an analogy between the inner layer of the bark and the periosteum, and that as the former hardens in successive layers so as to constitute the wood, the latter might suffer a corresponding conversion into bone. He supported this opinion by the following arguments:—1. That when bones are burned in the fire, or exposed to the weather, they separate into a number of thin plates. 2. That, in consequence of disease arising from external violence, the bones frequently throw off thin scales, or exfoliations as they are called.

* Vol. xiv. 1837.

3. That when animals are fed alternately with madder and without it, their bones exhibit alternate layers of a red and white colour; and, 4. That when bones are fractured, they unite by means of an osseous capsule formed externally to, and embracing the broken extremities, just as the branch of a tree acquires strength after being grafted, or simply broken across.

This theory of Duhamel was strenuously opposed by Haller, who urged, as altogether inconsistent with it, the mode in which bones are originally formed. He carefully investigated the process of ossification during incubation, and detailed the steps of its progress in the chick as well as other young animals. The rudiment of the future bone being traced from its earliest distinguishable appearance, was found first to present the characters of a jelly; then to acquire the consistence of cartilage or gristle; and finally to reach the perfect osseous state: whence it was contended, that a structure which thus originated in a distinct form, and independently of any other, could not owe its increase afterwards to a different source. Haller also engaged his pupils Detlef and Boehmer in extensive series of experiments, by breaking the bones of animals, and feeding them with madder during their recovery; from the results of which he inferred, that Duhamel had been mistaken in supposing that fractures are reunited by ossification of the periosteum.

Notwithstanding these objections, and the authority of the physiologist from whom they proceeded, the doctrine of Duhamel still maintained its ground; and not long afterwards—viz., in the year 1780—derived a great accession of strength from the experiments of Troja, who, by destroying the marrow of bones, caused their death, and the formation of new shells surrounding them, apparently from ossification of the periosteum. This experiment, which Troja himself performed some hundreds of times, when repeated and varied by the pathologists of almost every country, seemed to confirm the ossific power attributed to the periosteum beyond question, until Scarpa, the distinguished Professor of Pavia, again investigated the grounds on which it was originally founded by Duhamel. In Scarpa's treatise, 'De Penitiori Ossium Structura,' which was published in 1799, he explained that the foliated appearance, presented by bones that had been burnt, did not depend upon the development of a structure naturally belonging to them, but was an effect produced by the unequal action of the fire; and that the separation of scales from diseased bones was no stronger proof of their possessing a laminated structure, since thin and broad por-

tions of dead substance are wont to be detached from the skin and other soft textures, in which it was never supposed that layers existed naturally. He recalled attention to the synthetic experiments of Haller, who, by investigating the formation of bone from the earliest stage to its perfect state, had established the reticulated nature of its texture ; and by an opposite process of an analytic kind, which consisted in depriving bones of their earthy constituent by means of diluted acids, and then macerating them for a long while in water, he unravelled the texture so as to shew that it really was reticular. As a consequence of these observations, Scarpa denied that bone could be formed by the periosteum ; and this opinion was keenly embraced by several pathologists of the present century, and particularly by the French surgeon Leveillé.

At present, professional opinion is divided in regard to the ossific power of the periosteum, and different sides of the question are maintained by teachers and writers in this as well as other schools of medicine. As the point in dispute is not merely a matter of curiosity, but one of great practical importance, it is very desirable that the truth should be ascertained. It would detain the Society too long were I to shew how the different opinions on this subject may influence the practice of surgery ; and I shall, therefore, proceed to state the considerations which have completely satisfied my own mind, and are, I think, sufficient to satisfy any one who is open to conviction, that though Duhamel was misled into many errors by the false analogy which he supposed to exist between wood and bone—in regard to the mode of their natural formation—the periosteum, nevertheless, does possess the power of producing new osseous substance in certain conditions of disease.

The well-known and often-repeated experiment of Troja, which consisted in perforating the cavity and destroying the marrow of a bone, so as to kill it and cause the formation of a substitute in the form of a shell surrounding the old one, was devised in imitation of a process which not unfrequently occurs spontaneously in the human body. In this disease, which has been named Necrosis, a portion of the old bone dies, and becomes surrounded by a new one. The new shell is of a larger size and more irregular form than the old one, which may be seen through a number of circular apertures lying a prisoner within this structure, intended by Nature to serve as a substitute for it. Those who deny the ossific power of the periosteum maintain, that in all such cases, whether resulting from injury purposely inflicted with the view of experiment, or

proceeding from diseased action, a portion of the old bone remains alive, and serves as the germ of a new one ; that, in short, the formation of the new bone is simply an expansion or growth from the remnant of the old one, and that if merely the extremities of the bone affected remain alive, they will prove sufficient for generating the substitute shell.

It is difficult to reconcile this explanation with the rapid growth and uniform thickness of the new bone ; since, if its formation proceeded from the extremities, the process should be slow and progressive towards the centre ; but there is another objection still more conclusive against it. If the new bone is formed by a portion of the old one that remains alive, then the removal of a part by mechanical means should be supplied from the same source. But in all the cases where this has been done, either in the way of experiment, or for the cure of disease, the loss of substance, unless of small extent, has been found imperfectly repaired. For instance, after the operation of trepanning the skull, the aperture in the bone, though it becomes diminished in extent, is not altogether obliterated, and the newly-formed bone is not only smaller than the portion removed, but also thinner.

In the fore-legs of dogs and rabbits, there are two bones of nearly equal size, and so connected, that a large portion of one may be taken away without destroying the rigidity of the limb. There is here, therefore, a convenient opportunity of trying what can be done by the extremities of a bone for restoring losses of substance in its shaft. Experiments of this kind have, accordingly, been frequently performed on these animals, and the result has uniformly been, that when the portion removed exceeded an inch in length, there was a permanent deficiency of osseous substance, the ends of the bone being merely produced towards each other in a conical form, and connected together by a tough ligamentous texture. Sir A. Cooper has given representations of the results he met with ; and I have met with others precisely similar.

Some of those pathologists who deny the ossific power of the periosteum, and claim the whole production of new osseous substance for the bone itself, have attempted to explain away the difficulties which have just been stated, by supposing that, in cases of necrosis where a new bone is formed, the old one, in consequence of the increased action preceding its death, may determine the effusion of organisable matter into the surrounding soft textures, which will serve as a matrix or foundation for the new shell,

and be ready to take up the ossifying process so soon as it is communicated from the surviving extremities of the bone. That the process of reproduction may be accomplished in this way I am not prepared to deny, but that it is not necessarily, or always so performed, will, I think, appear from the following case:—

A girl, twelve years of age, strained her ankle in the month of March 1835. Inflammation followed, extending up to the knee, and attended with violent fever. She was brought to the hospital, and placed under my care. Incisions were soon afterwards made to evacuate a large collection of matter which had formed in the leg; and the bone being found dead, while the patient's strength was rapidly giving way, I amputated the limb above the knee five weeks after the injury had been received. The girl recovered, and is now well. In examining the limb to ascertain the extent to which the bone had died, I found that it was partially surrounded by the commencement of a new one. The shell had already acquired considerable firmness at some parts, but was not equally thick throughout, and did not seem fixed to the ends of the old shaft. This observation led to a very careful dissection of the parts concerned; and they are now before the Society. It will be seen that the tibia had died very nearly from end to end, and that the new shell enclosing it has been formed in the periosteum. The new osseous substance may be observed at some parts in the form of small distinct scales. At other parts it looked as if it had originally consisted of separate portions, and been composed by their union. The periosteum connecting these portions to each other and to the extremities of the bone was not thickened beyond its natural condition; and where it covered the posterior surface of the tibia, though quite detached from the old bone, had not suffered any further change. It also appeared that at those parts where the periosteum was absent, no new bone had been formed, so that the *cloacae* would have been formed by these defective portions, and not by absorption, as was supposed to be always the case.

There is here, then, an instance of a bone dying suddenly in consequence of acute inflammation, without any thickening previously formed in its neighbourhood, and nevertheless succeeded by the production of a new osseous shell, which evidently could not proceed from the old bone, and no less evidently depended upon an ossific process resident in the periosteum.

As Nature is not capricious or variable in her proceedings, I

regard this case as sufficient of itself, without any further evidence, to establish the ossific power of the periosteum. But, with the view of making the matter still more clear, I performed the following experiments. I exposed the radius of a dog, and removed an inch and three-quarters of it together with the periosteum. At the same time I exposed the radius of the other leg, and removed a corresponding portion *without* the periosteum, which was carefully detached from it and left quite entire, except where slit open in front. Six weeks afterwards the dog was killed, and the bones examined. In the one, from which a portion had been taken together with the periosteum, the extremities were found extended towards each other in a conical form, with a great deficiency of bone between them, and in its place merely a small band of tough ligamentous texture. In the other, where the periosteum had been allowed to remain, there was a compact mass of bone not only occupying the space left by the portion removed, but rather exceeding it in thickness. This experiment, when repeated, afforded the same results.

I next exposed the radius of another dog, and separated the periosteum from the bone as in the former experiment; but then, instead of cutting out the denuded bone, inserted a thin plate of metal between it and the periosteum. The edges of the membrane, and then those of the skin, were sewed together, and the wound healed kindly. At the end of six weeks I dissected the limb, and found a deposition of osseous substance in the periosteum, forming a bony plate exterior to the metal, and not connected with the old bone except by the membrane.

I lastly exposed the radius of a dog, and cut away the periosteum to the same extent that it had been merely detached in the experiment just mentioned, and surrounded the denuded bone with a piece of metal. At the end of six weeks I found a thick tough capsule formed, enclosing the metallic plate, but having no osseous substance in it.

The evidence which has now been adduced seems to me sufficient for putting beyond all question the power of the periosteum to form new bone, independently of any assistance from the old one. I submit it, with deference, to the Society, in the hope that those members who have directed their attention to the subject will give it their dispassionate consideration, and either admit the opinion which it supports, or shew the fallacy by which it has misled."

The treatment of necrosis seldom admits of active measures on the part of the surgeon at its early stage. Abscesses should be opened when they point. Sequestra ought to be assisted to escape, and the patient's strength supported by nourishing diet, and the other usual means. If the death of the bone is so sudden and extensive, that the new shell is not able, in the first instance, to support the strain of the muscles and weight of the limb, splints must be carefully employed until the process of ossification is advanced far enough to render them unnecessary. Finally, in case the patient proves unable to bear the long-continued and exhausting exertion requisite for accomplishing the cure, he ought to be relieved by amputation.

Suppuration of Bones and Caries.

It is only in the cancellated or spongy texture of bone that inflammation induces suppuration; the dense parts never taking it on unless they are previously expanded and loosened, in consequence of chronic inflammation. In the cancellated texture suppuration is frequently preceded by scrofulous deposition.

The matter may be collected either on the external surface, or in the interior of the bone. In both cases there is more or less excavation, effected by absorption of the bone concerned; and in the latter not only this effect ensues, but also an enlargement of the external shell of the bone, which thus forms an expansion, constituting what is called *spina ventosa.*

The most remarkable example of osseous expansion from the formation of matter with which I am acquainted, is here represented from a preparation in the Museum of the College of Surgeons of Edinburgh. It resulted from fracture of the tibia, and existed, progressively increasing, for many years, during which the patient was enabled to discharge the duties of an active life, by closing the orifice with a cork, which he removed from time to time when he found a convenient opportunity for pouring out the accumulated fluid.

The cavities which are formed in the cancellated substance of bones, especially in those cases where there has been a previous infiltration of scrofulous formation, frequently contain loose portions of the spongy bone, which have been deprived of vitality by the inflammation. When the matter escapes from a hollow of the bone by causing absorption of its sides, or when it is formed, in the first instance, exterior to it, the integuments are elevated, and at length

give way, with great relief from the pain which was previously suffered. The abscess may then heal, like an ordinary one of the soft parts, or prove very obstinate, or permanently resist all means of cure. It is impossible to foretell positively which of these events will ensue, but experience and attention to the following circumstances generally enable the surgeon to form a pretty accurate opinion as to the result:—1. If the patient possesses a good constitution, and suppuration in the bone has been induced in consequence of inflammation caused by severe external violence, such as the wound of a joint, the prognosis may be favourable. 2. If the patient possesses a bad constitution, and the primary inflammation has commenced without any external cause, or one comparatively so slight as a bruise or a strain, which of itself is evidence of his constitution being unsound, the disease will probably be obstinate or incurable. 3. If the patient is an infant or child, and especially if he suffers from suppuration of several bones at the same time, there is a good prospect of an ultimate cure, but not without a very tedious process of recovery. 4. If the suppuration takes place in a bone that naturally possesses a dense texture, but which has been opened out by previous disease, it generally admits of cure more readily than when seated in one originally cancellated. Sir B. Brodie has directed attention to abscesses forming in the cancellated texture of bones, but more especially the tibia, and remaining latent for an unlimited duration of months or years, the chief symptoms being enlargement of the bone, with thickening of the soft parts, and deep-seated pain. In such cases he advises the employment of a trephine to evacuate the matter; and this practice is said to have been adopted with advantage. But the operation must not be resorted to without the greatest caution, since chronic periostitis is extremely apt to simulate the condition requiring its performance, and has misled practitioners, even of the most extensive experience, to trepan unnecessarily, with effects not less disastrous than even the death of the patient.

Whatever be the opinion entertained of the probable result of the case, after the matter has been evacuated, it ought always at first to be treated as if the sore were expected to heal. Free openings should be afforded to the discharge; stimulating washes, with moderate pressure afterwards applied; and the patient's general health carefully preserved. If these means fail, some more powerful agents must be employed locally, such as the red oxide of mercury, or nitrate of silver; and if the patient's system seems to

require it, an alterative course of mercury, or iodine, should be prescribed. Counter-irritation, such as that effected by the actual cautery, is sometimes useful, and may be tried, if the disease is attended with much pain. When the ulcer of the bone resists all means of cure, it constitutes what is called Caries.

The distinguishing character of caries is obstinacy of the disease. The local symptoms vary considerably as to the quantity and quality of the discharge, the degree of pain, and the appearance of the orifice. The matter is generally thin and fetid, but sometimes possesses all the properties of perfect pus; the pain for the most part is gnawing and incessant, but often is hardly perceptible, or on the contrary extremely severe. The orifice is usually small and callous, but occasionally exhibits large and flabby granulations. The disease has for the most part remissions more or less complete, and of considerable duration, in which the pain and discharge nearly or altogether cease, and the ulcer seems to be on the point of healing, or actually becomes covered with a cicatrix, which, however, is always thin and soft. But these amendments are only partial and temporary, being always followed by relapse, and there is no natural limit to the duration of the disease except the life of the patient, who, after months, or even many years of suffering, becomes finally exhausted, either by the caries itself, or some other disorder which the irritation produced by it has excited. When a carious bone has been macerated, the diseased part is found excavated and rough, the cancellated texture being remarkably spicular, white, and brittle, so as to resemble a spongy bone which has been exposed to the action of fire. The surface thus affected is often of considerable extent, though frequently very small, even in cases of old standing, but the disease seldom reaches to a considerable depth. The field of the disease seems to be determined by the primary inflammation, and after being thus established, has little or no tendency to become larger. Around the carious part there is always an effusion of new osseous matter in the form of spines or tubercles, extending to a considerable distance, and greatly increasing the thickness of the bone. This new mass, which is no doubt produced in consequence of the irritation of the disease, like that formed to reunite fractures and supply the place of exfoliations, is characterised by compactness and smoothness when minutely examined, though on superficial inspection it appears rough and porous. The pores are apertures for the transmission of blood-vessels, but their form is circular and their edges rounded off, so

that sharp edges cannot anywhere be perceived. The newly effused bone may thus be readily distinguished from the diseased part, to the irritation of which it owes its origin. It is necessary also to distinguish between caries, and the excavation of the cancellated texture which is caused by absorption owing to pressure. In this case the bone presents the same appearance that it would do if its external crust were removed by mechanical means ; and it possesses none of the whiteness, brittleness, or spicular surface observed in caries. As this difference can hardly be ascertained until after maceration, a more useful distinction is afforded by the history of the case, and whenever the excavation is plainly referable to pressure, no apprehension need be entertained of caries. It is thought by many that deep-seated collections of matter, if not evacuated early, may occasion caries ; but when this morbid state of the bone is connected with deep suppuration, it will always be found to have been the direct result of the primary inflammation. That mere pressure is not sufficient to produce caries, may be learned from the want of any morbid disposition in the sides of the apertures which are formed by absorption to evacuate matter confined in the cavities of bones. In the living body the carious surface is generally more or less completely covered with unhealthy granulations, which often possess very considerable firmness, and render the discovery of its extent, or even existence, by no means easy. The disease occurs at all ages, but commences most frequently in the early periods of life. It is most frequently met with in persons disposed to scrofulous action, and often follows suppuration in bones which have been the seat of deposits proceeding from that morbid action.

The treatment of caries is to be conducted on the same principles as that of cancer, and consists in the use of means which have the effect either of destroying the life of the morbid part, or of removing it at once from the system. There is this difference, however, that there being no malignant tendency to take on the same diseased action in the neighbouring parts, it is not necessary to remove any of them, except in order to gain access to the seat of the evil. Notwithstanding this favourable circumstance, it is found extremely difficult to eradicate the disease by depriving the part affected of its vitality. The bone usually lies at a considerable depth ; the caries, though it seldom penetrates deeply into its substance, generally occupies an extensive and irregular surface ; and the effect of agents used with the view of killing the morbid part is necessarily much weakened by its humidity. The concentrated

mineral acids—the nitrates of silver and mercury—the red oxide of mercury—and the actual cautery, are considered the best means for the purpose. In using them the bone affected ought to be very freely exposed by a crucial incision, and then dried as well as possible, after which the caustic or cautery selected should be applied so as to produce a decided effect. The fluid caustics should be applied by means of a piece of lint soaked in them; the solid ones should be rubbed on the part, or, if they are in the form of a powder, as the red oxide of mercury, laid on it in substance; the cautery should be of a spherical or ovate shape, it must be pressed down firmly, and be succeeded by two or three others until the whole morbid surface has been subjected completely to their action. The effect of all these applications, however carefully employed, is very superficial, and it is extremely difficult, if not impossible, to insure their operation on the whole surface of the diseased part. They, therefore, frequently require to be repeated, and generally prove inadequate to destroy the disease, unless it is very limited and accessible; and it is even not improbable that some of them, as the actual cautery, may occasionally make the matter worse, and extend the disease to the neighbouring bone by exciting inflammation in it. For these reasons excision ought to be preferred to caustics for removing the carious bone; and if the part affected be within reach, which can always be ascertained previous to commencing the operation, it may by this method be surely and thoroughly eradicated at once. If the disease is superficial, and of small extent, it is easily scooped out with a gouge, the toughness and compactness of the sound bone distinguishing it from the morbid portion. If extensive and deeply seated, it is best removed by taking away the whole of the articulating extremities concerned, as will be explained hereafter when the diseases of the joints are considered. When the situation of the caries prevents it from being cut out, amputation ought, if possible, to be performed; and if this be impracticable, the disease will sooner or later prove inevitably fatal.

Exostosis.

The term Exostosis is employed to denote various morbid conditions of the osseous system differing materially from each other, and has consequently occasioned great confusion. In order to avoid this, it ought to be confined in its meaning to imply an unnatural growth of bone. Exostosis in this sense exhibits three remarkable

varieties in respect of its structure; being sometimes solid, at other times hollow, and also not unfrequently spicular or foliated—that is, composed of radiating points or plates. The first of these kinds of exostosis exists independently of any other disease, but the two others are connected with, and dependent upon, different morbid formations, along with which they may more properly be considered.

The first, which may be called the simple or solid exostosis, consists of a mass of osseous substance growing out of a bone naturally belonging to the skeleton. It is sometimes thin and flat, rising gently from the surrounding surface, and not causing any sharp projection, when it is named a Node—an appellation which is also used to designate a similar swelling dependent on chronic thickening of the periosteum. In other cases it forms a projecting excrescence, the neck of which is usually narrow in proportion to the extremity. The substance composing such excrescences is of various solidity, being sometimes open and spongy, at others extremely dense and compact, and occasionally more like ivory than bone. The bones most frequently thus affected are the femur, tibia, lower-jaw, and distal phalanx of the great toe; but there is no bone in the body exempt from it, though those of dense structure are certainly the most liable to it. It may appear at any age, but, for the most part, does so about the time of puberty.

The inconvenience which this sort of exostosis occasions depends very much upon its situation. Generally while the growth is enlarging, pain and annoyance are experienced from obstructed function of the neighbouring parts; but when it ceases to increase and becomes dense, which it usually does sooner or later, the irritation of its presence becoming habitual, is no longer troublesome. The treatment, therefore, seldom requires to be active; and nothing more is usually requisite than to protect the limb, or part affected, from the irritation of motion or pressure, so long as the exostosis is enlarging. Should it prove permanently or seriously troublesome, excision affords easy and effectual means of relief. For this purpose many ingenious contrivances have been recommended, but nothing answers so well as the cutting pliers. It has been thought necessary to perform amputation of the great toe on account of the exostoses which are apt to grow at the side or extremity of the nail; but this proceeding is equally severe and unnecessary, as excision of the tumour may be easily effected, and is not followed by relapse.

The hollow exostosis depends on the expansive effect of fluid or solid formations within the bone; and the osseous substance may

be regarded as devoid of any morbid disposition, so that if the contents were removed it would contract to its ordinary dimensions. The same observations apply to the spicular or foliated exostosis, which is always found connected with some source of irritation, and is to be looked upon rather as a consequence than a part of the disease. The causes usually concerned in giving rise to this production are morbid growths, ulcerations in its neighbourhood, and exfoliation from its internal surface.

Fibro-Cartilaginous Tumour of Bone.

It is usual to comprehend all the solid tumours of bone, the consistence of which is less hard than that of the bone itself, under the title of Osteo-sarcoma. But as this leads to much confusion, it is better to divide the softer tumours of bone into the fibro-cartilaginous, and medullary-sarcomatous, which differ essentially in their nature and consequences.

The fibro-cartilaginous tumour, when occurring in bones, possesses the characters which have been already described in the general account of this kind of morbid growth. Its colour is white, gray, or yellow; its consistence more or less nearly approaches that of cartilage, and it often has interspersed through it small cysts of transparent fluid. It generally originates in the central part of the bone affected, and gradually enlarging, expands the surrounding shell, which still preserves the properties of sound osseous tissue, though sometimes singularly altered in shape. The tumour is productive of little inconvenience except from its size, but on this account is often a source of great annoyance and distress; as when the lower jaw, humerus, metacarpal bones, or phalanges of the fingers are affected. There is reason to believe, that if the fibro-cartilaginous substance could be completely eradicated, the bone would resume its natural shape and size; but as its cellular or honeycomb-looking structure, when expanded by the disease, renders this impracticable, the only remedy is removal of the bone affected, which, however disagreeable in some situations, from the deformity occasioned by it, may at least be performed with a favourable prospect of effecting a permanent cure.

Medullary-Sarcomatous Tumour of Bone.

Medullary-sarcoma occurs in bone perhaps more frequently than in any other tissue of the body. It commences sometimes

immediately under the periosteum, and causes an excavation in the surface of the bone, around which more or less osseous matter is effused; at other times it begins in the interior, springing apparently from the medullary membrane, and then expands the bone into a shell, or, by inducing absorption, causes a perforation, through which it issues and swells into an external tumour; or it opens out the bone into beautiful needles or plate-like processes radiating from the central seat of the disease; or lastly it may simply occupy the place of the bone. But, whatever may be the diversity in this respect, the morbid degeneration always exhibits its characteristic features. There is usually great pain from the first, and often for a long while, before any external swelling is visible. The patient loses flesh, and indicates, by his anxious expression of countenance, the presence of a malignant disease. The tumour, though at first seldom so soft as when originating in the less dense tissues of the body, in its progress becomes softened, and acquires, at least in some parts of its extent, a consistence so nearly approaching that of a fluid, as to render the discrimination from it extremely difficult. Then the veins enlarge—the integuments inflame—ulceration ensues—fungous excrescences protrude—and the patient sinks under the exhaustion which results from profuse discharge of ill-conditioned matter or blood. The disease makes its attack at every time of life, and in both sexes; but seems, on the whole, most frequent between twenty and forty years of age. The only remedy is amputation; and unless this be performed early, before the constitution of the patient is much injured, and freely, so as to remove the whole of the affected bone, it will in all probability prove of little permanent benefit.

Cystic Tumour of Bone.

The bones sometimes, but very rarely, with exception of the upper and lower jaw, become the seat of cystic formations. The swelling is generally not attended with much pain, and at its commencement may be mistaken for a solid exostosis or cartilaginous growth; but as the cysts enlarge and approach the surface, the thinness of their parietes betrays the nature of the case. This disease occurs most frequently in the earlier periods of adult age. So long as it retains the characters of the cystic tumour, it may be regarded as free from any malignant action; but this morbid structure changes sometimes into medullary sarcoma. The best mode of treatment is early and free removal of the bone affected, if punc-

turing the tumour, or laying it open by free incision, has not the effect of curing the disease.

Rachitis or Rickets.

By Rickets is understood a morbid state of the osseous system, in which the bones are soft and flexible, being converted into a substance more like leather than bone; having a brown colour and cartilaginous consistence, with no appearance of marrow, but numerous irregularly circular and oval cells, even in the parts naturally most compact, containing a brownish-red fluid. The disease does not directly cause pain, but occasions great inconvenience by allowing the bones to bend under the weight of the body, and contraction of the muscles. It is accompanied with weakness and derangement of the whole system, the symptoms of which are a pale and sickly countenance, tumid abdomen, flabbiness of the muscles, and unhealthy evacuations. The earliest perceptible alteration of the bones is at the wrists, when the extremities of the radius and ulna become preternaturally large, and are apt to excite the suspicion of fracture. It is confined to the period of childhood, and seldom begins later than the second or third year of age. It affects chiefly the offspring of young or unhealthy parents, and occurs most frequently in cold moist climates. It terminates either in death or in a return to health, after months or years of duration. Contrary to what might be expected, rickety bones are readily broken by slight degrees of violence, and their reparation in such cases is effected chiefly by cartilage. When the bones regain their healthy nutritive action, they become as hard and unyielding as usual, retaining, however, the curvatures which have taken place during the softened state. The new osseous substance which is deposited during their subsequent growth, occupies chiefly the concave side of the arches into which they are bent, where it has most effect in strengthening their power of resistance, and gives them a remarkable flattened shape.

Rickets used to be ascribed to the operation of a morbid acid humour pervading the system, and the remedy consequently consisted in liberally supplying the patient with alkaline and earthy preparations, in order to neutralise this acidity, and replace the defective earth of the bones, which was supposed to have been removed by its chemical agency. The disease is now referred, more consistently with scientific pathology, simply to disorder of the nutritive action of the osseous tissue, and the means employed to

correct it are merely those which tend to strengthen the system in general, while every prudent precaution is taken to prevent the bones from suffering distortion, so long as they remain exposed to it by their softness and flexibility.

With these objects in view, the patient ought to be frequently put into a warm bath, and every day have the whole surface of the body subjected to friction. He should be warmly clothed, and, if possible, removed to a dry situation sheltered from the cold. His diet must be moderate, easily digestible, and nourishing; and he should abstain from all medicine, except what is required to maintain or excite the intestinal secretions. While the bones are in a yielding state, exercise in the erect posture may cause curvature and distortion, especially of the bones composing the trunk and inferior extremities; the patient ought, therefore, to be debarred from walking, running, &c., and encouraged to creep and roll upon the floor or on the ground in the open air. Should the limbs unfortunately have been bent through neglect or injudicious treatment, they may often be straightened by the gentle and continued use of splints or other apparatus.

Mollities and Fragilitas Ossium.

By Mollities Ossium or Malacosteon is understood a general disease of the bones, in which they become extremely soft, much more so than in rickets, so that in its advanced stages there hardly remains any trace of the osseous texture, and the periosteum encloses merely a yellow or brownish mass of lardy consistence. This affection is attended with excessive and almost incessant pain, —is almost confined to females,—occurs chiefly at the middle period of life,—and though often very slow in its progress, advances until the patient dies.

There is no effectual remedy for this dreadful malady, and its treatment consists in the use of means proper for palliating the patient's sufferings, of which the different preparations of opium are the best, and supporting the general health, for which purpose sea air seems to have most influence.

Fragility or unusual facility of being broken, naturally leads to the idea of a redundance in the earthy constituent of bones; and a certain degree of it depending on this cause is observed in old people; but the condition which is generally understood to be denoted by this title, and in which the proneness to breaking is so great that fracture is caused by the slightest external violence, or

even by the action of the muscles in effecting the ordinary movements of the limbs, is a state of preternatural softness instead of increased density. Rickets, malacosteon, and the medullary-sarcomatous degeneration, all occasionally render the bones more liable to be broken; and fracture being sometimes the first obvious effect of the diseased action, is not only thought to be the cause that induced it, but also chosen as the characteristic feature for its designation. A remarkable degree of fragility has been observed in the advanced stage of carcinomatous disease.

Diseases of the Spine.

There are two morbid states of the spinal column which occur so frequently, and are attended with such important effects on the system, that they require to be considered by themselves. These are inflammation, and some of its consequences, with or without curvature, and curvature without inflammation.

When inflammation occurs in the vertebræ, it is seated in their bodies and intermediate cartilages, and is indicated first by a dull gnawing pain at the part, which is aggravated by pressure and motion; then a slight degree of swelling generally appears so as to make the spinous processes of the affected vertebræ appear more projecting than usual; the patient loses his appetite and strength; becoming dull and listless, and preferring the horizontal posture; his inferior extremities are reduced in bulk, and affected with numbness and rigidity; whence the gait is awkward and vacillating, the legs frequently crossing each other, while the trunk is held peculiarly erect and rigid, to protect the diseased part from motion. As the disease advances, the patient sometimes loses the use of his limbs entirely; and, in addition to his other complaints, is generally distressed by an uneasy feeling at the pit of the stomach, and a painful sense of constriction round the chest, in the region of the diaphragm. Suppuration usually ensues, and the matter is either confined to the neighbourhood of the bone affected, or descends in the interstices of the soft parts so as to present itself lower down. When the dorsal vertebræ are affected, it generally points in the loins, and constitutes a lumbar abscess; when the lower dorsal or the lumbar vertebræ are concerned, it for the most part passes down along the psoas muscle, and appears in the groin, sometimes above, but more frequently below Poupart's ligament, when it is named a psoas abscess. The matter, in order to point above Poupart's ligament, must perforate the abdominal muscles and

fasciæ, through means of absorption, which happens generally by a small aperture; the pus thus comes to be quite superficial, and diffused under the skin, from which circumstance the abscess may be erroneously regarded as entirely subcutaneous. It must be observed, that though chronic abscesses in the loins or groin most frequently proceed from diseased bone, they may exist independently of such sources, just as in other parts of the body.

When the pus ceases to be confined near the bone, and begins to drain away from it, the patient generally experiences great relief from his complaints. The pain becomes very much lessened, and the use of his limbs is often in some measure or altogether regained. But this amendment is usually accompanied by a serious change to the worse in another respect; since the vertebral column is apt to bend under its superincumbent weight, when weakened by the destruction of bone and intervertebral cartilage which attends the suppuration. The curvature in this case takes place forwards, and being confined to a small extent of the spine, causes an acute projection behind, so that one or more of the spinous processes appear to be dislocated backwards. This change of shape does not take place, either when the extent of the disease is small in proportion to the size of the bones in which it is seated, or when it is so great that the patient is constantly confined to the horizontal posture; but these circumstances are comparatively rare in proportion to those which favour the occurrence of curvature. If the morbid action ceases before suppuration, the bones affected unite with a degree of approximation proportioned to the amount of absorption which they have suffered; and if suppuration does take place, the surface of the abscess either heals with approximation and consolidation of its parietes, the vertebræ concerned appearing as if run into one mass, or a state of caries remains, and gradually wears out the patient's strength.

This disease may occur at any period of life, but is by far most common in children from two to eight years of age. In adults it generally occupies a small part of the bone, and proves extremely obstinate, or rather always incurable, at least with such few exceptions as hardly deserve to be mentioned. In childhood it usually engages the whole substance of two or three adjoining bodies of the vertebræ, which on dissection are found almost entirely wasted away, together with the intervertebral substance, portions of dead bone and pus occupying the cavity.

The disease is usually ascribed to twists or blows; but as these

injuries are seldom thought of until long after they are alleged to have been received, and not before the symptoms attract attention, there is much reason to discredit their effect in exciting the morbid action. In children there is reason to believe that the first step of the morbid process is usually the deposition of scrofulous substance. It would seem that in adults the disease is liable to be excited by venereal excesses.

In conducting the treatment of this acute curvature, as it is generally named, surgeons proceeded formerly in the belief that the primary evil consisted in displacement of one or more of the vertebræ from violence; that the pain and loss of voluntary motion depended on pressure caused by the dislocated parts on the spinal marrow; and that the disease of the bones was not only caused, but kept up by the irritation proceeding from their unnatural position. The practice, therefore, consisted in the use of mechanical contrivances for rectifying the displacement. The inefficacy and danger of such a mode of proceeding must be obvious to every one acquainted with the true condition of the bones, which having their substance destroyed more or less extensively, though separable by force, must resume their situation as soon as it is removed. And if the vertebræ are much weakened or partially united, they will be very apt to suffer such fracture or disjunction as may render the limbs below permanently paralytic, or prove immediately fatal.

Mr Pott, observing that curvature of the spine from rickets, though productive of the most extreme distortion and deformity, was not attended with palsy; and that the palsy accompanying the disease in question did not resemble the state which is induced by pressure on the spinal marrow, the muscles of the limbs being not soft and flaccid, but rigid and tense, concluded that the curvature was an effect, and not the cause of the disease, which he thought might more reasonably be referred to inflammation seated in the bodies of the vertebræ, and causing more or less irritation of the neighbouring spinal marrow.

With this view of the matter he used counter-irritation by means of issues opened with caustic potash, as early as possible, in order to subdue the inflammatory action, and interdicted the erect posture, as increasing the irritation. Mechanical contrivances do not afford the diseased spine nearly the same repose which is obtained from the horizontal posture, and frequently occasion the greatest mischief, by pressing injuriously on different parts of the trunk, as well as by inducing the patient to indulge in exercises which the diseased

spine cannot bear with impunity. There can be no doubt as to the soundness of the principle which constitutes the foundation of Mr Pott's practice; but it certainly has been applied too indiscriminately. In the common case which commences with scrofulous deposition in the substance, or on the surface of the bones, and insidiously advances through its suppurative stage, no advantage can be derived from counter-irritation, which, on the contrary, may prove injurious by exhausting the patient's strength. In the case also, occasionally, though not so frequently met with, where the spine forms an acute projection posteriorily, becoming bent almost to a right angle, with little pain and no suppuration,—the bodies of the vertebræ seeming to be simply absorbed, so that the remaining rings and processes are consolidated together, there is no use in opening issues. It is only when the pain and other symptoms that have been mentioned denote the existence of inflammatory action, that caustic or the actual cautery should be employed. The latter agent seems greatly preferable, and is to be applied longitudinally to the extent of a few inches on each side of the affected part, except when the neck is concerned, in which case the middle line may be selected for the purpose.

This disease occasionally affects the first or second upper cervical vertebra, with the corresponding part of the occipital bone. The symptoms, in the first instance, are the same as those which have been already described, consisting of deep-seated pain felt chiefly at night, and aggravated by motion. But, owing to the importance of the portion of the nervous system which lies within the direct influence of the disease, when it is thus situated, namely, the lower part of the *medulla oblongata*, and the mobility of the joints concerned, the patient's sufferings are extremely severe. In eating and speaking he feels darting pains through the neck. In changing his position, he keeps the head perfectly steady, and employs both his hands to assist the muscles in preventing any rotation or flexion of the affected vertebræ. He loses his appetite and strength; complains of almost unremitting and intolerable nausea; and exhibits, by a peculiarly anxious and unhappy expression of countenance, that he labours under a disease of the most agonising kind. Loss of voice, difficulty of breathing, convulsions, and palsy, occasionally supervene; the head generally suffers more or less distortion to one side, in consequence of the bone giving way under the ulcerative process; and at length, after months or years of misery, the patient dies, either gradually, from mere exhaustion, or suddenly, from dis-

location of the odontoid process of the second vertebra, which becoming detached from the occipital bone, presses backwards on the *medulla oblongata.* If an abscess forms, it is seldom evacuated previously to the patient's death, and sometimes opens into the pharynx.

The subjects of this disease are mostly children and young adults. The treatment requires rest of the head, together with counter-irritation, effected early and powerfully by the actual cautery; and practitioners ought to beware of mistaking the first indications of this destructive disease for slight rheumatic ailments deserving of no particular attention. The preparations in museums prove that the cure of the disease, though perhaps very rare, is not impossible.

The other disease of the spine which requires to be particularly considered, on account, not of its danger to life, but its frequency and important consequences in respect to the patient's appearance and comfort, consists merely in curvature, without any specific or general morbid affection of the osseous system. It is named the Lateral curvature; its direction being very rarely from behind forwards, and almost invariably from side to side. It occurs chiefly between the ages of seven and seventeen; and, with few exceptions, is confined to the female sex. It generally comes on insidiously, increases progressively, and, terminating at a more or less advanced stage, leaves the patient permanently disfigured in a proportionate degree. The part of the spine principally affected is the dorsal portion, which, bending to one side, almost always to the right one, makes the corresponding scapula and shoulder seem larger and more prominent than usual. As the disease advances, a counter-balancing bend in the opposite direction takes place in the lumbar region, causing the hip concerned to appear enlarged. When the spinous processes are traced downwards from the neck to the sacrum, the alternate bending in their course may be readily observed. As the curvature continues to increase, the distortion becomes more and more apparent;—the trunk is shortened and looks compressed;—the ribs are approximated from side to side, and protruded forwards to increase the capacity of the contracted thorax, which thus has its shape entirely altered, and is widest from before backwards. However far the disease may proceed, the limbs and pelvis remain free from any participation in it.

In ascertaining the cause and nature of this curvature, the following circumstances which attend its commencement must be

carefully recollected:—1. It occurs almost exclusively in females who devote a large proportion of their time, during the period when the morbid disposition exists, to the pursuits usually followed in undergoing a fashionable education, or to some sedentary occupation, which does not require or permit much bodily exertion. 2. It usually affects most seriously those individuals who possess a slender frame, or one characterised by indications of a phlegmatic temperament,—their bodies, though thick and bulky, being pale, flabby, and prone to all the morbid states, depending on weakness of action. 3. Other things being equal, it occurs most certainly, and proceeds most rapidly, when the trunk is habitually maintained in a bent position.

The predisposition to the disease, therefore, appears to be constitutional weakness, and its exciting causes, circumstances which increase the weakness of the spine particularly, and promote its bending by the figure they make it assume. The strength of the spine depends partly upon the bones, and partly upon the muscles composing it; and it is probable that the former are chiefly affected by the predisposition, while the latter are influenced more by the exciting causes. All muscles require frequent exercise for the preservation of their strength; but, during the occupations of drawing, playing, sewing, &c., while the extremities are either constantly employed, or, at all events, unrestrained in their movements, the trunk is not only held perfectly steady in one position, often a curved one, but is also compressed with the rigid articles of dress which are used under the erroneous expectation of improving the shape. The muscles of the back, therefore, becoming extremely weak, and, indeed, as may be learned by actual examination, almost completely absorbed, are no longer able without an effort to restore the erect position of the spine when bent by the weight of the head and superior extremities, or by the occupation of the patient. It is consequently allowed to assume a permanent curve; and then the predisposition, which depends on a softened state of the bone, acts with full effect; because the more the column bends, the longer levers are afforded to the superincumbent pressure. As the distortion increases, the viscera of the thorax and abdomen are more and more compressed and displaced, their functions suffer corresponding derangement, and the whole system becoming disordered, the bones, even less properly nourished than before, lose still more of their resisting power. Should the patient unfortunately, during this process, fall into the hands of a machine-

maker, who attempts to prop up the weak and twisted spine by means of iron frame-works, the morbid alterations which have been described will be accelerated ; for all such contrivances must prove either insupportable to the patient, or inefficient in straightening the spine ; and granting even that they could accomplish this, they would still labour under the great objection of confining the movements of the trunk, and preventing the muscles from obtaining that exercise which is essential to the recovery of their strength. The result would be not more satisfactory if the practitioner were to go to the opposite extreme, and, regarding the muscles as the sole seat of the disease, attempt to strengthen them by enjoining exercise in the erect posture, or, still worse, recommending a weight to be carried on the head, in order to render their actions in balancing it more energetic than usual. Such means, however useful in preventing curvature, must manifestly tend to increase it when once commenced.

In the management of persons predisposed by their age, sex, temperament, or constitutional make to this disease, every means ought to be used for strengthening the system in general, and the trunk in particular. All long-continued and constrained positions must be interdicted,—frequent exercise of such kind as calls into action the muscles of the trunk should be enjoined. The use of stays, corsets, and every rigid article of dress, however designated, must be strictly prohibited. If curvature has already taken place, it is evident that the first step towards reparation must be relieving the weak and bent spine from pressure. The only mode of effectually accomplishing this is to make the patient assume the horizontal posture, which can be done without any great hardship, if a smooth well-stuffed sofa is provided, instead of the floor or a board, which is sometimes used for the purpose. When the curvature begins to diminish, the patient may rise occasionally for a few minutes, and exercise the muscles by some suitable employment, which ought never to be continued after the slightest feeling of fatigue is experienced. By persisting in this system, the disease will certainly be arrested in its course, the distortion, if not very great, will be removed, and the worst cases will be considerably improved.

CHAPTER XII.

JOINTS.

Sprains and Bruises.

THE ligamentous tissue is not liable to pain excited by the ordinary stimuli which occasion it in other parts ; but though insensible to cutting and tearing, it suffers severely from being overstretched, in conformity with the general law, that the sensibility of parts bears some relation to their use in the animal economy. The articular cartilages and lining synovial membrane again suffer from violent compression. The symptoms and effects, primary as well as secondary, which proceed from these two sources, are very similar. Joints of the ginglymoid or hinge-like structure, and those of the arthrodia kind, such as the tarsal and carpal articulations, are exposed to the first-mentioned injury, while the ball and socket-joints, though nearly exempt from it, are subject to bruises from their respective surfaces being squeezed together.

Both strains, or sprains as they are called, and bruises are attended in the first instance with severe sickening pain, and more or less complete inability of exercising the joint. To these symptoms succeed swelling, tension, and, if the joint is superficial, discoloration from ecchymosis, and not unfrequently inflammation, particularly if the patient possesses a scrofulous or otherwise irritable constitution. The inflammation, when chronic, leads to thickening and adhesions of the articular apparatus, which occasion deformity and lameness, or morbid degenerations of the same part, which frequently end in the destruction of the joint; when acute, it tends to suppuration. The immediate effects of these injuries are always distressing, and their secondary consequences, though not certainly serious, are generally inconvenient, and often destructive of the limb. Such accidents, therefore, ought always to be treated with attention, so that nothing may be neglected in any way calculated to guard against bad consequences to the joint.

The means that afford most relief from the pain directly caused by the injury, consist in the application of hot fomentations and the preservation of perfect rest. The ecchymosis is often considered a warrant for leeching or cupping; but, as has been already explained, the blood which produces the discoloration being effused from the vessels, cannot be withdrawn in either of these ways, and must be removed by absorption. If symptoms of inflammation come on, blood should be extracted freely, both locally and generally, and the other means employed that will be mentioned when the inflammation of joints is considered. After the injured part has ceased to be painful on pressure or motion, and remains merely swelled and stiff, it ought to be supported by a bandage, and at the same time have some stimulating ointment or lotion applied to promote absorption. Blistering, warm pumping, the vapour-bath, friction, and gentle, but frequently repeated exercise, are useful at the same time, and with the same view.

Dislocation.

By Dislocation is understood displacement of the respective surfaces of an articulation. The dislocation may be partial or complete; and also simple or compound, in the same sense of these terms as when they are used with reference to fractures. It is simple dislocations only which will be considered under this section, as those which are compound may be arranged more conveniently under wounds of the joints.

The joints least subject to strains are most readily dislocated, since the mobility, and freedom of ligamentous connexion, which protect them from the former injury expose them to the latter. The circumstance of having been formerly dislocated increases the predisposition. The causes of dislocation are—1. external violence; 2. inordinate muscular action; and, 3. diseased alteration of the articular apparatus. The displacements which proceed from the last of these causes are named spontaneous dislocations, and will be considered along with the diseases which give rise to them.

The process of dislocation usually consists of two stages or acts; there being first the displacement of the articulating surfaces, which results directly from the violence that causes the accident; and then a further separation of them by the action of the muscles which formerly held the bones together, but now pull them past each other. These two steps are sometimes designated by the names of primary and secondary dislocation.

Of the symptoms of dislocation, the most constant and characteristic one, especially as a distinction from fracture, is immobility or fixture, when motion of the limb is attempted either by means of its own muscles or by an external force, which depends upon the unnatural position of the articulating extremities of the bones, and the contraction of their surrounding muscles. The limb is generally shortened, but sometimes it is lengthened, and when the latter is the case there cannot of course be any suspicion of fracture. There are also attending the accident deformity from the altered situation of the bones, pain or numbness from their pressure on the muscles and nerves, and swelling with coldness from obstruction of the blood-vessels.

The treatment of dislocation consists in reducing or replacing the articular surface which has been moved from its proper position; in doing which it is necessary to counteract the forces that caused the two acts of removal. This is effected by first extending the limb, so as to draw back the bone to the point where the muscles began to operate in producing its displacement; and then urging it in a direction opposite to that in which the external violence primarily acted. These steps in the process of reduction, which are named extension and coaptation, have sometimes an equal share in its accomplishment, but more frequently one or other of them is chiefly useful. In ball or socket-joints the first, and in hinge-joints the second is chiefly used.

The dislocated bone ought generally to be extended in the direction which it has assumed in consequence of the displacement. The force for this purpose may be applied so as to act either directly on the bone itself, or on a part of the limb separated from it by one or more articulations. It has been objected to the former mode, that it causes compression of the muscles opposed to reduction, and to the latter, that, by keeping the limb straight, it is still more adverse to yielding of the muscles. It does not appear, however, that any practical inconvenience is experienced in either of these ways. The former method is on the whole more convenient in most cases, and is generally employed in this country. In order to make extension effectually, it is necessary to have counter-extension exerted on the corresponding surface from which the bone has been dislocated—viz., the one nearest the centre of the body; and the more directly it is subjected to the power employed for this purpose, the more perfectly will the object in view be attained. The force employed for extension may be either simply

the manual strength of one or two stout assistants, or this increased by the power of the pulley. In all cases of dislocation, except perhaps sometimes where the hip-joint is concerned, mere manual extension is sufficient, and it ought, therefore, in general, to be preferred, being more readily obtained, and also more easily managed than the pulley. The best bandage for applying the extending force is a skein of worsted, or a folded shawl, which must be securely fastened to prevent it from slipping in the process. The best noose for this purpose is either the *clove-hitch*, as it is called by sailors, or another which is preferred by the French surgeons. It is executed by placing the band across the limb in a triple form, and then drawing each of its ends through the opposite loop.

The strength of the patient's muscles used to be weakened by bleeding—the warm bath—tobacco injections—and the tartrate of antimony, given in solution in small doses frequently repeated. The involuntary resistance was also lessened by making the patient speak, so as to prevent fixture of the thorax, which being the central point of attachment directly or indirectly to all the muscles of the body, is instinctively rendered immoveable whenever any strong effort is to be made. With a similar view it is sometimes advantageous to effect the extension suddenly, when it is not expected by the patient; but unless it should seem practicable to accomplish the reduction in this way instantaneously, the limb ought to be extended slowly and steadily, since the effect of the stretching force in subduing the contractile energy of the muscles depends more upon its duration than its degree. The introduction of chloroform has superseded the use of all other subsidiary means, and, by completely suspending muscular contraction, wonderfully facilitated the process of reduction.

Coaptation is more or less required according to the resistance which is opposed to the reduction by the shape and situation of the articular surfaces. As has been already remarked, it is generally least useful in the ball and socket-joints, and of most advantage in those of the hinge form. In the former, it is sometimes not required at all; and in the latter, it is occasionally sufficient of itself to accomplish the operation.

After the dislocation is reduced, the joint ought to be protected against the operation of those circumstances which tend to renew the injury. It ought to be kept perfectly quiet, and frequently fomented, to allay the pain and irritation consequent on the lace-

ration and bruising of the various injured parts. It might be expected that the immediate pain, as well as the danger of consecutive inflammation, would be greater in dislocation where the ligaments are torn, than in strains, where they are only overstretched. But this is not the case, and though inflammation, both acute and chronic, may no doubt result from the former accident, it is seldom followed by any serious bad consequences of this kind.

When the dislocation is not reduced, the bone acquires adhesions to the neighbouring parts round the margin of its articular surface, and by its pressure induces absorption of the surface it comes to act on, so that a cavity is formed for its reception, and a sort of new joint produced, which enables the patient to regain considerable use of the limb. While this process is going on, the old articular hollow gradually contracts, and ultimately becomes obliterated; so that, if the bone were displaced from its new situation, it could not be returned to its original one. The time that may elapse before reduction becomes impracticable, varies with the age of the patient and the nature of the joint concerned, from two or three weeks to as many months. It is longer in old people than in young, and in dislocations of ball and socket-joints than in those of hinge-joints.

Shoulder-joint.—The head of the humerus may be dislocated downwards, forwards, and backwards. The first of these displacements is the most common, and happens more frequently than the dislocation of any other joint. The accident is caused by external violence proceeding from falls on the hand or elbow, or blows on the shoulder, while the arm is separated from the side, and also, though rarely, by sudden violent contractions of the *pectoralis major* and *latissimus dorsi*, while the limb is in a state of abduction. In some rare cases it has been observed to occur during an epileptic convulsion. The capsular ligament is necessarily torn, and the head of the bone rests upon the neck of the scapula over the origin of the long head of the triceps.

The symptoms are elongation of the arm, which is stiff and powerless, projecting considerably from the side, and slightly bent, both the biceps and triceps being put upon the stretch. The tension of the former muscle generally occasions supination of the fore-arm; the axillary hollow is occupied by the head of the humerus; and under the acromion there is a remarkable depression instead of the usual convexity of the deltoid, from the absence

of the bone. There is pain of the shoulder, numbness of the fingers, and more or less swelling of the whole limb.

The reduction may be effected by various methods, but the one which will generally be found most convenient, when the patient retains his consciousness, is to make him sit on a chair, and then having confined the motions of the scapula by means of a folded sheet or tablecloth encircling the chest, and held at its extremities by one or two assistants, to extend the arm horizontally or slightly downwards; the bandage used for pulling being fastened a little above the elbow. To perform the coaptation, the surgeon puts his foot on the chair, and his knee in the patient's axilla, then places one hand on the acromion, and with the other seizes the fore-arm. While the extension is gradually increased, he rotates the limb outwards, and endeavours to raise the head of the bone into its place, by elevating his knee at the same time that he depresses the shoulder. When the operation is completed, a sudden snap, or more frequently a dull grating, is perceived, and all the symptoms of the dislocation disappear.

Another method, which may be employed with most advantage under the influence of chloroform, is to place the heel of the operator in the axilla of the patient, while both lie horizontally in opposite directions; then perform extension by pulling the hand of the affected arm; and finally effect coaptation by bending the limb inwards over the fulcrum which is afforded by the foot. The great efficiency of this method depends upon the direction of the extending force, which is not opposed to the action of the *pectoralis major* and *latissimus dorsi*, as when the limb is drawn outwards at a right angle to the chest. In every case which proves difficult, or is expected to be so, from the duration of the displacement, extension should be made downwards, or in the longitudinal direction of the body, either by pulling with the heel in the axilla, or by employing the strength of assistants, aided, if necessary, by the pulley, to draw the arm in this direction, while counter-extension is effected by a cushion secured in the axilla by a strap passing round the shoulders, and secured to a wall or other firm support. In this way dislocations of several weeks' standing may be readily reduced; and even at the end of six or seven, success need not be despaired of; but, beyond this period, notwithstanding occasional instances of success, the case in general must be regarded nearly hopeless.

In dislocation of the humerus forwards, the head of the bone lies

on the sternal side of the coracoid process, a position into which it can get only by suffering a secondary displacement after having been forced downwards. The muscles then draw it upwards and inwards, as far as the clavicle allows.

In this case the limb is rather shortened. The elbow is bent and in the state of abduction, owing to the position of the head of the humerus, and, from the same cause, there is less numbness and swelling of the limb. There is not so much perceptible depression under the acromion, and the axilla is not so completely occupied as when it contains the head of the bone. As might be expected from the negative character of these symptoms, the diagnosis is not so easy as that of dislocation downwards; and hence practitioners who are not sufficiently careful frequently overlook the nature of the accident.

The reduction should be performed as in the former case; but it is here still more advantageous to extend downwards, in order to dislodge the bone from the position into which it is drawn by the muscles.

Dislocation of the humerus backwards or outwards is very rare. In the few cases of it which have been observed, the head of the bone lay between the scapula and infra-spinatus muscles, below the spine, so as to cause a distinct external swelling in this situation, and a deficiency at the fore part of the shoulder. The arm was directed forwards across the chest, and could not be moved into any other position without both force and pain. The reduction is easily effected, the extension being made in the direction which the limb retains from the accident.

In all very recent cases of dislocation of the shoulder, and more especially within an hour or two after the accident, there is a considerable chance of effecting reduction by suddenly rotating the arm outwards, and at the same time drawing the elbow backwards, while the operator's hand in the axilla urges the head of the bone into its place. In such circumstances, therefore, this simple method ought always to be tried in the first instance,—of course without any intimation to the patient of the intention to do so, which would certainly excite opposing action of his muscles.

Elbow-joint.—The elbow-joint is liable to various sorts of dislocation, the diagnosis of which is often very difficult, especially as fractures near or through the articular surfaces produce in some respects similar symptoms. There is a difference of opinion as to the comparative frequency of these accidents, and also as to the

characters for distinguishing them, with the exception of one dislocation, which is certainly the most common and best marked of the whole. This is displacement of both bones of the fore-arm backwards. The articulating extremity of the humerus stretches the biceps and *brachiæus internus*, occasions a hard tumour at the bend of the arm, and generally causes permanent semiflexion of the limb, though, sometimes, as I have had occasion to see in several instances, the arm is straight. The olecranon projects behind further than usual, and the triceps is much relaxed. The fore-arm appears shortened. This accident happens from falls on the hand while the arm is bent.

The reduction is very easily performed by making extension, and then bending the fore-arm, while the surgeon, embracing the elbow with his hands, so that the fingers rest on the olecranon, and the thumbs on the extremity of the humerus, pushes the displaced bones into their proper position.

The radius is liable to be dislocated separately, and may be driven either forwards or backwards. In the latter case, the displacement is so obvious from the tumour which is caused by the head of the bone, that it can hardly be overlooked; but in the former, which is the more common of the two, the nature of the accident is very apt to escape detection until it is too late to afford relief.

The symptoms are pain and swelling about the elbow, which is half-bent, and allows a slight degree of flexion and extension; any attempt to increase the former being attended with a sudden snap or catch, owing to the head of the radius, which lies over the coronoid process of the ulna, striking against the humerus. I have seen in one case the flexion continue quite free. The form of the fore-arm is altered, being round, instead of flat from side to side. When the hand is rotated, the radius is felt rolling under the origin of the flexor muscles, and a cavity is perceived where its head ought to be. Both forms of this accident result either from direct violence sustained on the elbow, or from falls on the hand. The reduction is very easy if performed early, and requires merely that the hand should be extended while pressure is made on the head of the bone, and the elbow is bent. The extending force is made to act on the hand, in order to concentrate it as much as possible on the radius; since, if acting on the ulna, which has not been displaced, it could not do any good. Lateral dislocations of the elbow are occasionally met with, and when examined early may in

general be easily recognised by the alteration of shape and direction of mobility which attend them. The reduction is effected chiefly by coaptation, and is not difficult, unless the parts concerned have been allowed to become rigid and adherent.

Wrist-joint.—The wrist often appears to be dislocated, owing to the swelling and immobility which it suffers in consequence of external injury, but these symptoms in the great majority of cases are merely the effects of sprains; and real dislocation of the joint is an extremely rare occurrence. It may take place in two directions, forwards and backwards, the bones of the carpus being driven upwards under either the extensors or the flexors. The causes are falls on the hand. The reduction is effected by extending the hand, and pressing on the dislocated bones.

Thumb.—The first or proximal phalanx of the thumb is occasionally dislocated from its connexion with the metacarpal bone, in consequence of falls or blows. It is driven upwards and backwards, where the extremity can be felt distinctly, while that of the metacarpal bone is not less perceptible on the palmar side.

The reduction of this apparently trivial displacement has been generally found very difficult, and sometimes altogether impracticable, the reason of which would seem to be, that the lateral ligaments of the joint remain more or less entire, and being pressed aside by the wedge-shaped extremity of the metacarpal bone in passing between them, afford a serious obstacle to its return. The best mode of proceeding is to extend the thumb with moderate force, and at the same time to exert strong pressure on the extremity of the phalanx in the proper direction for pushing it into its place. The operation, when thus performed, is sometimes executed with great facility. In cases where the difficulty proves insuperable, one of the lateral ligaments may be cut, which would certainly be better than leaving the bone unreduced, as has sometimes been the case. A needle sharp on the edges or a very small knife should be employed for this purpose, so as merely to puncture the skin.

Fingers.—Both the proximal and distal, or first and third phalanges of the fingers, are occasionally dislocated backwards, so that the displaced extremity rests on the dorsal surface of the corresponding bone. The accident can hardly be overlooked or mistaken, and the reduction is generally very easy, provided the force employed be directed chiefly upon the projecting end of the phalanx.

Hip-joint.—The hip-joint, notwithstanding the great strength of

all the parts which enter into its formation, is subject to dislocation in four different directions:—1. Upwards and backwards on the dorsum of the ilium. 2. Backwards into the sacro-ischiatic notch. 3. Downwards into the *foramen ovale.* And 4. Forwards upon the pubis.

In dislocation upon the dorsum of the ilium the limb is shortened from one and a-half to two inches—the affected knee is bent over the sound one—and the foot is turned inwards so that the great toe of it rests on the tarsus of the other. The thigh cannot be moved except slightly inwards—the *trochanter major* is higher up, and nearer the crest of the ilium than usual—and the head of the bone can sometimes be felt rolling under the muscles when the limb is moved.

This accident happens from falls on the side, and the circumstance of having a load on the back promotes the dislocation by increasing the strain. It happens most frequently in males, and is seldom met with either in very young or in very old subjects, being in a great measure confined to those in the vigour of life.

To effect reduction, the patient should be placed on a mattress upon his back. A folded sheet or tablecloth is then to be passed between the thighs, so as to support the perineum, its ends being either held in the hands of assistants standing behind the patient's head as he lies supine, or secured to a ring in the wall. A skein of worsted, or any other suitable lac, is next fastened round the limb immediately above the knee, and committed to assistants, either trusting to their own strength for extending sufficiently, or aided by pulleys, if the case promise to prove difficult. The points of extension and counter-extension having been thus determined, any degree of obliquity that seems requisite may be easily given to the former by turning round the mattress a little, until it appears that the limb is extended exactly in the line which it has assumed from the dislocation. It is usual to rotate the leg, and at the same time use means for drawing the neck of the thigh-bone outwards so as to lift its head over the edge of the acetabulum; but from my own opportunities of observation, I am led to believe that any such interference is quite unnecessary, since the extension, if sufficiently powerful and properly directed, completely attains the object, as the muscles generally pull the head of the bone into its place when it has been carried far enough; but if it should seem that the margin of the acetabulum opposes any resistance to its return, the difficulty may be surmounted by drawing the upper part of the thigh outwards while the knee is still held across the sound one.

The dislocation into the ischiatic notch is produced much in the same way as that on the dorsal surface of the ilium, but does not happen so frequently. The symptoms also are similar, and differ only in being less marked. There is less shortening—less bending of the affected limb over the sound one—less inversion of the toes—and less displacement of the *trochanter major*. In obscure cases a good diagnostic will be afforded by trying to bring the thigh into a straight line with the trunk of the body, which is impossible while the bone is thus displaced. The patient, when lying upon his back, finds it necessary either to arch the loins so that the surgeon may press his hand between them and the bed, or to keep the thigh bent upwards in the pelvis. If the back is straightened the thigh ascends, and if the thigh is laid flat the back becomes arched. The reduction is accomplished in the same way that has just been described, though it has been found to require more force to lift the head of the bone out of its preternatural situation.

The dislocation downwards is caused by heavy bodies falling on the hip, while the limb is in a state of abduction. The symptoms are extremely characteristic, there being elongation to the extent of an inch and a half,—abduction, owing to the stretching which is suffered by the gluteal muscles,—and flexion of the thigh on the pelvis, from the same cause affecting the *iliacus internus* and *psoas magnus*. These symptoms are often simulated to a very perplexing extent by the involuntary obliquity of position which the pelvis acquires from irritation of the hip-joint, occasioned by blows or other kinds of external violence; and inexperienced practitioners are consequently apt to commit the mistake of treating with rough measures a case that requires those of the most soothing sort. The best guide in avoiding this too common error is afforded by the *trochanter major*, which, when dislocation really exists, will be found by measurement to be more distant from the anterior spinous process of the ilium than its fellow is on the other side. The reduction is accomplished by extending and counter-extending the thigh and pelvis transversely, while the foot of the affected limb is carried inwards under the sound one.

The dislocation forwards on the pubis is caused by the body being suddenly bent backwards, while the foot is fixed and the limb is kept straight by the strong involuntary action of its extensor muscles. The symptoms are slight shortening, eversion of the toes, and the head of the bone being felt distinctly rolling under the integuments of the groin. The reduction is performed by extending

downwards and backwards, while the patient lies on his sound side, and then drawing the upper part of the thigh outwards, so as to lift the head of the femur over the acetabulum.

It has often been a question at how great a length of time after the dislocation reduction may be effected. I have succeeded at the end of seven and nine weeks; but, in using force at a more distant period, should have little hope of success, and some fear of doing harm, by deranging the process by which the displaced bone becomes accommodated to its new position.

Knee-joint.—The patella may be dislocated laterally by direct violence, and this accident is most apt to happen when the parts concerned are in the relaxed state, which results from sudden removal of a dropsical effusion into the joint. The dislocation is very readily recognised, and admits of easy remedy, by bending the thigh upon the pelvis while the knee is straight, so as to relax the extensor muscles completely, and then pressing the patella into its proper place.

The tibia and fibula are so strongly connected with the femur, that they very seldom suffer dislocation. In consequence of a violent wrench to one side, there is sometimes a laceration of one or other of the lateral ligaments, and a partial displacement of the articulating surfaces of the tibia. In the rare cases of its complete dislocation, it has generally been found behind the femur; but according to Sir A. Cooper, it may also be driven forwards. The accident is very readily recognised, owing to the great size of the articulating surfaces, and the thinness of their surrounding parts. The reduction, which is not difficult, requires extension and counter-extension, accompanied with pressure on the dislocated bone.

It is thought that the semilunar cartilages are subject to displacement, since persons of relaxed frame sometimes complain of pain and stiffness in moving the knee, which are felt suddenly, and disappear no less so when the joint is forcibly bent and extended.

Ankle-joint.—Though the ankle is frequently dislocated as a consequence of fracture through either malleolus, as has been noticed under the proper head, yet dislocation happens so rarely by itself, that it is hardly necessary to mention the possibility of its occurrence. This dislocation can be only backwards or forwards, and is reduced chiefly by coaptation.

Astragalus.—When a person falls from a height on his heel, the violence thus sustained not being diffused over a number of articu-

lations, as when he alights on his toes, is transmitted to the astragalus with such intensity, as sometimes to eject it from its place, turn it upside down, and make it protrude under the integuments of the instep, or force its way through them. This dislocation does not admit of reduction, and the bone, when so displaced, must be removed. If an opening has not been caused by the accident in the first instance, one ought to be made without delay, in order to anticipate and prevent the violent inflammation that will otherwise occur, as the precursor of ulceration or sloughing, by which the loose astragalus must make its escape.

Lower-jaw.—The lower-jaw cannot be dislocated so long as the mouth is closed, since the condyles are then firmly secured in the glenoid cavities. But when it is opened so as to bring them forwards on the anterior convex part of the articular surfaces, they may be readily displaced by a lateral impulse, or even by excessive action of the muscles. One or both of the condyles then glide forwards over the root of the zygomatic process; and sinking into the hollow on the opposite side, retain the jaw fixed in a state of expansion.

The reduction of this dislocation is extremely easy, since, if a fulcrum be placed at the back part of the grinding surface, the anterior portion of the jaw affords a powerful lever for replacing the deranged condyle or condyles. The best fulcrum for this purpose consists of one or both thumbs, accordingly as the dislocation is single or double, protected from the action of the teeth by being wrapped in the corners of a handkerchief or towel. After the reduction, the patient ought for some time to avoid opening his mouth wide, and exposing his jaw to the circumstances which favour a recurrence of the accident, as a considerable predisposition to it remains.

Clavicle.—The sternal extremity of the clavicle is sometimes dislocated forwards, in consequence of falls on the shoulder and arm. The displacement is readily recognised by the swelling arising from the projecting end of the bone and superjacent portion of the sterno-mastoid muscle, and by the mobility of the clavicle and depression of the shoulder that proceed from it. The dislocation is readily reduced by elevating the shoulder, and pressing down the sternal extremity of the clavicle, but returns so soon as the restraint which produces these effects is removed. A bandage, therefore, sufficient to retain the bone permanently in its proper position, should be applied; and the apparatus best calculated for doing this, consists of a sling to support the arm, together with a compress

placed on the end of the clavicle, and secured by means of a figure of 8 bandage.

The acromial extremity of the clavicle is also occasionally dislocated; but this accident requires no particular consideration, as its causes, symptoms, and treatment are the same as those of fracture of the acromion, or acromial extremity of the clavicle.

Vertebræ.—The vertebræ are very seldom dislocated without fracture or morbid alteration of the bones; and in all cases the accident is of importance chiefly in respect of the organs contained within the vertebral column, along with which, therefore, it may be more properly considered.

Wounds of the Joints, and Compound Dislocations.

The synovial membrane is very prone to acute inflammation, which causes violent constitutional disturbance, and leads to the most destructive morbid alterations. Wounds of the joints, therefore, must always be regarded as serious injuries; and the more so in proportion to the size of the joint, and degree of irritation which accompanies the wound.

The great object in treating such wounds should be to make them heal if possible by the first intention, which, of course, prevents the necessity of inflammation as the precursor of granulating action. With this view, all sources of irritation, whether direct or indirect, that may seem to exist, ought to be removed. If there is displacement of the articulating surfaces, they ought to be accurately reduced, which is generally effected with ease, owing to the laceration of the surrounding parts; and if the head of a bone protrudes so as to resist moderate force employed for this purpose, it must be cut away with the saw or pliers, since the distension that would be caused by its pressure would excite inflammation. The edges of the wound should be placed in contact, and assiduously cooled by wet cloths frequently changed, while motion of the limb is carefully prevented by the application of splints. The constitutional treatment is to be conducted on the same principles. The patient will generally be benefited by bleeding and purging, to lessen his strength of action; but sometimes the opposite means are required to correct the irritability that proceeds from weakness. The diet, in general, should be strictly antiphlogistic; but here also exceptions may require to be made on account of the peculiar circumstances of the case.

When compound dislocations are treated on these principles, the

necessity for amputation, which used formerly to be generally performed as their only remedy, is greatly lessened. The ankle-joint is most subject to the accident, and the formidable appearances which are presented by it seem at first sight to warrant the removal of the limb; but when the projecting extremities of the bones are sawn off, the distortion rectified by suitable splints or bandages, and the edges of the wound placed fairly together, the cure is often accomplished very readily. The elbow and wrist-joints also may in general be preserved, but the knee-joint, when subjected to the great irritation which attends both a dislocation and penetrating wound, can hardly be expected not to inflame, and either prove speedily fatal or require subsequent amputation. Hence in such an injury the limb will generally require to be amputated immediately. Gun-shot wounds of the shoulder and elbow, unless the integuments, blood-vessels, or nerves are much injured, may be remedied by cutting out the articulation, as in cases of caries.

Inflammation of Joints.

Inflammation of the joints is attended with deep-seated pain, greatly aggravated by motion or pressure, swelling, redness, and tenderness of the integuments, and more or less constitutional disturbance, according to the intensity of the local symptoms. It is caused by the direct irritation of wounds, strains, and bruises; and indirectly, by exposure to cold, errors of diet or exercise, and whatever induces derangement of the system. The consequences of inflammation in this situation are numerous and important, as might be expected from the number and nature of the textures which enter into the constitution of the articular apparatus. The synovial membrane becomes the seat of dropsical and purulent effusions, adhesions, thickening, and gelatinous degeneration; the cartilage suffers ulceration and exfoliation; and the bones are liable to suppuration, caries, and anchylosis, or union of their respective surfaces. The consequences of inflammation are serious in proportion to its severity, and the unsoundness of the patient's constitution; but it ought always to be dreaded, and induced, if possible, to terminate in resolution.

When the symptoms are acute, blood should be freely abstracted locally by leeches or cupping; and if there is much strength of action in the system, general bleeding must also be practised. Calomel and opium are very useful where there is much irrita-

bility; and the tartrate of antimony, given in frequently-repeated doses, is on all occasions a most valuable remedy, not only by allaying violent action, but also by promoting the secretions of the skin and mucous membranes. When the inflammation is sub-acute, warm fomentations, anodyne liniments, such as the liniment of soap and opium, with the internal use of diaphoretic medicines, as Dover's Powder, calomel and opium, or *vinum colchici*, afford most relief. In its chronic state, counter-irritation effected by stimulating liniments, blisters, tartrate of antimony, setons, and issues, especially those made by the actual cautery, with perfect rest, and a moderate degree of pressure, are the means which deserve most confidence. In preventing motion, and effecting the compression deemed requisite, the best means certainly consist in the application of leather splints. Pieces of bend-leather, cut to the proper size, having been moistened and placed on each side of the joint, are closely moulded to its form by the pressure of a common roller. When dry and rigid, they are taken off and lined with some thinner and softer leather; after which they are again bandaged on, and employed so long as may be necessary. In cases where the knee is severely affected, it is very important to prevent motion of the ankle-joint also, and for this purpose I find nothing so useful as a splint of iron wire covered with chamois leather.

Dropsy of the Joints.

The synovial membranes of the joints, though all similar to each other, and resembling in structure as well as function the serous coverings of the soft parts, are not equally subject to dropsical effusion. It is extremely common in that of the knee, but very rare in all the others.

Dropsy of the knee-joint is occasioned by a great variety of circumstances. It occurs most frequently in persons of weak and irritable constitutions; who often suffer from it in consequence of very slight direct irritation, such as twists and bruises, or the indirect operation of exposure to cold. It is met with, however, occasionally in the strongest frames; but then the irritation is always direct and severe; such as fracture of the patella or femur, especially in its lower third, or a violent strain. The effusion generally appears almost immediately after the injury is received, and is at first attended with more or less acute symptoms of inflammation. It is readily recognised by the swelling and fluctuation which are caused by its presence. The enlargement reaches

as far up the thigh as the synovial membrane extends, it fluctuates when subjected to pressure, and the patella is felt to float as it were, so that it may be made to strike upon the condyles of the femur if pushed downwards with moderate force.

The means employed for treating this affection must vary with the acuteness of the inflammatory symptoms which attend it. In the first instance, it is often necessary to cup or leech and foment the joint, while constitutional remedies of a co-operative kind are at the same time administered. When the swelling ceases to be painful, but continues still more or less red, tender to pressure, and unable to bear motion, a cooling discutient lotion may be used with advantage. Finally, when there is no longer any indication of excited action, and the only inconvenience that remains is merely that occasioned by the presence of the fluid, the joint should be blistered once or oftener, according to the extent and duration of the disease, and then carefully bandaged. In cases of a rheumatic kind, blisters may be employed at an earlier stage with advantage. For some time after the cure is completed, the patient should wear a laced or elastic knee-cap, to protect the joint from the various external injuries to which it would be exposed in consequence of its weakened state.

Moveable Cartilages in Joints.

Small moveable bodies are occasionally met with in the cavities of the joints, either quite detached or connected with the parietes of the articulation by a narrow neck. They have a glistening pearly lustre, and when divided are found to consist of a gristly substance enclosed in a firm capsule, with a bony nucleus in the centre. They are of various magnitudes, from the size of a barley-corn to that of a pigeon's egg, and are also very different in their shape, which is generally round, oval, or lenticular, but sometimes tuberous. They exist either singly or in numbers together, but seldom exceed two or three. They have been discovered in several of the joints, but are by far most common in the knee. Even here, however, they may be considered a rare occurrence. They generally make their first appearance in adults.

The origin of such bodies has been ascribed to the effusion and organisation of blood and lymph—to the detachment by fracture of a portion of the articular surface—and to the separation of morbid growths from the margin of the cartilages of the joints. The last of these explanations is on the whole the most probable,

as the bodies in question are often observed by the patient to be fixed before they become moveable, and they have been repeatedly found on dissection adhering to the extremities of the bones. It may also be observed, that, so far as can be learned by external examination, they do not suffer any change of shape or size after they are first discovered.

These bodies occasion no inconvenience, except when they happen to be squeezed between the opposite articular surfaces; they then excite a sudden and severe sickening pain, which forces the patient instantly to desist from the exertion in which he was engaged, and frequently makes him fall at once to the ground. In consequence of this irritation, repeated from time to time, the joint becomes the seat of a dropsical effusion, which is sometimes the first symptom of the disease that attracts the patient's attention, as he is apt to account for the pain previously suffered by referring it to rheumatism. Unless proper means are now employed, the use of the limb may be almost completely lost.

The radical cure is easily effected by cutting into the joint, and extracting the cause of irritation. But this very simple operation is attended with considerable risk of exciting such a degree of inflammation, as to endanger not only the patient's limb, but also his life. In order to diminish the danger, as far as possible, the patient should be confined to bed, and restricted to a regulated diet for some days previous to the operation. The cartilage should then be moved into that part of the joint which is most superficial, as over the flat surface of the external condyle in the case of the knee, and held steadily there, while a free decided incision is made down upon it, so as to allow of its escape when urged out by the same pressure that was employed previously to fix it, and render unnecessary any groping with hooks, forceps, &c. which must increase the chance of inflammation. The edges of the wound ought to be placed together, and kept constantly cool with wet cloths; the joint being at the same time protected carefully from motion, and all other kinds of irritation. It occurred to me, and nearly at the same time to a French surgeon, M. Goyrand, that the object of this operation might be attained more safely by merely dislodging the moveable body from the joint by puncturing the skin with a needle or narrow-bladed knife, and opening the synovial membrane by a subcutaneous incision, through which the body could be pushed into the cellular substance. The first case in which I tried this method was attended with a satisfactory result. The patient,

a man about 40, of a very irritable constitution, was admitted into the Infirmary on account of a cartilage in the knee, which completely disabled him for any sort of active employment. Superficial suppuration took place a few days after the dislodgment; and it being necessary to make an opening for the discharge of matter, I took the opportunity of extracting the cartilage. The joint remained free from disturbance. But in subsequent trials it has been found very difficult to effect displacement without a dangerous degree of manipulation; and I have therefore preferred another method, which generally succeeds without exposing the patient to any risk. This is making a free subcutaneous incision through the synovial membrane and cartilage, and applying a blister over the part where it is retained.

Mr Hey of Leeds, as a substitute for excision, which, though performed with every precaution, must always be considered a hazardous proceeding, suggested the application of pressure to the joint, so as to prevent the cartilaginous body from moving about as usual. He has recorded several cases in which this practice proved completely successful, the moveable substances, though they still remain perceptible, ceasing to occasion any inconvenience. The dropsical effusion which attends the disease opposes or altogether prevents effectual compression with this view, and therefore leeching, discutient lotions, or blisters, according to the circumstances of the case, must in the first instance be employed to promote absorption, after which a bandage or laced cap surrounding the joint ought to be constantly worn.

Gelatinous Degeneration of the Synovial Membrane.

The synovial membrane is liable to a process of morbid nutrition, which changes its natural structure into a soft grayish-yellow gelatinous mass, varying in thickness from a line to half an inch or more. This alteration usually occurs in individuals who are disposed to scrofulous action, whence it is generally named the Scrofulous affection of the synovial membrane. Though met with at all periods of life, it most frequently commences in young persons before the age of puberty, and is generally induced by some local cause of irritation, though there are many cases in which its origin seems to be entirely spontaneous.

The first symptoms of the disease that attract attention are swelling and diminished mobility of the joint affected. The swelling is soft, elastic, and colourless, and is diffused over the whole

extent of the synovial membrane which does not cover the articulating cartilages. As the morbid thickening increases, the degree of enlargement and stiffness keeps pace with it, but still the patient hardly complains of pain. If the parts be examined by dissection during this stage, the synovial membrane is found more or less thickened, gelatinous, and vascular; the surrounding cellular substance is greatly thickened and condensed by albuminous effusion into its interstices, and the ligaments do not present an outline so distinct as usual, being matted together with the adjacent tissues. The joint may remain thus altered for months, or even years, without suffering any further change; but the diseased condition at last terminates either in absorption or suppuration. In the former case, the articulation is restored more or less completely to its previous condition, but almost always continues somewhat swelled and stiff; in the latter, openings into the joint are formed for the discharge of matter, the articular cartilages exfoliate or are absorbed, the cancellated structure of the bones is exposed, and the patient, if not relieved, either dies hectic, or recovers with a limb rigid and shrivelled. Instead of the joint, there is then either a perfectly unyielding union by osseous matter, which is named Anchylosis, or a firm fibrous bond of connexion, constituting what is called false Anchylosis.

The treatment of the disease in its first stage ought to be directed with the view of preventing inflammation, inducing it to terminate in resolution if actually existing, and promoting absorption of the morbid structure. In attaining the first of these objects, it is necessary to protect the joint concerned from all irritations, both direct and indirect. Not only strains, blows, and violent exercise should be avoided, but also motion of any kind or degree; to prevent which the more effectually, splints of leather may be advantageously employed, the limb being fixed in that position which will render it most useful to the patient after the cure is completed. The various actions of the system should be supported by a moderate allowance of nourishing food—by exercise of such kind as will not derange the affected limb—and by medicine when it is found necessary. Should inflammation be unfortunately excited, leeches, cupping, fomentations, and general remedies, if the severity of the symptoms seem to require them, must be promptly and freely resorted to. But, in promoting absorption, it should be recollected that, as the disease depends upon a disordered state of the system, local remedies can be of very little service. Cod-liver oil,

protection from cold, and freedom from motion, have the most powerful influence, while pressure, ointments of iodine with mercury, and lotions, are of hardly any use. Mr Scott brought the advantages of pressure very prominently forward, and led many people to believe, that in this, as well as some other chronic affection of the joints, it may be deemed an almost certain remedy. Sir B. Brodie seems to have gone into an opposite extreme in regarding the disease as incurable, and all the remedial measures proposed for its removal as at best only palliative. Pressure is apt to occasion pain, and by thus exciting irritation, give rise to inflammation, so as to hasten on the malady to its last stage; it ought, therefore, to be employed with great caution. The best plan of treatment is, after subduing any inflammatory symptoms that happen to exist, to apply pledgets of lint, covered with an ointment composed of camphorated mercurial ointment and hydriodate of potass, and surround the limb and joint with a common roller, applied so firmly as to effect the desired degree of compression. Mr Scott recommended slips of plaster instead of the roller, and changed them not oftener than once in several weeks. But this practice seems objectionable on several grounds, since inflammation may thus be very easily overlooked, and allowed to proceed the length of suppuration before it is discovered; and if things go on well, it is obvious that in a very short time the diminution of the swelling must render the bandage loose and inefficient. The joint should always be restrained from motion by a splint, which may be made of leather or pasteboard, or iron wire, covered with chamois leather. The last mentioned splint, which I have found extremely useful in treating affections of the joints, may be easily constructed by bending a piece of strong wire to the shape of the limb, so as to extend along both sides of it—and then joining as many pieces transversely as seem necessary to give sufficient strength—after which the apparatus merely requires its leather covering, between the layers of which some cotton or other soft substance may be placed.

When suppuration ensues, free vent ought to be afforded to the matter. Stimulating washes should be applied to the sinuses, and moderate pressure still carefully continued, together with, if possible, even more rigid abstinence from motion. If the patient's strength proves inadequate to support the profuse and long-continued discharge which is apt to result, he must be relieved by amputation, or excision of the diseased bone. It might be thought

that the diseased synovial membrane would oppose the completion of a cure, even after the carious bone was eradicated, but experience has proved this to be not the fact; and all trace of the morbid structure in question soon disappears during the suppuration which succeeds the operation.

Ulceration of the Cartilages of the Joints.

The cartilages which cover the surfaces of articulation are often found to be destroyed more or less completely, becoming in some cases merely thinner than usual—in some rough and irregularly abraded—and in others detached from the bone, so as to lie in their natural situation, but nearly or altogether loose. These changes are ascribed to a process of absorption in the cartilages, commencing either on the surface of the synovial membrane which lines them, or in the substance of the cartilage. Ulceration of the cartilages occurs at all ages; but is more common in adults than the disease which originates in thickening of the synovial membrane. It is met with both in persons of scrofulous constitutions, and in those subject to rheumatism, but chiefly in the latter. The exciting causes are irritations of various kinds, both direct and indirect, such as strains, bruises, and exposure to cold. It is indicated by deep-seated gnawing pain, often referred to one particular point of the articulation, aggravated by motion, and felt most severely at night. The patient also generally complains of pain in the joint beyond the one affected, or in more distant parts of the limb, which is usually throughout its whole extent more or less weak, œdematous, and cold. There is little swelling in the first instance, and no great degree of it subsequently, unless thickening of the synovial membrane be associated with abrasion of the cartilages, which is not unfrequently the case. When there is no swelling from this source, the enlargement that does take place is confined to the immediate neighbourhood of the joint, and is of a more firm, unyielding consistence than that accompanying the other disease, as it depends merely on thickening and condensation of the cellular substance.

Ulceration of the cartilages sometimes causes such violent pain and hectic irritation of the system, as to require amputation even while the parts remain in the state that has been described; but, in general, it either goes on to suppuration, or terminates in recovery. When suppuration takes place, the joint passes into nearly the same condition as that which exists in the last stage of the

disease originating in the gelatinous degeneration of the synovial structure, so that it would be difficult to discover from dissection where the morbid changes had commenced; and the case admits of cure only by anchylosis. When the disease terminates favourably before suppuration, some stiffness of the joint almost always remains. It appears that the articulating cartilage is never restored, whether it has been removed by interstitial absorption, or destroyed by ulceration, and that the osseous surfaces deprived of it either unite together by means of a fibrous or bony medium, or become extremely hard and perfectly smooth, so that they seem as if encrusted with porcelain. This Porcelanous alteration of the articular surfaces, as it has been called, is far from rare in its occurrence. The corresponding bones are often grooved and ridged, so as to allow of motion in only one direction, and there is always an effusion of new osseous substance around the margin of the joint, as if an attempt had been made to effect anchylosis. It may be regarded as a substitute for the cartilage in facilitating motion, and is observed occasionally in the new joints resulting from dislocation. If the stiffness depends on true anchylosis or osseous union it does not admit of any remedy, but when the connexion is of a fibrous kind, much may be done to increase the degree of mobility.

In conducting the treatment of this disease, the first object is obviously to protect the joint from all irritations tending to render the morbid action more acute, and hasten it on to suppuration. For this purpose perfect rest, insured by means of splints and bandages, together with strict attention to the various secretions, ought to be particularly insisted upon. The next and not less important object is to subdue the chronic inflammation, or ulcerative action, which is going forwards. With this view all sorts of counter-irritation are in common use, but it appears that the choice of them need not be very extensive, if due regard be paid to their effects. Issues have unquestionably most power in checking the morbid action, but the means by which they are opened is not a matter of indifference. Caustic, moxa, and the actual cautery, may all be employed for the purpose, but the last-mentioned agent is infinitely preferable to the others. It is often thought that the pain which attends the opening of the issue affords all the benefit that is derived from it, and that, therefore, the moxa, which usually produces a superficial effect, should be selected. But it is well ascertained that any considerable amendment can in general be

hardly perceived, until the discharge of the new secreting surface has been fairly established. The ulcers of burns are always very slow in healing, and hence there is an obvious advantage of the cautery over the caustic; but its chief recommendation is the result of experience, and this is so strong as to leave no room for doubt or hesitation in preferring it to the other means. When the cautery is used, an eschar three or four inches long should be formed on each side of the joint. In mild cases, and during convalescence, the forcible aspersion of warm water by pumping, or pouring from a height, is attended with much benefit. To remedy the rigidity that remains after recovery, steaming with the vapour of hot water, frictions with gently stimulating liniments, shampooing, and persevering exercise, are the means that ought to be employed.

Nervous or Hysterical Affections of the Joints.

Young women, particularly those of the higher ranks, are apt to suffer from painful sensations in the joints, which closely simulate the symptoms of articular disease connected with alteration of structure, and consequently are apt to lead to treatment no less unnecessary than injurious. Counter-irritation and confinement in such cases tend to increase the constitutional derangement which gives rise to the complaint, and ought, therefore, to be carefully abstained from, unless it may be thought necessary to make an impression, in the first instance, on the patient's mind by some active measures. In general, the proper course is to pursue an invigorating mode of life by using the shower-bath, taking the preparations of iron, and regularly exercising the limbs as well as the body. The spine, knee, hip, ankle, and wrist joints are the most common seats of this troublesome affection.

In respect to its diagnosis, the absence of swelling, or any other symptom except pain, together with the time of life and general condition of the patient, constitute the best marks of distinction from structural derangements. Sir B. Brodie, to whom the profession are much indebted for the attention which he has directed to this form of nervous disease, considers, as one of the best characters for its recognition, the sensibility of the patient to impressions on the surface of the joint that cannot possibly affect the condition of the articulation, pinching the skin being equally effectual for causing wincing, as moving the limb or pressing the articular surfaces against each other. The whole system is usually observed to be in

a highly sensitive excitable state; but sometimes presents all the characters of perfect health. The uneasy feelings, though frequently remaining months or years, generally commence and disappear suddenly—whence empiricism is afforded a good field, which has been diligently cultivated.

Morbus Coxarius.

The morbus coxarius, or hip-disease, is an affection of the hip-joint, which requires separate consideration, not so much on account of any peculiarity in its nature, as from the frequency of its occurrence and importance of its effects. It prevails in cold moist climates, and attacks chiefly children between the ages of seven and fourteen, though it is not unfrequently met with both before and after this time of life. The first symptom complained of is generally pain of the knee, which often exists for months before attention is directed to the true seat of the disease. Sooner or later the patient is observed to walk awkwardly, and less vigorously than usual; and when the circumstances on which this difference depends are investigated, it appears that the affected limb is elongated and emaciated—that the convexity of the hip is flattened, so that the sulcus between it and the thigh is less distinct and more oblique in its direction—and that in standing, the foot is advanced a little with the toe slightly everted, and that the patient does not rest his weight upon it. Pain is now felt in the hip-joint itself, and though aggravated by motion, often becomes more severe from time to time without any such cause of irritation. It is most apt to do so during the night, particularly when the weather is wet and changeable. In this second stage, the disease remains generally several months. At length the symptoms which have been mentioned either disappear, and the limb recovers its former condition, or they are succeeded by others still more disagreeable. In the latter case the limb becomes considerably shorter than the sound one, its mobility at the same time being much impaired or altogether destroyed, and permanent eversion or inversion taking place. Collections of matter now generally make their appearance, most frequently pointing on the outer side of the thigh below the trochanter major, but occasionally in the groin or hip, and issue externally through openings formed either by ulceration or artificially by the surgeon. The patient then, after a tedious illness, becomes hectic and dies; or recovers with a stiff anchylosed joint and a wasted useless limb.

Such being the insidious and destructive progress of the morbus coxarius, it is evidently of much consequence to ascertain the nature and most efficient treatment of the disease. As opportunities of dissecting the parts in the first and second stages of the morbid process very seldom occur, being confined to those cases in which the patient dies of some other disease, the origin of the evil is still involved in considerable obscurity. Different authorities, accordingly, refer it to thickening of the synovial membrane, ulceration of the cartilages, and inflammation of the bones. But although the second of these opinions is the one generally received in this country, there seems good reason for considering the one last mentioned as nearer the truth. The facts that have been collected by actual examination are in favour of this view, and the symptoms observed externally all lead to the same conclusion. The long existing pain at *distant* parts of the limb, before any trace of disease at the part really affected can be observed, is strongly characteristic of chronic inflammation in the osseous tissue; the freedom of motion without any crepitus, that continues during the second stage, is hardly reconcileable with either ulceration of the cartilage, or thickening of the synovial membrane; and the dissections that have been recorded, in which the bones were found principally affected, afford a strong proof that they are the original seat of the malady. In the third stage there is unfortunately no want of opportunity for investigation by the knife; but then, as always happens in diseases of the joints which have advanced to suppuration, the whole articular apparatus is so involved in the destructive process, that the part primarily affected cannot be recognised. In three cases which I have dissected at the beginning of the third stage—that is, after suppuration, but before the matter was discharged externally—the articular cartilage was sound everywhere, both on the head of the femur and on the acetabulum, except a small portion not so large as a sixpence at the centre of this cavity, where it was removed, and allowed a probe to pass into or rather through the bone. That cases of ulceration of the cartilages of the hip-joint do occasionally occur, there can be no doubt, both from the symptoms and dissections that have been observed; but that these bear a very small proportion to those in which the disease originates in the bone seems no less certain.

The disease may be then regarded as in general consisting primarily and essentially of chronic inflammation in the bones composing the joint, of which the pelvic portion usually suffers more

than the femur; and the means proper for subduing it are consequently those which have been found most efficacious in the treatment of such affections of the articular apparatus. When the symptoms are not severe, as is usually the case in the early stage, perfect rest alone is required, though it may be prudent also to apply occasionally a few leeches to the groin. For preventing motion, nothing answers so well as the long splint, applied in the same way that has been advised for fracture of the neck of the thigh-bone, no extension being effected, but merely complete fixture of the limb in a line with the trunk of the body. But if the pain is severe, so as to disturb the patient's sleep, or continues after the means just mentioned have been employed, which is very seldom the case, recourse must be had to counter-irritation; and though the various methods of effecting it by blisters, setons, caustic issues, and moxa, are all occasionally beneficial, the actual cautery ought always to be preferred as the most powerful means that can be employed. The best place for applying it is the hollow between the trochanter major and the tuberosity of the ischium, where a broad eschar, several inches in length, should be formed. The patient must be kept perfectly quiet during the cure, which generally requires several months. He seldom experiences much benefit until the slough separates, and the ulcerated surface begins to discharge freely. Should there appear any tendency to heal prematurely, it may be easily checked by applying some diluted ointment of cantharides; and if the sore remains open after the diseased action seems to be at an end, some astringent wash, such as the solution of the acetate of lead, should be applied to promote its cicatrisation. When the disease goes on to suppuration in adults, the case may be considered nearly hopeless, as caries then almost always ensues, and being seated in a part where excision cannot be performed, inevitably proves fatal to the patient sooner or later. In children the chance of recovery is much greater, but the limb in this case remains small, rigid, and distorted, the toes being turned sometimes inwards, sometimes outwards. When the head of the femur is little affected, and the ravages of the disease, as usually happens, are chiefly exerted on the acetabulum, the thigh is rotated inwards, and presents nearly the same appearance as that which results from ordinary dislocation on the ilium. But when the head of the bone is destroyed by ulceration or interstitial absorption, the various muscles tending to effect rotation outwards, being no longer opposed by the usual mechanical resistance, draw the limb

into nearly the same position which follows fracture of the neck of the femur, and point the toes outwards.

Excision of the Joints.

It has been explained in regard to the treatment of caries, that the only remedy for this condition is removal of the affected portion of the bone. Amputation has until lately been regarded as almost the only means of relief from carious joints. But it is now fully ascertained, that, on many occasions, the limb may be saved by cutting out the articulation. The softened, discoloured, and ulcerated integuments, the thickened and indurated cellular substance, and the gelatinous synovial membrane, are found to afford no serious obstacle to recovery, provided the whole of the bone, so far as it is actually carious, be taken away. The operation requisite for this purpose, though severe, is not more dangerous than amputation, because the joint, previous to its performance, has been opened by the disease; the whole of the articulating tissues, which are apt to suffer violent inflammation when irritated, are either previously destroyed or removed; the great blood-vessels and nerves are not interfered with; and the patient is not subjected to the shock which is caused by taking away a limb.

As to the joints which may be subjected to this operation, it is evident that the extent to which the acetabulum is almost always affected in the hip-disease forbids any attempt at excision. Though experience has not yet fully decided whether the limbs that might be preserved by cutting out the knee and ankle joints would be preferable to the artificial substitutes which may be worn in their stead, it seems pretty well ascertained that they would not. The wrist also, from the number of bones, and complexity of articulations entering into its formation, together with the numerous tendons, arteries, and nerves passing over it, does not seem to be within reach of the operation. But the elbow and shoulder joints, while their structure and situation are most favourable for excision, hold out the greatest inducements to effect their removal without performing amputation. In all ranks and circumstances of life, the use of the hand is of great consequence; and even although the elbow or shoulder were to remain stiff and motionless, if the hand could be preserved entire and serviceable by excision of these joints, this would be infinitely preferable to taking away the limb. But it has been proved by numerous facts, that while the joints beyond the disease remain as useful as ever, the one which has

undergone the operation may regain such a degree of mobility and subjection to the action of its muscles as to render it hardly distinguishable from a sound one. There is no new joint, strictly speaking, formed, but a strong fibrous substance unites the extremities of the bones, and by its flexibility allows them to move within proper bounds; while the muscles obtain new attachments, so as to perform their usual office.

Shoulder-Joint.—Different methods have been followed in cutting out the shoulder-joint, but it will be sufficient to describe the one which appears to be the most convenient. The surgeon introduces a straight, sharp-pointed knife under the coracoid process, thrusts it down to the head of the humerus, and then cuts perpendicularly, close upon the bone, nearly as far as the attachment of the deltoid. In order to detach the head of the humerus, he introduces the fore-finger of his left hand into the joint, and using it as a guide for the knife, separates the attachments of the muscles, which are inserted into the greater and smaller tuberosities. The arm being then drawn backwards, the head of the bone protrudes through the wound, and being grasped in the hand, may be readily sawn off. The glenoid cavity should next be examined, and taken away as far as seems necessary. The whole of the surface covered with cartilage should always be removed, and in general this will be sufficient; but sometimes the caries extends further into the bone, and in this case must be carefully followed out by the pliers or gouge.

The only artery cut during the operation that in general requires a ligature, is a branch of the Thoracica humeraria. The edges of the wound should be stitched together, and some light dressing having been applied, the arm ought to be supported by a sling.

The patient need not be confined to bed beyond a day or two, or so long as the fever excited by the operation continues; and when the wound begins to heal, he must gently exercise the limb to prevent it from becoming stiff.

The credit of performing this operation for the first time has been ascribed to Mr White of Manchester (1769); but there seems good reason for believing that the case being one of necrosis, not caries, he merely removed part of the exfoliation before it had become detached from the living bone. The patient was a boy 14 years of age, who "had been suddenly seized about a fortnight before with a violent inflammation in his left shoulder, which threatened a mortification, but at last terminated in a large abscess,

which was opened with a lancet a few days before his admission." Through this opening, and another that had formed spontaneously under the acromion process, the *os humeri* could be felt and seen "totally divested of its bursal ligament."

Mr White made an incision from the acromion process half-way down the arm, protruded the head of the bone through the opening thus obtained, and sawed it off. At the end of two months he found that a large piece of the remaining bone had become loose, and easily removed it with a pair of forceps. The patient was perfectly cured at the end of four months from the operation. The arm was then not quite an inch shorter than the other, and he had the perfect use of it. In a work published twenty-five years ago,* I expressed my persuasion that this was not a case of caries, as it had generally been regarded, but one of acute necrosis; and the following very curious companion to it, at a more advanced stage, seems strongly corroborative of that opinion.

Thomas Cairns, aged 13, from Saline, recommended by Mr Craig of Ratho, was admitted into the Infirmary on the 30th of June 1833, on account of a great enlargement of the right shoulder, attended with pain and discharge of matter. It was stated that, ten months before, he had fallen from a wall about four feet high among loose stones, and afterwards had been pretty severely handled by a bone-setter, who alleged that the humerus was broken near the joint. Inflammation and suppuration followed, openings for the discharge of matter took place at various parts, the joint became stiff, and the patient's strength declined. In these circumstances, he was sent to be under my care.

As it was impossible to obtain any satisfactory information in regard to the condition of the joint by introducing a probe, I enlarged the sinus that led most directly towards it sufficiently to admit my finger, with the point of which the bone was felt bare. The firmness of the surrounding parts prevented a more free examination, but the information thus gained, together with the history of the case, convinced me that a portion of the bone was dead, and detached. I therefore extended upwards the incision already made, finding it necessary to use for this purpose both the knife and cutting-pliers, and then ascertained that the exfoliation lay loose in a bony case. Being unwilling to remove any of the new formed osseous substance which was destined to take the place of the old bone, I forcibly dilated the edges of the aperture until

* Treatise on the Excision of Diseased Joints, 1831.

the shell gave way sufficiently to permit extraction of the sequestrum. After the principal portion was removed, some small pieces were found lying in the cavity, which proved to be fragments of the dense plate that had formed the convex surface of the head of the bone. The glenoid cavity of the scapula was divested of cartilage, but covered with a smooth firm velvet-like lining. Recovery was delayed by unhealthy action of the sore, which assumed a phagedenic and afterwards a sloughing character, but was so far completed on the 7th of September that the boy returned home with an arm not perceptibly shortened, and, though still stiff at the shoulder, nearly as useful as ever. I saw the patient, some years afterwards, grown up to be a strong active man.

In 1826, I operated on a shoulder-joint which had been diseased for upwards of seven years, and had reduced the patient, a female between 30 and 40 years of age, to the greatest degree of exhaustion. The head of the humerus was completely excavated and carious, and presented a most favourable opportunity for excision. Recovery was soon completed, and for many years afterwards, until she died of some other complaint, the poor woman was enabled to lead an active industrious life, with the full use of her arm for all ordinary employments. The success of this case rendered me sanguine for the future; but I regret to say that results so satisfactory bear a small proportion to those in which, from extensive affection of the scapula, the operation proves abortive; and wherever there is ground for suspecting the existence of this obstacle, from the situation of sinuses, or the information obtained by probing, amputation ought to be preferred. On the other hand, it should be known that this joint is remarkably distinguished by its liability to suffer from disease in one of the bones composing it, while the other remains free from the same derangement—so that the head of the humerus may suffer from absorption and caries, while the glenoid cavity is no otherwise changed than by the removal of its cartilage. This important peculiarity until lately did not admit of any satisfactory explanation, but has had some light thrown upon it by a case in which I found the coracoid process of the scapula and the head of the humerus suffering from disease while the glenoid cavity was free from it, there being at the same time reason to believe that inordinate contraction of the biceps had been the cause of derangement. As the shoulder-joint is distinguished from all others by its anatomical structure in respect to the long head of the biceps passing through it, the peculiarity of pathological condition in

question may therefore with some reason be attributed to this source.

Elbow-Joint.—The best mode of performing the excision of the elbow-joint is that which was originally contrived and practised by Moreau. The patient should be placed so as to present the posterior surface of the joint. The surgeon, using the same kind of knife which was recommended for the former operation, makes a transverse incision into the joint, close above the olecranon, and extending from the inner edge of this process to the external tuberosity of the humerus. It is necessary in doing this to be careful to avoid the ulnar nerve, which lies close upon the inner side of the olecranon, and the safest plan is to thrust down the knife perpendicularly into the joint, with its back directed towards the nerve. At each extremity of the transverse cut thus made, the surgeon next makes an incision about an inch and a-half long, both upwards and downwards, in the long direction of the limb, so as to form two square flaps, and give the wound the form of the letter H. These flaps being detached from the parts below them, the olecranon may be easily removed by the saw or pliers, after which no difficulty will be experienced in cutting the lateral ligaments of the joint, protruding the extremity of the humerus, and sawing it off through the tuberosities. Lower than this would not be sufficient for removing the whole of the cartilaginous surface, and the caries very rarely extends higher up. The head of the radius may next be cut away with the pliers; and then nothing remains to be done but the separation of the portion of the sigmoid cavity of the ulna that was left after the removal of the olecranon, which may now be readily effected by the saw. It might be thought better to take away all of the ulna that required excision at once, but the attachment of the *brachiæus internus* to the coronoid process renders this very difficult, especially if it is attempted before the free space afforded by the removal of the other bones is obtained.

In determining the extent to which it is necessary to remove the bone, the truly carious part must be carefully distinguished from the rough and thickened state of the neighbouring bone, which depends upon the effusion of new osseous substance in consequence of the disease causing irritation. When we read of the humerus being cut out to the extent of *four inches*, it may be safely concluded that this discrimination has not been duly regarded.

It is seldom necessary to tie any arteries; but if a disposition to bleed should be observed when the operation is finished, the vessels

ought to be sought for and secured, as the hemorrhage when allowed to continue produces very disagreeable effects by distending the wound, separating its edges, and causing great irritation. The wound should be closed with stitches of the interrupted suture, and then a long bandage must be applied in the figure of 8 to support the limb, which should be bent at a right angle, and to prevent the ends of the bones from moving, or pressing injuriously on the soft parts. Rigid cases of iron or wood have been proposed for this purpose, but they are found to be in all respects less convenient than the means just mentioned. The patient after the first two or three days will find himself most comfortable in the erect posture; and when the inflammatory tension consequent upon the operation begins to subside, he should gently but diligently exercise the limb so as to preserve the mobility of the elbow.

The cases admitting this operation are much more frequent than those proper for excision of the shoulder-joint. Having adopted the practice when it was almost entirely neglected in this country, and employed it very extensively as well as successfully, I feel great pleasure in contemplating the benefit that has been derived from its introduction into general use. I have also employed it with great advantage in cases of anchylosis both from disease and injury. In such cases after the flaps are reflected so as to expose the bones, their union should be divided by the saw, after which each of the ends may be readily removed to the extent requisite.

CHAPTER XIII.

MUSCLES.

Injuries of Muscles.

THE muscular tissue is not by any means prone to diseased action, and in general suffers little irritation from the injuries to which it is subjected.

Wounds.—An incision in the long direction of a muscle occasions very little inconvenience, and the wound heals without any remarkable difference from one confined to the integuments. But if the muscular fibres are divided transversely, their contractility causes a separation of the sides of the wound, more or less considerable, according to circumstances. No new muscular substance is ever formed to supply the defect, and it consequently remains permanent, the intermediate space being occupied by a dense fibrous substance. The muscle concerned is for a time rendered weak in action, owing to the relaxation of its fibres; but in general it gradually becomes accommodated to the change, and acts with its former vigour.

In order to prevent this separation of the cut extremities as much as possible, the patient should be made to assume such a position as will most effectually relax the injured muscles. Sutures would have little effect in counteracting the retractile tendency, and it is not thought right to employ them lest they should excite irritation. Punctured wounds of muscles are frequently followed by diffused inflammation and extensive suppuration; but these effects are to be ascribed to the form of the wound, and the thick fascia which it generally penetrates before reaching the muscle. In gunshot wounds, and extensive laceration of the muscular texture, a troublesome degree of swelling is apt to proceed from expansion of the soft or vascular substance concerned, and requires the pressure of carefully applied bandages.

Rupture and Strains of Muscles by their own Action.—The

complete rupture of a muscle by the overaction of its own contractile power is an extremely rare occurrence. Instances of it have, however, been observed in the recti muscles of the abdomen and *rectus femoris*. The symptoms are sudden inability to perform the accustomed motions, and a vacuity perceptible on external examination of the part affected. The treatment consists in approximating the ruptured extremities as much as possible by the position of the patient, and by bandaging. When the parts become consolidated, the usual power is regained.

Partial rupture of muscles from violent exertion is far from being uncommon. The situation in which it occurs most frequently is the calf of the leg, where the *soleus* is apt to have some of its fibres torn during extension of the ankle-joint. This is more apt to happen from an inadvertent than a voluntarily violent exertion, and generally occurs without the patient being aware of making any effort. The symptoms are a sudden sensation similar to that which would be caused by a blow on the injured part, succeeded by severe pain, and inability of using not only the muscle injured, but also those associated with it in action, together with swelling and ecchymosis of the limb. The treatment consists in maintaining perfect rest, using warm fomentations while the pain continues, and then applying moderate pressure by means of a bandage, together with lotions or liniments, such as the solution of acetate of lead with opium, or the tincture of soap and opium. The cure is more or less tedious according to the extent of the injury, and requires from a few days to as many months for its completion.

Strains without rupture are not unfrequently occasioned by violent muscular action. The patient suffers severe pain at the injured part, and is unable to perform almost any motion with the affected muscles. In a day or two the pain subsides; but weeks often elapse before the original strength is regained. This accident is most apt to happen in the loins, where the long muscles of the back are subjected to violent exertion in lifting heavy weights, &c. The treatment requires in the first instance repose, warm fomentations, and sometimes the local abstraction of blood. After the pain has ceased, or has lost its intensity, friction with some stimulating liniment, and the support of a flannel bandage, are the best means that can be employed.

Dislocation of a muscle is met with only in the case of the *latissimus dorsi*, and here very rarely. The portion of this muscle

which lies over the inferior angle of the scapula and braces it to the chest, seems, especially in weak relaxed individuals, so loosely connected with the bone, that a very slight force would be sufficient to cause its displacement downwards. Such a dislocation does accordingly sometimes happen, but so seldom that few practitioners have an opportunity of seeing more than one or two instances of it. The accident is easily recognised by the projection of the lower extremity of the scapula, particularly when the arm is raised or separated from the side. All attempts to replace the muscle in such cases have proved unavailing. And the only remedy that can be advised is a bandage to press down the bone, and promote the formation of new adhesions between it and the muscle.

Derangements in the Nutritive and Functional Actions of Muscles.

It has already been observed, that the muscular tissue is little disposed to morbid action, and though diseases sometimes extend into it from the neighbourhood, there is no part of the body in which alteration of structure so rarely originates. The carcinomatous and medullary sarcomatous degenerations sooner or later engage every structure that lies near the one in which they originate, and the muscles are not spared. Scrofulous tubercles occur in every tissue, but are rarely met with in the substance of muscles. Fibrous tumours have been met with in the muscles, but still more seldom.

Absorption sometimes occurs in muscles so as to occasion an atrophy or wasting of them. This occurrence may be confined to a single muscle or affect a whole group of them. It is generally induced by some irritation, as that of a blow or irritating wound. The pricks sustained in dissecting have led to such consequences. There does not seem to be any efficient means of preventing or removing this morbid action when it has commenced.

The functional action of muscles depends very much upon the nervous system ; and derangement of it is to be regarded, in general, rather as symptomatic of changes in the condition of that important system, than indicative of any alteration in the organs with which it is more immediately connected.

It sometimes happens, however, that inordinate disposition to contract, and also in other cases deficiency of contractile power are met with, when the muscles themselves appear to be the seat and

cause of the disease. One muscle, or a group of muscles, occasionally contracts with unusual energy, and either without any, or with very imperfect intermissions of relaxation. A permanent deformity or unusual position of part of the body is thus caused, which becomes increased in degree from time to time owing to paroxysms of contraction. These paroxysms are extremely variable in their frequency and duration. They often occur without any assignable cause, but are usually induced or aggravated by irritations, whether of body or mind. The muscles affected in course of time enlarge, and project more than is natural; they are also the seat of uneasy sensations, and are painful on pressure. This morbid action of the muscles is most frequently met with in the neck, especially in the sterno-mastoid. It then occasions one kind of wry-neck, the head being turned habitually to the opposite side.

The treatment of this disease consists in removing all sources of irritation, whether direct or indirect, that may be discovered to be in operation. The state of the various secretions ought to be carefully inquired into, and rectified if deranged. If there are symptoms of local irritation, leeches, warm fomentations, and anodyne liniments should be applied over the seat of the disease; and if these means fail, blisters and acupuncturation may be tried.

Single muscles, or groups of muscles, are more frequently met with in the opposite state to that which has just been described, their power of contracting being much diminished or altogether lost. The muscles of the face and fore-arm are most subject to this affection, and they suffer from it variously, both as to degree and extent. At one time it is the flexors alone, at another the extensors, and in some cases both together, which lose the power of action. The cause of this condition is sometimes a blow, when the cure is usually tedious and imperfect. All that can be done is to use fomentations, frictions, and persevering attempts to exercise the muscles. The causes more frequently concerned are exposure to cold and long-continued pressure, and both of these often seem to be conjoined in producing the effect; as the most common history of the disease is, that the patient fell asleep in the open air, or in some unusual situation, and rested his head on one arm. In such cases, the cure is in general readily accomplished by applying a succession of blisters along the course of the affected muscles.

Contraction of Muscles—Club-foot—Wry-neck—Strabismus.

In addition to that temporary or spasmodic contraction which has been already mentioned, the muscles are liable to a permanent shortening of their natural length, necessarily producing deformity, as well as causing inconvenience from restricting motion. Such contractions of the muscles are occasionally congenital, as in the common case of club-foot, which depends not upon any faulty conformation of the bones, but upon a want of due balance in the muscular powers of the limb. In general, the foot is turned inwards (*Varus*); but sometimes, though very rarely, it is found in the opposite direction (*Valgus*). The foot may also be maintained in a state of extension without any lateral inclination (*Pes equinus*); but this condition is hardly met with as a congenital derangement, and usually occurs in childhood, especially during the period of teething, or after an attack of the exanthematous diseases to which that age is liable.

Until recent years, the treatment of club-foot, in all its forms, was limited to the employment of various apparatus with the view of counteracting the muscles by mechanical force, and gradually elongating them so as to remedy the distortion. This process was excessively tedious, expensive, and too frequently, with every care, imperfect in its effect. Hence the number of adults to be seen everywhere, especially in the lower ranks of life, retaining the bones of their limbs in a perverted position, until, becoming altered in their form, they constitute supports for the body of very defective utility, and no less unseemly appearance.

A great improvement has been introduced into practice by surgeons of the present age, particularly Stromeyer and Dieffenbach. It consists in dividing the tendons of the contracted muscles by subcutaneous incision, and thus at once removing the grand obstacle in the way of treatment, which, when this has been done, merely requires such a degree of mechanical support as may compensate for the state of elongation and relaxation in which the ligaments necessarily remain for a time. The sooner the operation for this purpose is performed the better; but it may be undertaken without impropriety so long as the bones have not suffered such an alteration of form as must render them unfit for assuming their natural position. This is more especially the case in simple extension of the foot (*pes equinus*, or pointed toe), which may be remedied in apparently the most confirmed degree, provided the

astragalus is not displaced so very far forwards that it does not admit of being returned into its proper position.

In dividing the tendons, instruments of various shapes and sizes have been employed. The knife should have a very small and narrow blade, with blunt back. An assistant should hold the foot so as to stretch moderately the tendons about to be cut, and then the operator, pinching up the integuments lying over it with the thumb and fore-finger of his left hand, introduces the knife with its flat edge between the skin thus elevated and the tendon. The integuments being now left free, the cutting edge is directed upon the tendon, and by a slight sawing motion, aided with pressure on the back of the blade, readily completes the section. A sudden snap, or absence of previous tension, distinctly denotes when this has been effected. A piece of dry lint is then to be applied on the puncture; and to insure healing of the wound it is prudent to afford the support of a pretty long bandage with the view of preventing motion. At the end of two or three days the foot may be placed in the boot provided for it. The best apparatus of this kind is merely a strong boot made of bend leather—moulded into the requisite form while moist—and may be employed with great advantage as a substitute for the more complicated machines in common use.

As to the selection of tendons for division, the circumstances of the case must of course be the guide. In *varus* the tendo Achillis, *tibialis anticus* or *posticus*, and in *valgus* the *peronei*, are most frequently in fault. But in *talipes* or *pes equinus*, nothing more is required than division of the tendo Achillis. Indeed, favourable cases of the last-mentioned kind are remedied almost at once by this operation, without the assistance of any mechanical means; since the action of standing or walking is of itself sufficient for restoring the limb to its proper shape, so soon as the opposing muscular contraction is removed. In one remarkable case, where both feet were affected, the patient, a young man who was about to sail for Australia, walked without any assistance, before the end of a week after I had divided the tendons.

Wry-Neck.

The sterno-mastoid muscle occasionally becomes contracted, and causes a very awkward distortion, the head being drawn towards the clavicle on the side affected, while the face is turned in the opposite direction; and unless relief be soon afforded, the trunk is

apt to suffer a degree of lateral curvature, from the want of due balance at its upper extremity. Attempts to remedy this deformity, by division of the muscle, were made at an early period; but being effected by free incision of the integuments, proved severe in their execution, and unsatisfactory in their results. In 1831, I thought of performing the operation in the way of subcutaneous incision, by means of a knife so narrow-bladed as merely to puncture the skin. The patient was instantly and completely relieved, without any pain or subsequent inconvenience. It appears that nearly at the same time Dieffenbach had adopted this method, and that ten years earlier it had been practised in one case by the late M. Dupuytren. Every case of wry-neck that has come under my care since the one just mentioned, I have treated in this manner with invariable success. I have seldom found it necessary to divide more than the sternal portion of the muscle, at the distance of an inch above the clavicle. No dressing or indeed after-treatment of any kind is required, since the distorted parts soon regain their natural position.

Strabismus.

Strabismus or squinting has always been known to depend upon unequal action of the recti muscles of the eye-ball, and the idea of affording relief by their division has occasionally presented itself, though not until lately carried into effect. It was only in 1838 that Dieffenbach first performed this operation with success, and since that time it may be said, without exaggeration, to have been repeated in thousands of cases. The procedure being new was eagerly seized upon by the youngest and least experienced members of the profession as an unappropriated territory, which might be made their own through the claim of early possession, and the public made to believe, by newspaper advertisements and the titles of trumpery pamphlets on the subject, that the operation was somehow different in its nature from the ordinary practice of surgery—not requiring for its proper performance the usual qualifications of experience, dexterity, and judgment—and best exercised by persons having no claim to confidence in any other department of the profession. The consequences may be readily anticipated. No discrimination of cases being made, and no difference in the treatment adopted according to the variety of circumstances, while the fundamental doctrine of invariable success opposed that fair statement of the results which might have tended to improvement,

frequent failures, and the loss of not a few eyes, have brought the operation into a considerable degree of discredit. Having had occasion to divide the muscles for squinting very extensively in that class of patients which permitted me to watch the progress and ascertain the final issue of the treatment, I feel entitled to express a highly favourable opinion of the operation, provided it be conducted on proper principles; and these I will now endeavour to explain.

Strabismus is not a congenital derangement, as used to be thought, but commences during infancy or the early years of childhood. It frequently seems to be connected with some of the febrile affections incident to this age; and though often met with in several members of the same family, cannot justly be attributed to imitation. The obliquity is for the most part confined to one eye, and when both are affected, they suffer alternately. In a very large proportion of cases the eyeball is turned inwards to the nose, so that the leer or outward squint is not seen, I should say, more than once in fifty cases. Squinting is not only unseemly in appearance, but usually attended with more or less deficiency in the power of vision,—the patient being seldom able to read or distinguish any minute objects with the affected eye. This was formerly thought to cause the complaint, but is now ascertained to be its effect, and to depend merely upon the inability of attending to the different impressions made on the eyes at the same time, so that one of them being habitually disregarded, the organ ceases to be serviceable. A lady who squinted inwards with both eyes alternately found that she saw distant objects best with one, and near ones with the other. A gentleman who squinted outwards with both eyes alternately complained that, in driving, he felt great difficulty in avoiding obstacles from inability to judge accurately of distances. If the eyes are restored to their proper directions at an early age, the vision of both usually becomes perfect, but in elderly persons there is seldom more than a partial improvement.

The internal or external *recti* muscles occasion the obliquity, but do not effect this, as in the case of club-foot or wry-neck, by permanent contraction. The patient can usually render the eye straight by a voluntary effort, and whenever the sound one is closed, the other ceases to squint; but, if the eyelids are then suddenly opened, the eye, however straight it may ordinarily be, is found completely inverted or everted, just as the squinting one was previously. From this very curious fact it would appear that the

complaint depends upon an alteration, not in the texture or length of the muscle, but in its disposition to contract, or rather in the disposition to contract possessed by the two corresponding muscles, and consequently, that if advantage is to be derived from division of the *rectus*, the muscle of either the straight or the squinting eye may be subjected to the operation. Another inference of practical value is, that in cases where complete relief has not been afforded by cutting the rectus of the squinting eye, the corresponding muscle of the other eye may be divided with advantage. In confirmation of the derangement depending rather upon functional than organic alteration, it may be added, that most persons labouring under the complaint remark that it varies in degree with a variety of circumstances, but especially disturbance of the digestive organs. *A priori*, therefore, it might have been expected that division of the *recti* would not afford complete, or, at all events, permanent relief, since, if the tendency to contraction remained, it would reinduce obliquity so soon as the muscle acquired new attachments to the sclerotic, just as has been ascertained to happen in the spasmodic form of wry-neck. Experience, however, having happily ascertained that the operation does in general prove effectual, the theoretical objection must not stand in the way of its employment; but may account for the failures as well as relapses occasionally met with, and afford encouragement to repeat the division when it does not give all the relief desired at once.

The operation essentially requires an opening of the conjunctiva sufficiently extensive to expose the insertion of the rectus in fault, and a complete division of the muscle at this part. Various methods have been recommended for effecting this, by the use of hooks for catching the muscle as it lies in the loose texture of the orbit; but the procedure consisting in a simple secure dissection of the part, without any hap-hazard diving, has always seemed to me greatly preferable to any such uncertain and dangerous artifices. I have always, with the exception of some experimental trials in the early part of my experience, performed the operation in this way, with some little modification, and will now describe the mode of conducting it.

There should be two assistants—one to elevate the upper eyelid, by means of a speculum, and keep the eyeball everted by a small double pointed hook, and the other to depress the lower lid, and hold a sponge. The first step is to insert the speculum under the edge of the upper eyelid, and confide it to the assistant, then to do

the same with the lower one; next to fix the hook through the conjunctiva into the substance of the sclerotic, about midway between the margin of the cornea and the *caruncula lacrymalis*, and, pulling the ball steadily so as to evert it completely, to place the hook in the principal assistant's unoccupied hand. Lastly, to raise a fold of the conjunctiva by means of the forceps applied close to the caruncle, and with the scissors cut it in a vertical direction to the extent of about half an inch in the middle line between the forceps and hook. The attachment of the muscle, being then distinctly exposed, is divided by successively cutting with the scissors portions of it raised by the forceps, just as in dissecting this part in a dead body. The after-treatment requires no particular attention beyond a moderately abstemious regimen,—avoiding bright light,—exercising the eyes equally,—and not employing them in reading or any minute work. At the end of ten days or a fortnight, if any obliquity is found to remain, or to have returned, it will be a question, whether the rectus of the other eye should be divided, or the muscle already operated on should be cut a second time. In deciding as to this, I think the best guide is the effect produced by closing the sound eye. If it is found to be altered in its position by doing so, and to present obliquity when suddenly exposed by opening the eyelids, the rectus concerned in producing this effect may properly be divided. But if it remains straight, the operation should be repeated on the squinting eye, in the hope that the antagonist muscle, being afforded a second opportunity of contracting, will do so more effectually than on the first occasion. In the course of two or three weeks after the operation, a warty-looking excrescence frequently grows from the seat of the wound, and requires to be cut away by dividing its neck, which is small and almost thread-like, with a pair of curved scissors; or, to render this unnecessary, the nitrate of silver may be applied occasionally until the conjunctiva is completely healed. If left to itself, the growth, after gradually indurating, ultimately drops off from atrophy of the nutrient vessels.

CHAPTER XIV.

TENDONS.

Injuries of the Tendons.

Wounds.—TENDONS are sometimes divided by cutting-instruments, the immediate consequence of which is loss of power of the muscles concerned. It was formerly the custom to sew the cut surfaces of the tendon together; but this practice is now abandoned, and the only means employed in addition to those which the wound of the integuments requires, consist in careful attention to the position of the limb, in order to relax the muscle connected with the injured tendon, and prevent as much as possible the separation of its extremities. When the tendon is of a large size, such as the *tendo Achillis*, lateral compresses are useful in keeping the surfaces opposed to each other. It is ascertained that though the extremities remain considerably distant, they are still united together through the medium of a new formed substance, the result of an interstitial process of reproduction. This part is sometimes thinner, sometimes thicker than the original tendon, but always inconvenient by causing relaxation of the muscle, and consequent diminution in the effect of its contractile power. The surgeon, therefore, should do everything in his power to render the bond of union as narrow as possible. In cases where the wound has been allowed to heal, with such separation of the extremities of the tendon as renders the patient lame, it may be warrantable to cut out the intermediate substance, and sew the ends of the tendon together, as I once did with success in a case where the *tendo Achillis* had been divided and allowed to heal with great retraction.*

Rupture.—Tendons may be torn either by external violence, or by inordinate contraction of their own muscles. In the former case, they are most apt to give way where the muscular fibres are attached to them, and it not unfrequently happens that the tendons

* Ed. Med. and Surg. Journal. Report of Surgical Cases, 1835.

of the penniform muscles of the fingers or wrist are drawn out to the extent of five or six inches. It might be expected that great irritation and diffused inflammation would result from such injuries; but the wound in general heals kindly, as if not complicated with any unusual peculiarity. It is a prudent precaution, however, to oppose the commencement of inflammation by using cold applications in the first instance; and if it should occur, incisions, together with warm fomentations, if the symptoms are violent, and the latter means alone if they are moderate, will be proper. When suppuration is established, compression along the course of the sinus, stimulating washes, and bandaging are required.

Tendons are more frequently ruptured by the too energetic action of their muscles. The tendo Achillis is most liable to this accident, and, indeed, with the exception of the tendon of the extensors of the thigh, is almost the only one in which it occurs. It has been supposed that the thread-like tendon of the plantaris may be ruptured without a corresponding injury of the great tendon of the ankle, and that such is the case where patients suddenly after exertion lose the power of extending the foot, while no vacuity can be felt in the course of the tendo Achillis. But there can be little doubt that on such occasions the injury sustained is rupture of the muscular fibres, probably of the soleus. It is difficult to conceive that the loss of so small a power as that of the plantaris muscle should render the patient unable to move the ankle; and the pain, discoloration, and tedious recovery which are usually observed to attend cases of the kind in question, are additional grounds for believing that the injury is seated in the muscular tissue.

The *tendo Achillis* is usually ruptured in consequence of some sudden exertion in raising the body, or preventing it from falling. The patient feels a sensation as if struck with a blunt weapon. It seems to him that his heel has sunk into a hole, and a noise as of a cord giving way is occasionally heard, both by him and the bystanders. When the limb is examined, a hollow may be felt at the part where the tendon is torn, owing to the retraction of its extremities. The patient, by means of the deep-seated extensors of the ankle, retains the power of extending the foot slightly when there is no resistance except its own weight, but cannot do so with any considerable force, such as is required in walking. Strong adult males are most subject to this accident.

The treatment consists in bending the knee, and extending the

ankle so as to relax the gastrocnemius as much as possible, applying lateral compresses at the injured part to keep the ends of the tendon in proper position, and supporting the limb with a bandage. Various contrivances have been employed to maintain the requisite posture. Of these the slipper and calf-piece of Monro I. may be first mentioned.

The calf-piece Dr Monro compares to the article of dress which jockeys wear to connect their breeches and boots, differing only in so far that it is made to lace on, instead of being buttoned. By means of a strap and buckle, the heel of the slipper can be drawn up to this bandage and secured, so as to effect permanent extension of the ankle. Petit used a similar apparatus, with this difference, that the strap coming from the heel of the slipper was fastened to a collar surrounding the thigh above the knee, which had the advantage of keeping the knee bent, as well as the foot extended. This seems, on the whole, to be the best method, and an apparatus sufficiently effective for the purpose may be readily constructed extemporaneously, or a splint may be applied on the front of the ankle to keep the foot in an extended position. Compresses of lint should be placed on each side of the tendon at the ruptured part. In the course of three or four weeks the reunion is completed; but it does not become strong enough to resist much force until a considerably longer period has elapsed, during which the patient should be cautious in using the limb, and, as a precaution against straining the tendon, wear a high-heeled shoe.

Inflammation and Sloughing of Tendons.

The tendons, their fibrous sheaths, and also the fasciæ which lie over them, are very readily deprived of vitality by inflammation. This occurrence most frequently happens in the fingers and palm of the hand in what is called Paronychia or Whitlow. By this term is understood an intense inflammation, generally confined to one finger, but sometimes affecting several, and extending into the palm of the hand, to which also it is occasionally limited. Though the swelling is generally on both sides, the principal seat of disease is almost always confined to the palmar aspect. The pain is agonising, the tension great, and the redness of the skin affected very bright. The inflammation extends to various depths, and leads to consequences of corresponding importance. Sometimes there is merely a collection of matter found under the thick skin of the part affected. More frequently, in addition to this,

there is more or less sloughing of the tendinous structure, and not rarely death of the phalanges. The causes of paronychia are generally local irritations, but it is probably necessary that their effect should be favoured by a state of the system predisposing to derangement. The only effectual treatment consists in making a free incision through the tense and swollen parts. There is reason to believe, that if this were done soon enough it would generally prevent the subsequent suppuration and sloughing; but the opportunity of interposing thus early is seldom afforded, and the incision is usually practised to evacuate matter. Much mischief is often done by continued poulticing in such cases. Under this influence the matter is long of making its escape by ulcerative absorption, and the opening, when at last formed, is always too small for allowing free exit either to it or the tendinous sloughs. The irritation, therefore, is kept up, especially by the retained sloughs of the tendons, and the destruction of the tissues proceeds. There is no advantage in poulticing previous to incision, and though useful for a day or two afterwards in promoting the separation of the matter and sloughs, it ought not to be persisted in longer than this, as lotions with pressure are much more beneficial. When the tendons slough so extensively as to render the finger rigid and useless, amputation is the most prudent course; and the patient will generally decide upon it after being made fully acquainted with the reasons for its performance. The distal phalanx often dies, along with a portion of the tendon, but the extremity of the finger ought not to be removed on this account, as it is of great consequence to preserve the secreting organ of the nail, which renders the finger, though shortened, little less useful, or seemly than it was before.

Ganglion.

By Ganglion is understood a tumour connected with a tendon, composed of a bag containing a glairy fluid, and varying in size from that of a pea to that of a pigeon's egg. There is a difference of opinion as to the nature of ganglions, the question being whether they are entirely new formations, or merely developments of the natural serous structure connected with the tendons. Though arguments might be adduced to support the former of these opinions, it seems on the whole more reasonable to adopt the latter.

The bags vary greatly in thickness, and their contents are no

less dissimilar in respect of consistence, being sometimes perfectly watery, but in general glairy, like the white of eggs. The disease occurs most frequently at the wrist and ankle, the extensor tendons of the fingers and toes being affected. Females are more liable to it than males. It seldom produces inconvenience, except from the deformity which it occasions, but sometimes the patient complains of weakness in the limb. It is generally referred to over-exertion, but there is nothing certainly known as to the causes of its production.

The most simple and effectual mode of treatment is to rupture the bag by pressure applied externally, and force its contents into the surrounding cellular texture. For this purpose some recommend that the ganglion should be struck a smart blow with a book or similar body ; but this is a violent and uncertain method, and it is much better to exert a steady pressure on the tumour by means of both thumbs acting in concert. To promote absorption, a compress and bandage should be applied for some days after the operation. If it should be found impossible to rupture the bag, owing to its strength, the best plan is to introduce a narrow sharp-edged instrument through the skin, and open the sac, after which its contents may be squeezed into the cellular substance, or discharged externally. The instrument used for this purpose may be a common surgical needle, or a small tenotomy knife. To make the effect more certain, a blister ought to be applied immediately after the contents of the bag have been evacuated. Such being the different methods of treatment which will be found most effectual and sufficient for the remedy of the disease in all its forms, it would be useless to detail the other measures which have been recommended, and are still occasionally employed. Of these, continued pressure, effected by means of a piece of money or similar solid compress fastened over the swelling, repeated blistering, inunction of tartrate of antimony ointment, seton, incision, and excision, are the most deserving of notice, but, for the reason mentioned, need not be more particularly considered.

Bursæ Mucosæ.

The *Bursæ Mucosæ*, like other serous structures, are subject to dropsical effusion. The exciting cause is usually some local irritation ; and when of an indirect kind, such as cold, its effect in producing the disease seems in general referable to a predisposition of the system, depending on weakness or some peculiarity of constitu-

tion. If the membrane is merely distended, and has not suffered any thickening or alteration of structure, blistering, succeeded by pressure, may induce absorption of the fluid. If the sac is thick and indurated, these means often prove insufficient, and it is found necessary to puncture the swelling, so as to let its contents escape, after which, a blister having been applied, and followed by pressure, the radical cure is accomplished. Sometimes, along with the fluid, the sac contains a number of loose bodies, appearing to consist merely of indurated lymph. They are of a yellow or brownish colour, tough consistence, and variable size, from that of a millet-seed to that of a field bean. It is obviously necessary that, in such cases, the puncture must be large enough to let the bodies escape, after which the treatment ought to be conducted on the principles already explained. The lymph which is effused from the inner surface of the bursa sometimes becomes organised in the form of thick bands stretching across the cavity. In such cases, after the means for producing absorption have been tried and failed, the disease must be removed by the knife.

Bursæ, whether in a sound state or one of chronic disease, are subject to acute inflammation in consequence of local irritation, especially that of bruises. The symptoms are severe pain, aggravated by pressure or motion, bright redness of the superjacent skin, and more or less swelling. The inflammation usually terminates either in resolution or effusion of lymph or serum, but sometimes goes on to suppuration. The surrounding cellular substance then also becomes inflamed, and a diffused abscess is the result. Leeches, warm fomentations, and lotions of acetate of lead with opium, are the best means for subduing the inflammatory action, but when matter is formed, a free incision should be made without delay. After the suppuration of a bursa a troublesome sinus may remain, and harass the patient by frequent exacerbation of the symptoms. Free dilatation is for the most part sufficient in such cases; but should it not prove to be so, the surface of the cavity must be touched with caustic.

The particular bursæ, which most frequently suffer the different diseased conditions that have been described, are those of the flexor tendons of the fingers, and those seated over the olecranon, patella, and ball of the great toe. In the first of these situations, the bursal sheaths, which accompany the flexor tendons of the fingers from the fore-arm into the hand, are liable to thickening of their texture, with distension, from effusion of fluid and the formation of

moveable bodies, apparently composed of indurated lymph; the wrist and palm of the hand become greatly distended, and the patient loses the use of the limb until the disease is remedied. Although this condition does not materially differ from that of other bursal sacs, which, when so deranged, yield without much difficulty to remedial treatment, it has proved peculiarly obstinate under the means of remedy formerly in use, and indeed was regarded as nearly, if not altogether, incurable. Blisters, and similar applications, produced little or no beneficial effect, and puncturing the tumour where most prominent in the wrist or palm afforded no permanent advantage, as the wound either continued to discharge, or closed without obliteration of the cavity. The last patient treated thus in the Royal Infirmary died from the protracted local and constitutional disturbance so excited; and this case led me to reflect seriously on the subject, in order to discover the cause of obstinacy, and devise a safer remedy.

The only peculiarity that I could notice was the constriction caused by the annular ligament, above or below which the opening had always been made, and which might perhaps so interfere with the healing process as to occasion the obstinacy in question. In this view of the matter, it appeared that the proper site for an incision was at and through the ligamentous arch itself. I took the earliest opportunity of trying the effect of such a procedure, which was so satisfactory as at once to establish the operation. Its results in my own practice, and that of others, have, so far as I know, been uniformly successful.

The easiest mode of operation is to puncture the swelling a little above or below the annular ligament, then introduce a blunt-pointed curved bistoury under the arch, and, lastly, divide it together with the superjacent integuments. Light and superficial dressing are sufficient in the first instance; and if the swelling does not speedily subside, one or two blisters may be applied.

The superficial bursa lying over the olecranon is subject to irritation and acute inflammation from blows, but not unfrequently suffers an accumulation of fluid with thickening of the membrane, and sometimes also with the formation of internal crossing bands, from organisation of effused lymph. The bursa over the patella is very often distended with fluid, and thickened so as to constitute what is called Ganglion of the Knee. It is met with most frequently in persons whose occupation leads them often to rest their weight upon the knee. The bursa over the ball of the great toe, when

irritated by the pressure of a tight shoe, lays the foundation of that painful and unseemly swelling named Bunion. The parts adjacent become thickened and indurated; the bones of the joint enlarge, and in process of time suffer a sort of subluxation; and the bursa being thus projected more and more against the shoe, is kept in a state of continual excitement. Dropsical effusion, thickening of the membrane, and suppuration with obstinate sinuses may ensue. It is therefore proper, by the timely application of leeches or lotions, and the removal of pressure, to subdue the disease in its infancy.

Though the deep-seated bursæ have long been well known to anatomists, and regarded by surgeons as the seat of morbid derangements, those which lie superficially under the integuments are of comparatively late observation, and the swellings, as well as other local affections which proceed from their diseased condition, have been ascribed to entirely new formations. In club-foot, for instance, the bursal sac, which in some measure protects the *malleolus externus* when the weight of the body rests upon it, is not, as has been alleged, a production entirely the result of circumstances, but merely the development of a structure naturally belonging to this part. The superficial bursæ seated over the joints of the fingers and toes, of which views are given in the work of Schreger,* though almost wholly overlooked, deserve great attention in consideration of the effects which attend their injuries and diseases.

* De Bursis Mucosis Subcutanei, 1825.

CHAPTER XV.

THROAT.

Wounds of the Throat.

When self-destruction is attempted by cutting the throat, the wound is generally inflicted transversely near the *os hyoides*, sometimes above, but more frequently below it. There is usually an extensive division of the integuments, which are occasionally the only parts injured—and when the injury penetrates deeply, it almost always extends into the pharynx. Sometimes an opening is made into the larynx, and in a few rare cases the trachea is cut, either alone or together with the œsophagus. The great blood-vessels are very seldom injured, from the force of the incision being spent in dividing the tough substance of the pharynx and air-passage, from the part of the throat which is chosen for the purpose, and from the position in which it is held, while the knife is applied. When they are opened, it is usually by a sharp-pointed knife being thrust directly down upon them.

In considering the treatment of cut-throat, it is necessary to distinguish between—1. those cases in which an opening is made above the *rima glottidis;* 2. those in which it is below the *rima glottidis*, but does not extend to the œsophagus; and, 3. those in which the œsophagus is wounded.

When the aperture, as usually happens, is above the orifice of the larynx, the dangers to be dreaded, in the first instance, are the entrance of blood into the trachea during respiration, owing to its accumulation in the pharynx, and the escape of food through the wound during deglutition. To obviate the former of these, the cut edges should not be brought together until the bleeding from them has entirely or nearly ceased; and with the same view the patient should be made to lie on his face or side, so as to favour the exit of fluids from the wound. If the injury of the pharynx is not very extensive, it will hardly be requisite to employ any measures

to assist the entrance of the food into the stomach, since the whole of what is attempted to be swallowed will not pass through the breach, and it is not to be desired that the diet should, for some days at least, exceed the limits of extreme moderation. But if the aperture is large, so as to admit one or more fingers, it will be prudent to introduce a tube, such as a flexible catheter, into the œsophagus, to serve as a channel for the conveyance of fluid articles of nourishment, until the wound contracts sufficiently to render this unnecessary. The tube may be passed either by the nose or mouth, and also through the wound. When passed by the nose it may be allowed to remain, and is not liable to displacement; but its introduction is extremely difficult, unless the surgeon takes advantage of the opening into the pharynx to direct the point of the instrument, which otherwise is apt to enter the *rima glottidis*, or engage itself in the lining membrane above the orifice of the œsophagus. When the tube, if judged necessary, has been introduced, and the hemorrhage is suppressed, the edges of the wound should be brought together by stitches, while the head is bent forwards, and retained in this position by a bandage or other means. The tube may be safely allowed to remain for several days; but if retained during the whole period of healing, which may extend over many weeks, the irritation produced by its pressure, though perhaps not much felt by the patient, is apt to occasion ulceration of the mucous membrane, with abscess, or even exfoliation of the cartilages. After the first week, therefore, nourishment should be afforded either by the power of deglutition still possessed, or by the temporary introduction of a tube into the œsophagus through the mouth.

When there is a wound into the air-passage alone, a tube is not required, unless the breach in the larynx or trachea is so large as to make it desirable to prevent the action of swallowing, in order to guard against displacement of the edges of the wound. If the preternatural aperture is allowed to remain open, the *rima glottidis* has a tendency to contract, and even to close altogether. It may be possible, when such obliteration or straitening has occurred, to widen the passage sufficiently for the performance of its office by introducing bougies from below upwards; but such a procedure is extremely difficult and uncertain, and the necessity for having recourse to it should therefore be avoided by carefully promoting early closure of the wound.

In cases where the œsophagus is cut, the patient must be fed

through a tube, unless the opening in the coats of the canal should be so small as to render this unnecessary.

The medical treatment of cut-throat is always extremely important. There is generally great cerebral excitement,—the desire for self-destruction frequently continues in operation,—and the profuse hemorrhage which sometimes happens exposes the patient to the danger of excessive reaction. It should be recollected also, that the irritation of the wound may occasion swelling of the pharynx, and other deep-seated parts of the throat, adverse to free respiration, and may lead to bronchitis, more or less acute. Every source of bodily or mental excitement must therefore be strictly guarded against, while bleeding, counter-irritation, opiates, and antimony, are employed according to circumstances. And whenever it seems, from the efforts of the patient or the sound of his respiration, that the air does not obtain a sufficiently free entrance, an opening into the trachea should be effected without delay.

Tracheotomy and Laryngotomy.

These titles are used to express operations, of which the object is to admit air into the lungs, when the natural passage is obstructed, or to extract foreign bodies that have entered it. The diseases chiefly productive of obstruction are croup, *œdema glottidis*, and ulceration of the larynx. The membranous crust, which is effused in croup, and occasions the diminution of the air-passage, is generally of great extent, stretching from the larynx down the trachea into the bronchial tubes, and is so rarely limited within those bounds below which an aperture can be made, that an operation in this case must be regarded as almost desperate. *Œdema glottidis*, though not a very uncommon affection, has been only recently recognised by pathologists ; but through the striking descriptions of M. Bayle and Mr Lawrence,* together with the frequent notice of it by later writers, is now so well known to the profession, that any account of its symptoms or progress would here be equally unnecessary and out of place. It is sufficient to observe, that in this case the obstruction is nearly or altogether confined to the *rima glottidis*, the lips of which are thickened by infiltration of serous effusion, so as greatly to impede inspiration, though they still allow of expiration being performed with moderate facility ; and that, consequently, there is ample space below

* Med. Chir. Trans., vol. vi., 1815.

for making an opening to admit the air. M. Bayle's judicious observation, however, ought not to be forgotten, that if the operation is delayed until the disease has advanced so far as to occasion repeated threatenings of suffocation, it will hardly prove successful, owing to the excessive secretion of mucus which is induced by the continued irritation and dyspnœa. As soon, therefore, as the nature of the patient's complaint is distinctly ascertained, he ought to be impressed with the propriety and necessity of having the aperture made without loss of time. Ulceration of the larynx does not often impede respiration, though it deprives the patient of his voice, and occasions many other distressing symptoms. But sometimes the breathing in such cases suddenly becomes extremely difficult, and the danger of instant dissolution demands surgical interference, though there may not be the slightest prospect of permanent recovery, or of any advantage more than a few weeks, or even only days, longer existence.

The operation may be performed anywhere between the thyroid cartilage and sternum ; but convenience and safety limit the choice more narrowly. The space between the thyroid and cricoid cartilages, though covered with little besides the integuments, and so far favourable for the purpose, is objectionable in general on the ground of its proximity to the disease, and always on account of the difficulty which has been experienced in obtaining here a sufficiently large aperture without encroaching on the cartilages of the larynx. In opening the trachea near the sternum, the depth of the tube, which retreats backwards as it descends,—the presence of the thyroid veins in the line of incision, or even occasionally of the *thyroidea ima* artery,—and the transverse portion or isthmus of the thyroid gland, which often, especially in females and children, leaves hardly any accessible space below its inferior margin, are obstacles of no inconsiderable importance. The most convenient situation seems to be immediately below the cricoid cartilage. A sufficient portion of the trachea is here often left uncovered, and what more room is required may be gained by turning aside or dividing a little of the glandular substance. The bleeding from it should be allowed to cease before the trachea is opened.

In performing the operation, there are required a scalpel, a couple of hooks, a sponge, and a tube of the flattened conical and slightly curved form, which has been found most convenient for the purpose, and of a size suited to the age of the patient. It is well also to be provided with forceps and ligatures, in case of meeting

with any arteries unusually large or irregularly distributed. The patient should be seated on a chair with his head bent back, and rested on the breast of an assistant. An incision, about an inch and a half long, is made as nearly as possible in the mesial line. The space between the sterno-hyoid muscles is recognised by its white appearance, and opened with the knife. The operator then feels for the lower margin of the cricoid cartilage, or the trachea, and cuts down upon its rings, the surface of which having been exposed, serves as a guide for bringing into view what further space is required for the opening, which should be about half an inch long; and is readily effected by pushing in the knife, while an assistant holds aside the muscles with a hook in each hand. Before wounding the trachea it is proper to wait a little until the arterial bleeding has nearly ceased, or has been suppressed by ligature, should such means be required, which is seldom the case. But as the obstructed respiration, which renders the operation necessary, impedes the venous blood in returning to the heart, the surgeon should not delay opening the trachea on account of dark-coloured bleeding. A violent access of coughing follows the introduction of the tube, which is useful in ejecting the accumulated mucus, and any blood that may have entered; but the patient soon becomes accustomed to the unusual irritation, and respiration is performed without any uneasiness. The viscid tenacious mucus, which is usually secreted very copiously in cases requiring the operation, is apt to obstruct the tube, whence the necessity of employing one at first of a larger size than would be sufficient merely to admit the air, and of clearing it from time to time by means of a probe wrapped round with lint. The tube must be retained in its place by means of tapes passed through rings at its mouth, and tied behind the neck. It should be taken out and washed daily, as long as there continues to be occasion for its use; and it will be prudent to cover the orifice with gauze, to prevent the entrance of injurious matters from without.

Foreign bodies are very seldom admitted through the *rima glottidis;* but as the accident, when it does occur, is attended with very distressing and dangerous consequences, great care ought to be taken lest it be overlooked. When it is learned that the patient, while in his ordinary health, in performing the action of deglutition, or, if a child, in playing with some small foreign body in his mouth, was all at once seized with a violent cough, which has continued to recur in paroxysms with variable intervals, although

no other symptom of local inflammation or constitutional disturbance can be perceived, the presumption will be strong that this accident has happened; and if the sensation of something moving in the trachea should also be felt, there can remain little room for doubting that a foreign substance has entered the air passage. If it is of heavy material, as a piece of money, relief may be obtained by inverting the body. It has also occasionally happened that a violent cough proved the means of cure by ejecting the foreign body through the glottis, but no reliance can be placed on this rare chance; and the danger of suffocation, continued irritation, or suppuration of the lungs, fully warrants recourse to tracheotomy.

When the operation is performed with this view, it should be conducted in the same way that has been described, with the exception that, instead of a tube being introduced into the trachea, the edges of the opening are held asunder by a couple of hooks, until the source of irritation is expelled by the forcible stream of air which it occasions.

Should the bit of bone, pea, nut, or whatever may have entered, not appear at the orifice, a pair of curved forceps may be introduced upwards to search the larynx, and, if necessary, the cricoid cartilage should be divided to afford more room for this purpose. The forceps may also be directed downwards if there is reason to suspect that the foreign body is impacted in one of the bronchi, of which the right one, as being the larger, and more directly in the course of the trachea, will be more likely to contain it.

In cases of urgency, either from the presence of a foreign body, or sudden swelling of the parts concerned, though the proper apparatus for performing tracheotomy cannot be procured, the patient should not be permitted to die of suffocation. A penknife being thrust into the space between the thyroid and cricoid cartilages, as near as possible to the former, and carried down so as to divide the latter, will afford a sufficient aperture, the edges of which may be kept apart by a thin bit of wood, or the expanded branches of a small pair of forceps.

Removal of Foreign Bodies from the Pharynx and Œsophagus.

The detention of matters, in passing from the mouth towards the stomach, is owing either to their size or their figure. If prevented from descending on account of their bulk merely, they are generally arrested at the commencement of the œsophagus, just behind the

cricoid cartilage,—since, this being the narrowest part of the tube, if not impacted more or less firmly into its orifice, they are expelled either upwards or downwards, by the contractile action of the pharynx,—and if fairly introduced into the canal, they have their descent favoured by its increasing width. When, again, the foreign body is small and sharp-pointed, as a pin, needle, or fish-bone, it is usually entangled about the arches of the palate or the neighbourhood of the epiglottis, often stretching across the cavity. And should it be impeded partly by figure, partly by bulk,—in other words, should it be small enough to pass readily into the œsophagus, if not prevented by its rigidity or angular form,—the bottom of the pharynx and commencement of the œsophagus are the situations where it is generally found.

In the case of a tough digestible mass impacted in the œsophagus, the usual method of affording relief is to push it down with a probang—*i.e.* a piece of whalebone with a sponge or ball of ivory fastened to its extremity. The patient's head should be held back, and the whalebone must be slightly curved to assist its taking the proper direction, which is further promoted by holding the larynx forwards. Instead of this method, I prefer extracting the obstructing substance, which may in general be easily effected by means of long curved forceps. If the foreign body is of a hard substance, which might occasion inconvenience if swallowed, and more especially if it possesses an angular form, which might render its more firm lodgment the consequence of force being employed to push it down, the safest course is to induce vomiting, in order to effect ejectment upwards. Where the passage was so completely obstructed as to prevent the swallowing of an emetic for this purpose, a solution of tartrate of antimony has been injected into the veins; but such means are quite unnecessary, as irritation of the fauces by a feather or the point of a finger is sufficient to induce the most violent expulsive efforts, emptying the stomach of its contents, which carry out the foreign body along with them. In removing pins, needles, and such sort of things, the best plan is to ascertain their situation by means of the finger, and then extract them with the curved forceps. Patients frequently apply for assistance days or weeks after swallowing some pointed body, which they believe still remains fixed in the throat. If nothing can be felt with the fingers, it is most probable that the patient's feeling is deceptive, proceeding from imagination alone, or some irritation of the throat, and not dependent upon the actual presence of the

foreign body, which may have descended or been ejected. And even should it be actually detained in the œsophagus, it would be safer to trust its removal to the ulcerative process, which will soon be excited by its pressure on the tissues concerned, than to persevere in fishing for it with any of the ingenious but ineffective contrivances that have been devised for the purpose.

Œsophagotomy.

The object of this operation is, to make an opening into the œsophagus, or lower part of the pharynx, to extract a foreign body that cannot be removed otherwise ; but such a circumstance happens so rarely that there are few instances of a surgeon being called upon in the whole course of his practice to perform the operation.

The patient should be seated or laid reclining, with the head bent backwards, and to the right side. An incision about two inches and a half in length is then to be made in the middle of the triangular hollow at the upper part of the neck, which is bounded below by the sterno-mastoid and sterno-hyoid muscles. It should extend from the upper margin of the thyroid to a little below the cricoid cartilage. The *platysma myoides* and fascia of the neck having been successively divided, the sheath of the vessels will come into view, and the surgeon then making an assistant press the larynx to the right side, dissects inwards to the pharynx, avoiding, if possible, the superior thyroid artery, and tying it if cut, until he feels the foreign body through the coats of the bag, or a curved instrument introduced by the mouth so as to distend them. He finally opens the pharynx, and with his finger, or curved forceps, removes the body of which he is in search.

Stricture of the Œsophagus.

The œsophagus is subject to three different kinds of stricture : one depending on inordinate contraction of the muscular fibres ; a second consisting in a simple constriction and thickening of the mucous membrane ; and a third caused by degeneration of the coats of the tube, which, becoming the seat of a tumour, render the canal narrow and tortuous.

The first, or spasmodic stricture, is met with chiefly in young or middle-aged persons ; particularly those of a nervous habit, or disposed to hysterical complaints, or who have suffered much from mental distress. It is recognised by the difficulty which is experienced in swallowing, and by a disagreeable sensation of constric-

tion in the throat.* The remedy consists in administering antispasmodic medicines, such as the tincture of valerian; correcting any irregularities that may be discovered in the performance of the various secretions; and, if necessary, passing a full-sized bougie into the œsophagus, which sometimes at once completely removes the unpleasant feelings of the patient.

The second, or simple organic stricture, as it may be named, occurs chiefly at the commencement of the œsophagus, opposite the cricoid cartilage; and for the most part in people who have somewhat passed the middle period of life. The contracted part is usually of small extent, seeming as if it were caused by drawing a thread round the tube, and exists in various degrees of width, from that of a small quill upwards. The circumstances which occasion this morbid state have not been well ascertained. When irritating or escharotic fluids, such as the diluted mineral acids, or strong alkaline solutions, are introduced into the œsophagus, the usual consequence, in case the patient survives, is thickening and contraction of its coats. And it may reasonably be imagined that the change in question is produced by similar causes operating on a smaller scale; but the patient can hardly ever refer the origin of his complaint to any particular irritation from stimulating food or other source.

The symptoms of this disease generally manifest themselves very insidiously. The swallowing of large morsels becomes difficult and painful; the food is more carefully masticated than before; and as the contraction increases, while none but very small portions of solid matter can be got down, even they in passing the stricture occasion pain, which is felt shooting into the back of the neck and shoulders. From the frequent recurrence of this distressing sensation, and the dread of exciting it, the patient's countenance acquires a very characteristic expression of anxiety; which, together with the emaciation that results from deficient supply of nourishment, is almost sufficient to betray the nature of the case to an experienced practitioner. It may be added, that the voice is peculiar, sounding as if the person spoke with a foreign body in his throat; that there is no swelling to be perceived by external examination; and that, though there is frequent spitting of saliva, no blood is discharged. But the only method of positively ascer-

* Similar symptoms are sometimes produced by a paralytic state of the muscles of deglutition; in which case, if the patient survives the derangement of the nervous system that primarily occasions this dysphagia, food must be supplied through a tube introduced from time to time into the œsophagus.

taining the existence, seat, and degree of stricture, is to introduce a succession of bougies, gradually decreased in size from that which ought to enter the œsophagus readily, if it were sound, down to that which the constriction is capable of admitting.

The treatment of this kind of stricture has been conducted on two principles:—one of them being to apply caustic, with the view of destroying the thickened or contracted part of the membrane; and the other to produce a gradual dilatation of it by means of bougies. The former of these methods, though supported by the strong recommendation of Sir E. Home and other authorities, labours under the objection of being painful, difficult, and attended with great danger of injury to the neighbouring parts; while the latter is not only in a great measure free from these defects, but proves much more speedy in its operation. The bougies may be constructed either of elastic gum or of steel. If of the second kind, they ought to be a little curved, and have their extremity made slightly bulbous, as this enables the operator to feel more distinctly when it has passed the stricture. The effect of bougies in removing strictures of mucous canals is not, as was formerly supposed, merely mechanical. This no doubt is the first effect; but another very important one follows, which is the action of absorption, induced by the pressure of the instrument. The organisable matter effused into the coats of the gullet, causing their contraction and thickening, is thus gradually removed. But if the bougies be passed with undue force, or too frequently, or be retained too long, the effect, instead of being absorption, is apt to be effusion, the consequence of which is an aggravation of the disease. The bougies, therefore, should be immediately withdrawn after being passed through the stricture; and the operation ought not to be repeated until the irritation of the previous one has entirely subsided, which usually requires an interval of two or three days. Great care must be taken to avoid making a false passage for the instrument, which, if improperly directed, or urged with undue force, may be readily pushed into the posterior mediastinum, or elsewhere through the coats of the canal. In this case the action of deglutition tends to propel foreign matters into the new aperture, instead of the strictured œsophagus, and speedy death is the almost inevitable consequence.

The third kind of stricture, or that which depends on morbid degeneration of the œsophagus, causing a tumour in its coats, and which may be named the malignant or carcinomatous stricture, is

met with chiefly in persons of advanced age. It usually occurs at the ordinary situation of other strictures, that is, behind the cricoid cartilage ; but sometimes takes place lower down, near the cardiac extremity of the tube. The symptoms are those of simple stricture, together with those attendant on morbid formations of the kind in question. The patient feels lancinating pain, more or less constant and severe, in the part affected. A tumour can often be perceived by external examination of the throat. There is occasionally a bloody, foul discharge ; and the patient's countenance acquires that greenish-yellow complexion which characterises a system labouring under malignant disease. As it is evidently impossible to effect excision of the tumour, the disease must be regarded as truly incurable ; and any attempts with caustic, or the simple bougie, instituted either from misapprehension of the nature of the case, or an ill-grounded expectation of promoting absorption of the morbid structure, must prove injurious by increasing the patient's sufferings, and hastening the progress of the disease. This kind of stricture, as well as the one depending on simple contraction, is simulated by malignant disease of the stomach, which therefore requires to be carefully discriminated. This is best done by passing a moderate-sized bougie.

Bronchocele.

By Bronchocele is understood a tumour depending on enlargement of the thyroid gland. The morbid growth is usually most akin to the simple vascular sarcoma ; but sometimes consists, partly or entirely, of cysts, and has also been found to contain calcareous masses bearing some resemblance to bone. The swelling varies in size, from the slightest perceptible degree of fulness, to a magnitude that occupies nearly the whole space between the chin and sternum ; and extends forwards as well as laterally in large round irregular projections. Its consistence is soft and elastic, and a section of it exhibits a yellowish granular structure. The vessels are generally very much enlarged, in proportion to the size of the tumour, whence incisions into its substance during life are attended with profuse hemorrhage. Sometimes the whole gland is equally enlarged, but it generally exceeds on one side ; and occasionally the swelling is entirely limited to the right or left lobe,—particularly the latter. In this case the surgeon must be upon his guard against supposing that the disease is an aneurism of the carotid artery, or an independent tumour admitting of excision, which

opinion he may be led to adopt by the seeming mobility of the growth, owing to the flexibility of its substance. Bronchocele is observed to abound chiefly in certain districts, which are mostly of a mountainous kind, where it is often associated with mental imbecility. The frequency of bronchocele in such regions has not yet been satisfactorily explained. It has been attributed to the use of snow-water, the violent exertions required by the inhabitants in climbing precipitous paths, which, it has been alleged, must expose them to frequent venous congestion, and to the prevalence of a damp atmosphere, in the misty valleys and ravines, which has been supposed likely to promote the growth of glandular swellings. In the countries where the disease is not endemic, it is almost entirely confined to females, generally commencing about middle age, and affecting chiefly the labouring classes.

The symptoms of bronchocele are swelling in the situation of the thyroid gland, which follows the motions of the larynx during deglutition, and cannot be moved without a corresponding displacement of it. There is seldom much obstruction either of breathing or swallowing, owing to the resistance which is made by the cartilaginous structure of the air-passages, and the protection from pressure which the trachea affords to the œsophagus. Headache, however, not unfrequently results from the obstruction which the blood meets with in returning from the head through the jugular veins; and the patient occasionally complains of more or less uneasiness in the tumour itself. But, for the most part, the principal inconvenience sustained depends simply upon the bulk and weight of the enlargement; and after attaining a certain size, it usually ceases to increase.

The deep situation, muscular coverings, firm connexions, and large blood-vessels of bronchocele forbid excision; and the attempts which have been made with this view afford a sufficient warning against their repetition, by the fatal issue that has almost invariably, and often immediately, followed them. The ligature of the superior thyroid arteries, which, though previously proposed by others, was first executed by Sir W. Blizard, does not seem deserving of adoption. The operation has been sometimes found extremely difficult, owing to the displacement and overlapping of the vessels by the tumour—it has even proved fatal, by giving rise to extensive ulceration—it has rarely or never effected an entire removal of the swelling—and has generally induced only a very partial absorption. The plan of passing a seton through the tumour, in

order to excite suppuration, and a consequent diminution of bulk, which was brought into notice by Quadri of Naples (1818), but had been proposed and even practised previously, is easily executed, and seldom leads to any serious bad consequences. Fatal cases, however, have been observed by Chelius and others, in consequence of the centre of the tumour entering into a profuse suppuration, while the rigidity of the parietes prevented their contraction, so as to diminish the size of the cavity; and the good effects of the practice have been at best but of partial extent. Except, therefore, in cases where circumstances render it very desirable to reduce the size of the swelling, there seems to be little encouragement to employ the seton. If it is thought proper to do so, a skein of silk or cotton should be conveyed through the anterior part of the tumour where there is no danger of wounding the large arteries; compresses if necessary are then to be applied over the orifices, and fomentations with poultices must be employed afterwards, if required by the occurrence of inflammatory consequences. When suppuration commences, the seton may be changed, and when the tumour ceases to diminish, it may be withdrawn altogether. Incisions into the tumour, and the application of caustic to it, which act on the same principle as the seton, are less eligible means, inasmuch as they are more severe in their administration, and not so efficient. Mr Liston employed the ligature with success, previously dissecting the integuments of the projecting part of the tumour, and then transfixing its base; and I once adopted this method in the case of a lady who had a lobe of the thyroid enlarged into a round tumour with such a narrow neck as to appear altogether insulated.

With the exception of those cases where some energetic interference is peremptorily required, which are fortunately rare, the best treatment for bronchocele is to blister the surface, and apply ointments, containing iodine alone, or in combination with mercury. Ever since Dr Coindet of Geneva introduced the use of this medicine to promote absorption (1820), it has been very generally employed both internally and externally for this purpose. Along with such external applications the tincture of iodine or the hydriodate of potass may also be given internally. The internal use of burnt sponge, which was formerly considered the grand specific for bronchocele, has gone nearly into disuse since iodine came to be regarded as its active principle in exciting the action of the absorbents. Under this treatment, the tumour generally suffers

some diminution; and occasionally, but unfortunately very rarely, is reduced to the natural size. When the case ceases to improve, or is obstinate from the commencement, the patient should be dissuaded from subjecting himself to any more severe expedients unless his existence should be threatened or rendered seriously uncomfortable by the presence of the swelling. The headache, which occasionally proves a distressing attendant of the disease, is sometimes much alleviated by the application of a few leeches to the temples from time to time.

When the enlargement is found to depend on the presence of a cyst it should be punctured, and injected with tincture of iodine, as in the case of hydrocele.

CHAPTER XVI.

THORAX.

Wounds of the Thorax.

SUPERFICIAL wounds of the thorax which do not penetrate the cavity require merely ordinary treatment. Muscular bruises occur very frequently, and often occasion so much uneasiness in respiration as to simulate inflammation, and induce the practitioner to employ copious and repeated depletion, which can do no good, and may prove very hurtful by inducing the symptoms of excessive reaction. The state of the pulse in such cases, if attended to, will prevent this injudicious practice, instead of which the injured muscles should be restrained from motion by encircling the chest with a broad bandage.

Penetrating wounds are attended with various important effects, the mode of production and treatment of which should be familiar to the practitioner, who on such occasions is called upon to act without delay on the knowledge he happens to possess.

If air be admitted through the aperture, as it must almost necessarily be to more or less extent, the lung of the side affected, unless adherent to the parietes of the cavity, contracts itself, owing to the elasticity of the pulmonary tissue, which is thus placed in equilibrio as to the pressure of the atmosphere. If only a small quantity of air has been allowed to enter before the wound is closed, the contraction of the lung will be proportionally inconsiderable. But if the wound remains open until the contractile tendency of the lung exerts its full effect, respiration, so far as that half of the pulmonary apparatus is concerned, will be completely suspended. The patient then feels great oppression in the chest, his cheeks become purple, owing to the imperfect oxygenation of the blood, his extremities are cold, his pulse frequent, small, and irregular, and, if proper measures are not employed for his relief, death may ensue from congestion of the sound lung, or from the inflammation

which results from this state. In cases of recovery, the wound of the thoracic parietes heals, and then the air which had been admitted into the cavity of the pleura is absorbed, so that the lung is forced to expand, and performs its function as before the injury.

In conducting the treatment of a simple penetrating wound, it should be recollected that the danger consequent upon the injury proceeds from inflammation of the pleura, caused by the wound, or by oppression of the sound lung. The practice thus suggested consists in protecting the patient from all sources of bodily and mental agitation, and diminishing the quantity of blood in the system so as to lighten the labour of the weakened organ. With these views, the thorax should be surrounded with a broad bandage, —the horizontal posture, and strict antiphlogistic regimen, should be enjoined,—and blood should be taken from the arm in quantity proportioned to the strength of the patient, but so largely as to relieve, if not remove altogether, the sense of oppression which is felt about the breast, after which antimonials and opiates must be diligently employed to moderate the force of the circulation, supersede the necessity of further depletion, and lessen the risk of excessive reaction from what has been already employed.

When a wound of the thorax not only penetrates the cavity, but also extends into the substance of the lung, the consequences are still more important, since, in addition to those that occur in the former case, there are the dangers which attend hemorrhage into the cavity of the pleura, and into the bronchial tubes of the sound lung. The injury is generally recognised by bloody expectoration, and a discharge of blood or bloody froth from the wound. But it must be recollected, that, though neither of these indications be observable, a wound of the lung may exist, and even be productive of a copious bleeding into the cavity of the chest.

The same objects of treatment exist here as in the case of a simple penetrating wound, but should lead to a practice still more decided and careful, as the danger must always be regarded as more serious. The circumstance of internal hemorrhage demands additional consideration, and has afforded fruitful subject of discussion in respect to the mode of preventing and remedying it, and also as to the diagnostic marks of its presence. Some recommend the external wound to be closed immediately, in order to retain the blood, and limit the extent of its effusion by effecting pressure on the breach of the lung. It is true that the fluid thus accumulated

may be removed by subsequent absorption, without causing any trouble to the patient, but experience has ascertained, that, instead of this salutary process, the irritation of its presence is more apt to excite a fatal inflammation, and there seems little inducement to incur this risk when the alleged advantage of the practice is fairly weighed. When the lung is wounded it must suffer a complete contraction, since the air, though not allowed to enter by the external wound in sufficient quantity to occupy the space required for its entire collapse, will find a ready entrance from the branches of the trachea which are wounded; and the external surface of the lung being thus maintained permanently in equilibrio with the internal one as to the pressure of the atmosphere, the elasticity of the organ will meet with no obstacle to the exercise of its contractile tendency. The cavity for the reception of the blood must therefore be very capacious; and when the yielding nature of its parietes towards the diaphragm and the other side of the chest is taken into account, it seems difficult to conceive the possibility of making effectual pressure on the cut surface of the lung by retaining the fluid.

For these reasons, it appears to be the more prudent practice to afford free exit to the blood, by keeping the original wound open, or making a new one in a more convenient situation, while by bleeding from the arm, and the other means that promote the cessation of hemorrhage by inducing coagulation in the wounded vessels, the further flow of blood from the lung is restrained.

If the wound of the parietes is small, or near the upper part of the chest, internal hemorrhage may take place to a great extent without any external indication of its existence, especially if, as sometimes, but very rarely, happens, it should proceed from one of the intercostal arteries. Various symptoms of blood accumulating in the chest have been observed and carefully described as affording the means of recognising it. Of these the most important are, coldness of the extremities—clammy perspiration of the face—a purple colour of the cheek on the side affected—inability of lying on the sound side of the body, which is probably the cause of the preceding symptom—extreme oppression of breathing—a small fluttering pulse—suppression of urine—and a want of the usual resonance when the affected side of the chest is subjected to percussion. As all these signs, and also those more questionable ones which have not been thought deserving of mention, whether taken together or separately, must be regarded as insufficient to yield

positive proof on the subject, it is prudent in doubtful cases to open the wound in order to ascertain the truth.

In consequence of wounds and fractures of the thorax, air is frequently injected into the cellular substance under the integuments of the chest, constituting what is called Emphysema, and in other cases it is accumulated within the pleura so as to distend the membrane, and compress the sound lung with distressing or even fatal effect. It is highly important to be acquainted with the circumstances on which these events depend, and the mode of preventing or remedying them.

For the production of emphysema, it is requisite that there should be an aperture in the *pleura costalis*, to admit the air into the cellular substance, and the power which forces it to enter is always the contraction of the parietes of the thorax; but there are two sources from which the air thus impelled may be derived. One of these is a simple penetrating wound of the thoracic parietes, so narrow, or so shaped and situated, as to allow the air to enter the chest during inspiration, but oppose its free exit during expiration, permitting it to pass no further than through the pleura. The second is a wound of the lungs and *pleura costalis*, existing without any outlet through the parietes of the chest, which may be caused by the spicular extremity of a fractured rib, or may result from the healing of the skin, while the breach in the lung and pleura remains open, in a case where both the parietes and lung have been wounded. When the air enters the cellular substance, it diffuses itself more or less extensively, and occasions a flat undefined swelling of the integuments, which is recognised by a crepitating or crackling sensation, that is felt on pressing it, and by the quick disappearance of dimples thus occasioned in its surface. The integuments of the whole body, except where the subjacent connexions of the skin are very firm, as the palms of the hands and soles of the feet, may be distended in this way,—but universal emphysema is an extremely rare occurrence,—its extent being usually limited to the side of the chest which has been injured. The treatment is simple and obvious, consisting in the application of a compress over the wounded part, to oppose the further issue of air from the cavity of the pleura, and, if necessary, in making punctures at different places, to discharge that which is contained in the cellular substance,—but this should not be done unless the swelling is so great as to be productive of much inconvenience, since, if left to itself, it will soon be removed by absorption.

Accumulation and confinement of air in the cavity of the pleura, or *pneumothorax*, as it is called, though less obvious to sight than emphysema, is a more distressing and dangerous occurrence. It gradually distends the membrane in which it is enclosed,—presses upon the pericardium and sound lung,—and may at length occupy so much of the thoracic cavity as not to leave sufficient space for the lung of the sound side to perform its function. In this case, as has been already remarked, the air may either enter by an external wound, which is of such a valvular kind as to allow its getting in when the chest is expanded during inspiration, but prevents its exit when the parietes of the cavity are drawn together during expiration; or may pass into the pleura by a wound of the lung which exists without an external one,—the wound of the lung itself having necessarily a valvular effect, as the soft substance of the pulmonary tissue, though opposing no resistance to the escape of air from the small bronchial tubes, will prevent its return into them by collapsing round their cut orifices, when subjected to pressure during expiration. In either of these circumstances every inspiration will tend to enlarge the quantity of air contained in the pleura, while the succeeding expiration has little or no effect in reducing it. The patient consequently feels great and increasing difficulty of breathing. The inspirations are short, almost instantaneous, and effected with a sort of catch. The expirations are laborious and ineffectual; and there is a distressing sensation of tightness across the breast; the pulse is small and irregular; the countenance is livid; and unless relief be afforded, death ensues. The symptoms of this condition bear considerable resemblance to those of hemorrhage into the pleura,—but the resonance of the chest, which is absent in the latter case, and more than usually distinct in pneumothorax, distinguishes the one from the other.

If emphysema is present along with pneumothorax, scarifications should be made for the discharge of the air contained in the cellular substance, which also afford exit to that accumulated in the chest; but if this proves insufficient, or if there is not any emphysema, an opening should be made without delay through the parietes of the thorax. *Paracentesis thoracis*, for this purpose, was first proposed by Mr Hewson.*

Paracentesis Thoracis.

Paracentesis, or puncture of the thorax, is performed to evacuate

* Med. Obs. and Inquiries, vol. iii., 1767.

air, blood, pus, or serum accumulated to an injurious extent within the cavity of the pleura. It might appear at first sight that almost any part of the parietes could be chosen for this purpose,—but the following considerations limit the proper bounds of the operation to a more narrow space. An opening higher up than the fifth or sixth rib would not afford a convenient outlet for the fluid which requires to be discharged,—and it could not be made lower than the ninth or tenth without incurring the danger of injuring the diaphragm. The intercostal spaces not thus interdicted are thickly covered with muscles for a third part of their extent at least, from both the sternal and vertebral extremities; and at these parts the intercostal arteries are more exposed to danger than in that which lies between the angles and the cartilages of the ribs. The principal vessel of each intercostal space runs along the lower edge of the superior rib, overlapped and protected by the sharp descending ridge of its external margin,—but a branch of the artery proceeds along the upper border of the lower rib,—and the safest place, consequently, for cutting through the parietes is equidistant between the two ribs that circumscribe the space selected for the operation. It appears, on the whole, therefore, that the best situation for operating is between the fifth and eighth ribs on the right side, and the sixth and ninth on the left, where the presence of the pericardium renders it prudent to cut lower, at an equal distance from the sternum and spine, and in the middle of the space between the two ribs.

The patient should be laid on a sofa, or brought to the edge of his bed, and be made to bend his body so as to render the affected side of the chest as convex as possible. The surgeon then introduces a small trocar, without any preliminary incision of the integuments, and withdraws the canula when the fluid has escaped.

Diseases of the Mamma.

The Mamma is liable to so many diseases that it is necessary to make a classification of them. They may be divided into—1. Those in which there is merely derangement of its nutritive or sensitive action, causing simple enlargement, induration, and pain; 2. Those in which there is a collection of purulent fluid; 3. Those in which there is a morbid growth limited to the part in which it originates; and, 4. Those in which the growth is of a malignant kind—that is, tends to spread, ulcerate, or fungate, and affect the patient's constitution.

The first of these divisions comprehends the painful indurations which occur at the time of puberty, and in the early months of pregnancy—also a more chronic condition of the same kind, not unfrequently met with in middle-aged women—and lastly, a painful state which is named the Irritable Breast. The second division includes the Acute or Milk Abscess, as it is usually called, and the Chronic Abscess. The third division embraces Vascular or Simple Sarcomatous, Fibrous, and Cystic Tumours ; and the fourth, those of the Carcinomatous, and Medullary or Cerebriform kinds.

In both sexes about the time of puberty the breasts frequently become enlarged, hard, and painful, but soon return to their ordinary condition, and seldom require any treatment further than the application of fomentations or some soothing lotion. This state of excitement, which attends the development of the sexual organs, is apt to occasion alarm, from being supposed to denote malignant action of the part, and, there is reason to fear, has even led to excision of the gland. The same observations will apply to the painful and slightly swollen state of the breast which is observed at the commencement of pregnancy.

Induration of the breast at a more advanced period of life is a very common effect either of slight direct irritations, as blows or bruises, or of the indirect irritation which proceeds from suppression or derangement of the natural secretions. Women about the middle period of life, particularly those who are not married, or who have no children, are most liable to this complaint. It generally affects both breasts, but is sometimes limited to a lobe of one. The induration is not well defined. It does not feel very hard or heavy, and, if attended with pain, the patient describes her uneasiness as a sort of burning sensation, which is not always equally severe, but varies much in this respect, according to the state of mind and body. The patient's appearance and time of life, the history of the tumour, its consistence, and the readiness with which it generally yields to proper treatment, distinguish this from more serious affections of the mamma. When the breast is particularly painful, leeches and warm fomentations may be used with advantage, or a litharge plaster may be applied over it; but local treatment is to be regarded as of secondary importance, since the disease almost always depends upon the state of the general health, and is to be remedied by its improvement. With this view any derangement of the intestinal or menstrual secretions, which is ascertained to exist, must be, if possible, rectified without delay;

and then a gentle course of alterative medicine, especially the saline laxatives, used daily, with due attention to the mental condition of the patient, ought to be carefully employed.

The mamma sometimes becomes the seat of uneasy sensations so distressing and unceasing as fully to warrant the appropriation of a particular title to express them. The Irritable breast is generally met with in middle-aged women, of nervous disposition, who have been much exposed to grief, disappointment, or anxiety. It is recognised by the extreme suffering of the patient, who represents the pain as equally intolerable and indescribable. It never leaves her entirely, but has remissions of partial relief, and exacerbations in which the agony is extreme. These paroxysms are induced by everything that directly or indirectly occasions excitement. Pressure, as that applied in examining the breast, agitation of mind, and derangement of the secretions, are the most certain means of producing this effect. When the patient submits to an examination of the painful part, it is felt to be a little fuller and denser than usual; sometimes engaging the whole gland, and at others being confined to a single lobe, or a still smaller portion. In cases where the symptoms are mild, great or even complete relief is sometimes obtained from fomentations and other soothing local applications, together with the internal medicines requisite for restoring to a healthy state the secretions that may be deranged. If these means prove unavailing, and the patient suffers such distress that she insists upon the seat of the pain being removed, this wish must sometimes be complied with in order to allay the apprehension of malignant disease, which greatly aggravates the complaint by agitating the mind. The gland when cut into displays a somewhat whiter and denser structure than usual, and frequently also cysts of various size containing a limpid fluid. The operation is usually followed by an interval of complete relief, and sometimes by a permanent cure, but the cicatrix or neighbouring parts are apt to become the seat of sensations similar to, though seldom so severe as, those previously experienced, and for which the same soothing means ought to be employed.

The milk abscess is a collection of purulent matter formed in the mamma during lactation. If, while the gland is in this active state, constitutional disturbance should be excited by exposure to cold, errors of diet, or any other circumstances, the fever thus induced is very apt to be attended with or followed by inflammation of the previously excited organ. The patient's first intimation of

indisposition is a rigor, accompanied with pain of the back, and headache, which is soon succeeded by heat of skin, quickness of pulse, loading of the tongue, and flushing of the face. At the same time the breast becomes red, tense, and painful, while short but smart fever, or Weed, as it is vulgarly named, subsides in the course of twenty-four or forty-eight hours. In a few days, if the inflammation does not terminate in resolution, the fluctuation of fluid may be felt in the mamma; and if the process is allowed to proceed naturally, the matter is evacuated by ulceration or sloughing of the integuments.

In treating this affection it is usual to begin with the application of leeches; but it does not appear that much advantage is thus obtained. Warm fomentations externally, and saline purgatives, to promote the intestinal secretions, with gentle antimonial draughts, to produce a similar effect on the skin, ought to be employed in the first instance, as being the most efficient means for inducing resolution of the inflammatory action. If it goes on to suppuration, poultices should be substituted for the fomentations, and the patient must observe a restricted regimen to moderate the flow of blood towards the breast. The cavity of the abscess generally heals sooner when evacuation of the matter is not hastened by using the knife, before the suppuration is so far completed that the thin superjacent integuments project or *point*. When the process is thus far advanced, a free incision should be made, since it will not then delay the subsequent process of cure, but accelerate it by preventing extensive ulceration, sloughing, or the formation of sinuses. After the matter has been discharged, a poultice is useful for a few days; and then simple dressing, succeeded by some gently stimulating lotion, may be used to dress the sore until it is completely healed.

The chronic abscess forms insidiously without any observable symptoms of inflammation. It occurs at all periods of life, but is met with most frequently in middle-aged women. The size of the swelling is generally about that of an egg, its contents are usually thin, and it is for the most part deeply seated. The integuments being free from redness and tension, while the substance of the gland, except in the neighbourhood of the part affected, where it is condensed and thickened, retains its natural consistence, the abscess is apt to be mistaken for a solid tumour, and this error is in some cases confirmed by swelling of the axillary glands, which, taking place in consequence of the irritation caused by the collection of

fluid in the mamma, or perhaps altogether independently of it, is regarded as evidence of malignant action propagated along the absorbents. The equality of the surface of the tumour when examined through the parts lying over it, the absence of pain when this is done, and the feeling of fluctuation that may then be more or less distinctly perceived, afford in general sufficient grounds for an accurate diagnosis; and should there remain any doubt as to the nature of the swelling, it may be readily resolved by making a puncture, which will evacuate the fluid if there is any, and will do no harm if there is not, since in that case excision ought to be performed without delay. A free opening should be afforded to the matter, and the sides of the incision must be carefully kept separate to prevent their union, which is very apt to happen owing to the thickness of the parts. This operation is sometimes followed by considerable inflammation and constitutional disturbance, during the continuance of which, fomentations, with poultices and suitable remedies of a general kind, are to be employed according to circumstances. If necessary, more free dilatation, and stimulating washes, with an alterative course of medicine and diet to improve the patient's health, may afterwards be had recourse to.

As a consequence both of this and the former kind of abscess having been improperly treated, there frequently remain sinuses of great extent, seated very deep between the mamma and pectoral muscle, and running through the substance of the gland in various directions. A copious thin sero-purulent discharge issues from the orifices, which are generally numerous, and the whole breast becomes hard, and immoveably attached through induration and adhesion of the muscular, cellular, glandular, and cutaneous tissues. The appearances presented by the disease are then so alarming, to one not acquainted with the nature of the case, that excision of the affected parts might very readily be thought of, and, there is reason to believe, has even been executed. Mr Hey of Leeds proposed, as a substitute for removal, the free incision of all the sinuses, so as to lay them fairly open, however numerous and deep, even though it should be necessary in doing this to divide, or even insulate, portions of the gland. This severe practice is not necessary, since experience has shewn, that merely enlarging moderately with the knife the orifices of the more dependent sinuses is sufficient for the purpose. During the process of cure, the affected breast should occasionally be rubbed with some gently stimulating liniment. A sulphate of zinc lotion, either simple or combined with spirits, as

recommended by Mr Hey,* will be the best application to the surfaces of the wounds.

Vascular Sarcoma.

Vascular sarcoma, or hypertrophy of the mamma, seldom occurs to such an extent as to constitute what may be regarded a diseased enlargement, and fulness of the breast is generally owing much more to redundance of the adipose tissue than the size of the gland. Occasionally, however, the mamma does suffer a morbid increase, and may attain such dimensions as to become an insufferable load to the patient. Cases are recorded in which tumours of this kind were found after removal to weigh many pounds. Iodine and pressure may perhaps have some effect in repressing such growths, or even in diminishing them, especially if conjoined with efficient means for improving the general health, and restoring any secretions that are found to be suppressed; but if the tumour continues to enlarge, and is the cause of intolerable oppression to the patient, there can be no doubt as to the propriety of removing it.

Fibrous Sarcoma.†

This tumour is not like the one last mentioned, merely an enlargement of the mammary substance, but a distinct new formation. It possesses a fibrous structure of variable density, from that of cartilage to the consistence of a salivary gland; its colour is generally white, or grayish-yellow; its figure is usually round, or oval, with an irregularly nodulated surface of a glistening appearance. When small, it is extremely moveable, and seems, upon examination through the integuments, as if it could be pushed about from one part of the breast to another. As it enlarges, the gland, being subjected to pressure, suffers a progressive diminution of size, until at length so little trace of it may be left as even to require a search for its discovery. This kind of tumour is generally met with in unmarried women between the ages of twenty and forty. It grows with very different degrees of rapidity, sometimes remaining for years no larger than a walnut, and at others in the same period attaining such a size as to weigh several pounds.

* R Aquæ . . unc. xxx.
Sp. Rosmar. . unc. ii.
Sp. Lavand. comp. dr. ii.
Zinci Sulphat. . dr. j. M. ft. lotio.
Hey's Surgical Observations, chap. xxii. p. 525.

† Chronic Tumour of Sir A. Cooper. Pancreatic Sarcoma of Mr Abernethy.

There is seldom much pain referred to the breast affected, and when it is complained of, the mental uneasiness, excited by apprehension of cancer, is probably the principal cause of its production. If the tumour is small, it may be cut out to relieve the patient's anxiety; and if so large as to occasion inconvenience, its extirpation is more decidedly indicated. In the former case, it is necessary to make merely a simple incision through the integuments and substance of the mamma, so as to lay open freely the capsule of condensed cellular membrane which surrounds the tumour, and loosely adheres to it; but in the latter, where the morbid growth, from its long standing and large size, may be expected to have induced more or less absorption of the gland, and adhesions of it to the adventitious structure, it is best to remove the whole together. In cutting tumours *out* of the mamma a troublesome hemorrhage may be expected, from the numerous arterial branches which are divided, and, in addition to a number of ligatures, it is sometimes necessary to stuff the cavity with lint.

Cystic Sarcoma.

It is comparatively rare to meet with tumours in the mamma entirely composed of a cystic structure; but cysts are frequently found in growths of a solid kind, particularly the one last mentioned, and are sometimes so large and numerous as to constitute the principal feature of the disease. Such cystic formations occur at all periods of life, generally in women of a healthy appearance; occasion little inconvenience, except from their size; and tend to increase without any limitation. Their nature may sometimes be recognised previous to removal by the imperfect feeling of fluctuation and bluish appearance of their contents, perceived through the thin distended integuments by which they are covered; but, in general, the nature of the structure is not precisely ascertained until it is displayed by a section. The inconvenience which results from the bulk of the tumour, and the risk of its becoming the seat of malignant action, are sufficient grounds for recommending excision of the disease at all stages of its progress; and the operation may be performed with the same favourable prognosis as for the fibrous and vascular sarcoma. Simple serous cysts, existing without any complication of morbid texture, may in general be remedied by evacuating their contents through means of a trocar, and immediately afterwards applying a blister.

Carcinomatous Sarcoma.

There is no other part of the body in which carcinomatous degeneration occurs so frequently as in the mamma, though a large proportion of the cases in which it has been, and still is too often supposed to exist, if subjected to a more accurate diagnosis, would be referred to other kinds of disease, and particularly to those that have been already considered. Carcinoma occurs in the breast at all periods of life, from the age of twenty upwards; but commences rarely before thirty-five, and most frequently between forty and fifty. It sometimes seems to be called into existence by the irritation of a blow or bruise, and is occasionally preceded by simple induration of the gland; but very often a local cause cannot be assigned, or is so loosely connected with the appearance of the disease as to give no good ground for believing in its operation. The suppression of the menstrual secretion is regarded as a great predisposing, or even exciting, cause of the morbid action, by disturbing the balance of the system; and it has been observed, that distress of mind, errors of diet, and any other circumstances which derange the secretions, tend further to promote the commencement, and increase the activity of the disease. I am inclined to think that the cessation of the menstrual discharge does not exert so much influence as is generally attributed to it, and suspect that this opinion rests more upon theoretical grounds, or views of probability, than actual experience. It is true that, in women suffering from cancer of the breast, the catamenia are seldom present; but if inquiry be made whether their disappearance or the commencement of the disease was first noticed, the latter will, in many cases, prove to have been the earlier of the two events.

Carcinoma of the mamma is recognised by its inequality of surface, extreme hardness, and specific gravity, which is greater than that of any other tissue, sound or morbid, except bone and cartilage. The integuments, when adherent to the tumour, are puckered, and drawn towards it. The nipple is flattened, hardened, and depressed. The patient complains of occasional lancinating pain shooting through the tumour, and from it in various directions; and she generally betrays, by her greenish-yellow complexion, that depraved state of health, which, whether it be a cause or consequence, or partly both, as is most probable, usually attends such local affections. The course of the morbid process, if it be allowed to

proceed, is to engage the glands of the axilla, which become enlarged and indurated; to form ill-conditioned matter in the substance of the carcinomatous masses; to evacuate the contents of these abscesses by ulcerative absorption of the superjacent parts; and thus give rise to sores which prove truly incurable cancers. The pain and discharge that ensue occasion more or less exhaustion of the patient, but are seldom the immediate cause of death, as she generally dies before they produce this effect; and existence is often terminated in such cases so suddenly and unexpectedly as to suggest the suspicion of a poisonous influence proceeding from the disease. The patient generally complains of what she believes to be rheumatic pains, extending through the whole body, but being particularly severe in the arm of the affected side, which is often œdematous, numb, and powerless; and the fatal event is usually preceded by sickness, loss of appetite, and extreme weakness. Effusion into the cavities of the chest is occasionally the cause of death. The skin sometimes shews a great tendency to assume the diseased action, either being primarily affected with it, or, while the gland is undergoing this morbid change, becoming studded at various distances with flat carcinomatous tubercles. The disease varies greatly in the rapidity of its progress, according to circumstances, which seldom admit of being satisfactorily distinguished, but it generally proceeds more slowly in advanced periods of life.

The appearances which are presented by the section of carcinomatous tumours, though they all agree in some respects, differ considerably in others. There is always more or less of a very dense, almost cartilaginous structure, of a mixed brownish-gray and bluish-white colour, which exists either in the form of compact masses, with bands of a similar substance, that radiate from the centre,—or in that of capsules, smooth and distinct externally, but gradually softening towards the interior. Within this texture there are, as the disease advances, cavities filled with a soft friable grayish-yellow or brown substance, or thin imperfectly formed purulent matter. Sometimes the appearance produced by the radiating fibrous bands is strikingly marked, while at others, though the carcinomatous texture does not form a capsule, the confines of the morbid formation are very distinctly circumscribed,—and there seems to be a mixture of the brown and white dense texture approaching to a granular consistence, and containing small cells filled with semifluid matter. The distinction between this and the

more diffused form of carcinoma should be carefully observed, as it affords some assistance in deciding on the prognosis as to the duration of recovery after the tumour has been removed. When the lymphatic glands suffer carcinomatous degeneration, the morbid structure always assumes the capsular form, unless the disease should be very far advanced, and adhesions to the neighbouring parts have taken place. In this case radiating bands may be discovered, but hardly with the same distinctness that they usually present themselves, when the disease originates in the substance of the mamma.

The cure of carcinoma, whether in the state of scirrhus or cancer, by external or internal remedies, being confessedly impracticable, it does not seem necessary to mention the various means that have been ineffectually employed for this purpose. Leeching, soothing fomentations, and attention to the general health, alleviate the uneasy sensation of scirrhus, and delay its progress towards ulceration. Poultices of hemlock, and Fowler's solution of arsenic, diminish the agonising pain of cancer. Solutions of chloride of lime or soda destroy the fetor which proceeds from its discharge; and more or less temporary amendment results from the application of various ointments, powders, and washes, which can never be prescribed with any certainty of benefit, and must be frequently changed to obtain even the slight and transitory improvement that they at best afford. The only method of giving effectual relief is to remove the morbid structure with the knife, the depth and connexions of the affected parts rendering other means of extirpation, such as caustic and the ligature, inadmissible. Few questions in surgery have occasioned more discussion than that which has been, and still is, agitated in regard to the propriety of operating. It is admitted that relapse frequently occurs after excision has been performed; but much difference of opinion exists as to the chance of its doing so, and the consequent advantage of the operation. It would appear, on the whole, that the prospect of permanent recovery is not so hopeless as it has been represented, provided the operation be performed only in proper cases and in an efficient manner. Similar diseases are removed from other parts of the body, as the lip, with almost invariable success; but no surgeon thinks of cutting out a cancer of the lip if there be an affection of the glands under the chin; and, in operating, he carries his knife wide of the morbid part, and leaves a perfectly sound surface for healing. In excision of the mamma, on the contrary, a diseased

state of the axillary glands is often either totally disregarded, or considered no obstacle to the operation, provided they admit of removal; and the surgeon frequently cuts close to, or perhaps at some points through, the substance of the tumour. It need not, therefore, excite any surprise, or lead to distrust in the advantage of the operation, to find that the disease frequently returns. The affection of the glands should be regarded as an objection to the operation, not so much from presenting an obstacle in the way of its complete performance, as from affording evidence of a tendency in the constitution of the patient to take up the diseased action.

The different cases of carcinomatous disease may be divided into—1. Those where an operation is altogether improper; 2. Those where it may be performed, but with a very unfavourable prognosis; and, 3. Those where it has a chance of proving permanently successful. The first class will include cases in which there are enlarged glands, so seated or connected that they cannot be removed,—or where the skin is so extensively diseased that all the morbid portion of it cannot be taken away,—or lastly, where there is positive evidence of some other part of the body, as the stomach or uterus, being similarly affected, or of some other internal disease of a serious nature, such as dropsical effusion of the chest. The second class comprehends those cases in which the glands are tainted, but within reach,—or in which the disease is in the state of open cancer, or the progress of the morbid process rapid,—or the patient's appearance unhealthy. And to the third class may be referred those in which the disease has advanced slowly,—feels circumscribed,—is not attended with enlargement of the glands, and exists in a person of tolerably healthy appearance. Should the complaint have been distinctly the consequence of local irritation, or the patient be of an age at which the predisposition is generally not very strong, as above sixty, the prognosis will be still more favourable. In very advanced periods of life, as beyond seventy, the diseased action is so slow, and the chance of troublesome symptoms consequently so small, that the operation would in general not be warranted. In my own practice I decline to operate except in cases of the third class just mentioned, and have no hesitation in advising this limitation of interference with the knife, having seen much mischief and no benefit from operations where the glands were affected, though only in a slight degree.

When the operation is to be performed, the patient should be laid in a reclining posture, properly supported, and turned towards

the light. The nipple, as being a part likely to take up the diseased action, if it has not already done so, and, for the same reason, the whole of the gland, should always be taken away. For this purpose two curved incisions are to be made in the direction of the fibres of the pectoral muscle, including an elliptical portion of the integuments, together with the nipple; unless the particular circumstances of the case render it more convenient to cut in some other way, so as to remove the whole of the affected integument. In calculating the direction and extent of the incisions, the object should be, in the first place, to include all the skin that is diseased; and in the second, to leave no more of it than what is sufficient for allowing the edges of the wound to be brought together without straining. The surgeon then exposes the anterior surface of the tumour completely, first separating the lower flap, and then the upper one, while the assistant presses his fingers on the orifices of the divided arteries. In doing this he should proceed carefully and deliberately, so as to cut wide of the confines of the disease, and keeping in mind that the permanency of recovery is a more important object than the rapidity of the operation. He lastly turns up the edge of the tumour, and detaches its remaining connexions. The vessels that continue to bleed are then tied; and, if there are glands to be removed from the axilla, he next cuts down upon them, seizes them, one by one, with a hook, and partly by cutting, but also by tearing, completes their separation; after which, any more ligatures that seem requisite are applied. It has been proposed in such cases to remove the glands before the mamma, on the ground that, as the arteries wounded in the operation come chiefly from the axilla, the dissection should be commenced there, in order to avoid cutting and tying them twice over. This advantage is more theoretical than practical, and does not afford any sufficient recompense for the risk and trouble required in digging out the glands, before free access to them has been obtained by removing the mamma. The edges of the wound should be stitched together, and compresses of lint will be useful if placed over the integuments which have been undermined in the operation. Instead of a bandage surrounding the chest, a folded towel ought then to be applied.

Medullary Sarcoma.

The medullary sarcomatous affection of the mamma occurs at all periods of life beyond puberty, but most frequently about middle

age. The tumour is recognised by its usual characters of irregularly nodulated surface, and soft elastic consistence, either throughout its whole extent, or at the most prominent parts, which are generally red, either of a dull or bright hue, and exhibit numerous small arborescent vessels. The pain attending the disease varies much in different cases, being at one time very severe, at another hardly perceptible. When there is a strong disposition to the unhealthy action, the complexion of the patient is of a greenish-yellow colour, and the countenance has a peculiar anxious expression. The tendency of the morbid growth is to enlarge; to contract adhesions with the integuments and muscles in its neighbourhood; to excite a similar disease in the axillary glands; to suppurate, ulcerate, and fungate; and occasionally in this last stage to throw out blood from time to time, but more frequently a thin watery discharge, which is in general very copious and fetid. The substance of the tumour often protrudes at the ulcerated openings in large masses, which seem nearly in a sloughing state, and are occasionally altogether detached. The bulk of the swelling is thus diminished, but enough of the disease remains to prevent a cure from being accomplished.

The different steps of this process are completed, and follow each other with various degrees of rapidity. A few months are sometimes sufficient for the whole progress from the first to the last stage, and, on the other hand, years even may elapse before the disease proves fatal.

All external and internal remedies have been found quite unavailing in the treatment of medullary sarcoma, whether in the mamma or elsewhere, and the only mode of affording the patient relief is to cut out the morbid structure. To this operation the same objections have been urged as to that for carcinoma, and the same considerations ought to guide the surgeon in deciding on the propriety of its performance. If the whole of the diseased parts cannot be taken away, no operation ought to be attempted. If the operation be performed when the morbid process has made a rapid advance—the patient's appearance is unhealthy—the confines of the tumour are indistinctly circumscribed—or when ulceration has taken place, the prognosis will be very unfavourable. If the tumour is of firm consistence—distinctly limited—not adherent—of slow formation—and the patient has a tolerably healthy appearance, the prospect of a durable recovery will be better. The appearances found on dissection also afford important indications

in regard to the result. The more soft and bloody the consistence of the tumour is, the more malignant may be regarded the morbid disposition; and the more firm it is, the more fibrous intersecting bands it contains, the more, in short, it approaches the nature of fibrous sarcoma, the less fear may be entertained of a relapse.

When two kinds of malignant disease pass into each other by insensible degrees, and, when existing in their distinct forms, present varieties hardly less numerous than the cases in which they occur, any attempt to classify such shades of difference could obviously serve no purpose of practical utility.

CHAPTER XVII.

ABDOMEN.

Wounds of the Abdomen.

WOUNDS of the abdominal parietes, which do not penetrate the peritoneum, require merely the ordinary treatment that is proper for injuries of the class to which they belong. When the peritoneum is implicated, the wound must be regarded as much more dangerous, since this membrane, like all the others of a serous kind, is very apt to inflame when thus injured. There is seldom much internal hemorrhage in such cases, as the pressure of the viscera, which are contained in the cavity of the abdomen, opposes it.

In treating simple penetrating wounds, it is evidently proper, in the first place, to press back any part of the intestines or omentum that may be protruded through the aperture. This should be done as gently and with as little delay as possible. Great care must be taken also that the protrusion is not merely returned under the integuments, without being fairly restored to the abdominal cavity, especially if the wound be oblique and narrow, as when inflicted by a pointed instrument. In cases of this sort it has happened that the inner opening of the wound so compressed the intestines or omentum permitted to remain in it, under the erroneous impression that reduction had been completely effected, as to cause fatal inflammation. The surgeon, therefore, should follow the protruded parts with his finger, and not be satisfied with their replacement until he feels the point within the peritoneum, enlarging the wound in it, if necessary, by means of a probe-pointed bistoury. It is more particularly necessary to observe this precaution when any swelling remains at the seat of injury, or the protrusion tends to re-appear after being pressed within the external orifice of the wound. I once successfully reduced a mass of omentum of the size of a walnut, that lay in an oblique wound, of

which the inner aperture was not larger than a small quill. The edges of the wound ought then to be stitched together with the interrupted suture, and the patient must afterwards be diligently protected from all sources of excitement. A milk diet, and moderate depletion, may be employed as preventives of inflammation; and should symptoms of it actually appear, leeching, together with warm fomentations of the abdomen, and the internal administration of calomel with opium, are to be employed without loss of time, since the safety of the patient will depend in a great measure on the activity and decision with which these means are used. During the first twenty-four hours, therefore, the surgeon should be constantly on the watch for increase in the frequency or hardness of the pulse, anxiety of the countenance, and tenderness of the abdomen to pressure. Should there be no positive evidence of the wound actually penetrating the peritoneum, as from protrusion of the viscera, it ought to be treated with the same attention as if there were,—since it is much better to run the risk of being too careful, than to fall into the opposite error of not being sufficiently so. And it would be highly improper to decide the question by probing, as, in case of the wound penetrating, this must necessarily increase the danger of inflammation.

When the intestine is wounded, the injury must be regarded as still more serious, and likely to be followed by the worst consequences. The reason of this will appear from the fact, that whenever the contents of the bowels are effused over the surface of the peritoneum, death is the invariable, and, in general, very speedy result. When this extravasation occurs in consequence of disease, the effect is the same, unless the ulcerative process, that forms the breach in the intestine, is preceded by or accompanied with such an infusion of lymph as to limit the extent of the mischief, and confine the extravasation within the bounds of an abscess. It is not easy to understand how the intestinal matters operate thus fatally on the system, when they escape into the cavity of the abdomen; for the patient often dies in a few hours after the discharge takes place, and long before it can be supposed that inflammation has proceeded to the extent requisite for destroying life. The symptoms presented are intense burning pain of the abdomen,—insatiable thirst,—coldness of the extremities,—collapse of the features,—cold clammy sweat,—small frequent pulse,—coffee-coloured vomiting; in short, a condition nearly the same as that of sinking from mortification. The fatal event generally happens between

the 20th and 30th hours, and seldom sooner than the 12th, or later than the 48th.

When death does not ensue until the later periods that have been mentioned, there are always traces of inflammation to be perceived; but when it happens within a few hours after the injury has been sustained, no such appearances can be discovered. The disastrous effect of penetrating wounds is opposed by the resistance which the surfaces of the neighbouring viscera offer to the escape of the intestinal contents, and also by the contraction of the muscular fibres of the bowel at the injured part, which tends to protrude the mucous membrane through the aperture so as to obstruct it. If the effusion is restrained by these means for a short time, it may be prevented altogether by an adhesive exudation of lymph, that soon seals up the orifice, and unites the adjoining surfaces together. It will be most apt to occur when the intestine injured is distended by fluid contents,—when the wound is longitudinal in respect to the direction of the canal,—and when, if transverse, it is so large as to divide the circumference of the gut to a considerable extent. Extravasation of the contents of the urinary and gall-bladders produces the same effects as that of the intestinal matters.

Internal hemorrhage may occur either from an artery of the abdominal parietes, or from the vessels of the viscera. It is recognised by the usual indications of weakness, coldness, and sickness, together with a feeling of oppression in the abdomen, and, in extreme cases, a fluctuation perceptible on examination externally. On dissection, the blood is found either diffused in a thin stratum over the whole peritoneal surface, or accumulated at one part.

In the diagnosis of wounded intestine, probing of every sort is quite inadmissible. The shape and size of the weapon that inflicted the injury, together with the direction and extent of the course which it seems likely to have taken, will afford some ground of probable suspicion; vomiting, or dejection of blood by stool, will not only prove that the gut has been wounded, but lead to a conjecture as to the seat of injury; and the symptoms of intestinal effusion, or the escape of feculent and bilious matters from the wound, will render the case more decided. Should the wounded intestine protrude through the integuments, the extent of the injury may, of course, be determined by simple inspection.

In respect to the treatment of wounded intestine, it is evident, that unless the injured part presents itself to view, no local treatment can be employed to remedy the injury, and that the patient's

only chance of recovery will depend upon the powers of the system effecting the process of reparation which has been described. The object of the surgeon should be to prevent this process from being disturbed, with which view he will be led to enjoin absolute rest, with strict starvation, and abstinence from purgatives. If the injured part of the gut is protruded, an important question will present itself in regard to the management of the wound, with respect to which much variety of opinion and practice has existed.

If the wound is very small, and especially if it is seated in a part of the canal not usually distended by its contents, the most prudent course will probably be to return the gut, as if it were sound, without any more ceremony. Should the wound be somewhat more than a mere puncture, and allow its cut edges to be distinguished, a thread ought to be passed through them by means of a round sewing needle, and tied, after which both ends may be cut away close to the knot, and the gut returned, since it has been ascertained by experiments on the lower animals, that stitches inserted into the coats of the intestinal canal are detached by ulcerative absorption towards the interior of the tube, and thus escape with the feculent discharge.* If the wound is so large as to require more than one stitch, as many as seem necessary are to be introduced in the same way at the distance of a quarter of an inch, or less, from each other. If the wound is lacerated or contused, the injured part should be cut away before the edges are joined. And, finally, if the whole circumference of the gut is divided, it may be best to insert only one stitch on the side next the mesentery, so as to keep the two mouths of the intestine together, and then retain the aperture of the canal in correspondence with the external wound, by means of threads passed through their respective edges. A preternatural opening for the discharge of the bowel must thus in all probability be formed in the first instance; but the immediate danger will be diminished, while room is afforded for subsequent reparation, in the way that will hereafter be described.

The viscera of the abdomen, with which may be included the urinary bladder in its distended state, are liable to be ruptured by external violence without the infliction of a penetrating wound. The symptoms are those indicative of extravasation of the intestinal matters; and the result is certainly fatal, almost always within the short period that has been already mentioned. It is important to

* Travers on Injuries of the Intestines. 1812.

know that the bladder, when much distended with urine, may be ruptured very readily, as by falling on the floor or the corner of a table,—since death occurring in such circumstances may give rise to very serious questions in medical jurisprudence. Urinary effusion from this source sometimes does not prove fatal before the lapse of several days, and in a case that came under my own observation the patient survived a week. It is also possible that the urine may be effused through a rent in the fore-part of the bladder where it is not covered by the peritoneum, so as to escape into the cellular texture of the abdominal parietes, and permit the patient's recovery, as happened in a case which I have placed upon record.*

Paracentesis Abdominis.

The abdomen is punctured for the removal of dropsical collections of serous fluid in the cavity of the peritoneum, and for the evacuation of cysts developed in the ovary, which grow so large as to occasion distension of the abdomen. The circumstances of these diseases, which denote the propriety of paracentesis, need not be considered here; and it will be sufficient to explain the mode of performing the operation.

The instruments employed for this purpose consist of a trocar and canula. The point of the trocar may be either in the form of a three-sided pyramid, or have a flattened heart-shaped figure with two cutting edges. The canula of the former is round, that of the latter flat; the first is generally employed, and ought to be preferred, especially in cases of ovarian dropsy, where the fluid is often very thick and viscid. In introducing the three-sided instrument, it was formerly the custom to make a preliminary incision through the integuments with a scalpel; but this is quite unnecessary, and the flat one may of course be still more readily pushed through the whole of the parietes at once.

Two situations have been chiefly selected for the operation—one in the *linea alba*, about an inch below the umbilicus; the other in the *linea semilunaris*, at a point between, and equidistant from, the umbilicus and superior anterior spinous process of the ilium. The former of these ought certainly to be preferred, since there is here no danger whatever of wounding either the vessels or viscera, —while, in endeavouring to puncture through the *linea semilunaris*, the surgeon runs a risk of injuring the epigastric artery, which, owing to the unequal resistance of the anterior and lateral

* Contributions to the Pathology and Practice of Surgery, p. 332.

portions of the abdominal parietes to the force of distension, alters its relation to these points. If it should ever be desired to puncture in this situation, the safest plan is to introduce the instrument at the distance of a handsbreadth from the crest of the ilium, in the course of a line extending from the spinous process to the umbilicus.

The patient should be seated on a chair, or the edge of his bed, with the back and legs properly supported. A flannel bandage, nine inches broad, and long enough to surround the abdomen, cross behind, and leave a sufficient hold for an assistant on each side, whose duty is to maintain the pressure as it is diminished by the evacuation of the fluid, is applied. The surgeon then having made an aperture in the bandage, opposite the part where he wishes to puncture, and holding the handle of the trocar in the palm of his hand, while the point of his fore-finger is rested on the abdomen by the side of the canula, pushes the instrument through the thin distended parietes, until he feels that the point does not encounter any more resistance. He then withdraws the trocar, and at the same time insinuates the canula a little further, to prevent any chance of its escape during the flow of the fluid. When it appears that the cavity has been emptied, the canula may be taken out,—a piece of folded lint is placed on the wound,—the ends of the bandage, which hitherto have been held by the assistants, are brought round and fastened over the front, or opposite sides of the abdomen,—and the patient is replaced in bed.

Hernia.

When the viscera of the abdomen are protruded through the parietes of their containing cavity, while the integuments covering the part remain entire, the displacement is named a Hernia. It was formerly thought that the peritoneum was necessarily torn in such cases, whence the disease was named Rupture; but it has been fully ascertained, that, except in some few rare cases, this membrane always remains entire, and being pushed before the protruded viscera, constitutes a pouch or Sac, as it is called, for their reception. Hernia may take place at almost any part of the abdominal parietes, but does so most frequently through the apertures that naturally exist in them for the transmission of vessels. These are the inguinal and femoral canals, and the umbilicus; and the hernial protrusions which occupy them are accordingly named Inguinal, Femoral, and Umbilical.

Inguinal Hernia.

The vessels of the testicle in the male, and the round ligament in the female, proceed through the parietes of the abdomen in an oblique passage about two inches and a-half long. This passage, which is named the inguinal canal, being formed through the fasciæ and muscles that constitute the abdominal parietes in the hypogastric region, the connexions of which have been variously described, and are still differently regarded, it seems necessary to enter into some anatomical details on the subject. Before doing so, it may be proper to observe that the part of the abdomen to be particularly considered at present is that which lies below a line drawn transversely between the anterior spinous processes of the ilium.

Under the integuments and subcutaneous adipose tissue there is here an expansion of condensed cellular substance, constituting a membranous fascia, named *fascia superficialis*, not very thick, but comparatively strong, and always very distinct. Beneath this lies a strong tendinous expansion usually named the tendon of the *obliquus externus;* but which, instead of being regarded as subordinate to one particular muscle, ought rather to be considered an independent fibrous structure, like the *fascia lumborum*, or the *fascia lata* of the thigh, since many other muscles are attached to it besides the external oblique. Much confusion would thus be avoided; and it might be called the tendinous fascia of the abdomen. Within this the recti muscles occupy the space on each side of the mesial plane, as far as a line running parallel with it upwards from the tuberosity of the pubis. The internal oblique and transverse muscles cover the remainder of the region under consideration, except a small triangular portion of it near the pubis. On the inner side of this muscular layer, there is a fascia, which was first noticed and described by Sir A. Cooper. It is very thin, except at the lower part, and has been named the *fascia transversalis;* the peritoneum comes next, and completes the formation of the abdominal parietes. The three fasciæ that have been mentioned are united together at the line which extends from the spinous process of the ilium to the pubis. They may all be traced distinctly down thus far, but cannot be separated lower without cutting them. The *fascia tendinosa* (tendon of the external oblique), before uniting with the others, turns back upon itself downwards, so as to present a thick round border like a hem, which has led to the erroneous appella-

tion of ligament (Poupart, Fallopius,) to this part. The internal oblique and transverse muscles lie between the *fascia tendinosa* and *fascia transversalis.* Their fibres at this part are intimately connected, and constitute but an inconsiderable mass of muscular substance; they are attached to the junction of the fasciæ all the way from the spinous process to about a third of its length from the pubis. The *vas deferens* and other vessels which compose the spermatic cord meet together on the outer surface of the peritoneum, about midway between the spinous process and pubis, and about half an inch above Poupart's ligament. They here perforate the *fascia transversalis,* not through a well-defined aperture, but by carrying a thin funnel-like projection of it along with them. Descending obliquely towards the pubis, they become united with some fibres of the internal oblique and transverse muscles, which constitute the cremaster muscle. Having thus escaped from under the edge of these muscles, the cord passes through the *fascia tendinosa* at a sort of slit-like opening about an inch and a quarter long, that extends from the tuberosity of the pubis between the body of the fascia and its inverted margin. From the edge of this slit, which is named the external ring, a thin fascia is continued over the cremaster muscle; and the cord then proceeds into the scrotum, covered by an extension of the superficial fascia of the abdomen, which is continued along with it. The epigastric artery rises from the iliac nearly opposite Poupart's ligament, and running in the direction of the umbilicus, between the peritoneum and *fascia transversalis,* crosses the cord about the middle of the inguinal canal, having nothing interposed except the fascia just mentioned.

Inguinal hernia either descends along the whole course of the cord, or protrudes directly through the external ring. In the former case it is named Inguinal or External Inguinal, and in the latter Ventro-Inguinal or Internal Inguinal. Whether of the one kind or the other, it may either remain confined in its extent to the groin, or, getting lower down, distend the scrotum or labium. In the first of these situations it is denominated Bubonocele, and in the others Scrotal or Pudendal Hernia, according to circumstances. There is an important modification of inguinal hernia which takes place before the cavity of the *tunica vaginalis* ceases to communicate with that of the abdomen. The neck of this process of the peritoneum usually becomes impervious soon after the descent of the testicle, which generally happens about a month

before the time of birth. But if the obliteration is delayed longer, or the fœtus is subjected sooner than this to the circumstances which induce the formation of hernia, the viscera are apt to descend into the same bag with the testicle, so that the sac is formed by the *tunica vaginalis*. The merit of detecting this Congenital hernia is usually ascribed to Percival Pott, but unjustly, as Haller first discovered the descent of the testicle and continuity of the *tunica vaginalis* with the peritoneum, and also suggested the probability of hernia in infants taking place in that way, while Dr William Hunter first established the truth of this explanation by dissection. There is another very rare form of inguinal hernia, in which the protruded intestine pushes the intestine before it *into* the *tunica vaginalis*, so that the sac lies within another sac. I have met with this condition only on one occasion, but then in the most perfect form. The contents of inguinal hernia usually consist of a portion of the ileum, with more or less of the omentum. Sometimes the *caput cœcum* descends by a gradual extension of its cellular connexions, and in this case the intestine of course is not completely enclosed in a sac. The sigmoid flexure of the colon also may be protruded, and, though more apt to descend on the left side, has been found on the right, while there are not wanting instances of the *caput cœcum* being discovered on the left. The Hernia is named Enterocele, Epiplocele, or Entero-epiplocele, accordingly as it contains intestine or omentum alone, or both together. There is no limit to the size of the protrusion, which varies from mere fulness in the situation of the inguinal apertures, to a size nearly equal to the whole intestinal canal.

The causes of hernia may be divided into those which predispose to the disease, and those which immediately give rise to it. The predisposing causes are circumstances which diminish the resistance that opposes the exit of the viscera. Of these the sex of the patient may be mentioned first, since the larger size of the inguinal canal in males renders their predisposition to the disease greatly superior to that of females, so that the proportion which the cases of the former bear to those of the latter is at least a hundred to one. Emaciation and relaxation of the body diminish the resistance remarkably, and some persons seem to labour under a natural peculiarity of structure that exposes them more than others to the disease. The exciting causes consist in the operation of more than usual compressing force acting on the viscera of the abdomen. Such force is exerted during every energetic effort, especially if made with the

superior extremities; since, to give the muscles of the arms firm points of attachment, the chest must be rendered immoveable, and this is done by contracting the diaphragm together with the abdominal muscles, while the glottis is kept closely shut. The viscera being thus compressed between the diaphragm and abdominal muscles, are violently forced against the whole surface of the cavity, and if any weak part exist in it, a protrusion takes place. This effect is most apt to happen when an effort is made in the erect posture, for the diaphragm, which then extends obliquely downwards and backwards, will consequently press the viscera downwards and forwards in the direction of the inguinal openings. An attention to the same circumstance will afford some explanation of the fact that inguinal hernia occurs much more frequently on the right than the left side, the reason of which appears to be that, when an effort is made, the trunk of the body is usually bent to the opposite side, and, as most vigorous efforts are made with the right arm, the diaphragm will on such occasions generally present its concave surface, and consequently press towards the right groin. Tight articles of dress, which compress the abdomen, and increase the confinement of its contents without strengthening the parietes at the natural apertures, promote the occurrence of hernia.

The symptoms of inguinal hernia cannot be properly described or understood without considering separately three different states in which the disease may exist. In the first of these, the viscera return into the abdomen when the patient assumes the horizontal posture, or when moderate pressure is applied to the tumour. The hernia is then said to be Reducible. In the second state, the viscera are detained in the sac, but produce no further inconvenience, when the hernia is said to be Incarcerated. And in the third, the viscera are not only prevented from leaving the sac, but suffer in it such pressure or constriction as impedes the exercise of their functions, and produces other bad consequences, in which case the hernia is said to be Strangulated.

The symptoms of Reducible inguinal hernia are—a tumour in the region of the inguinal canal, colourless, elastic, and compressible, which disappears when the patient lies down, or when moderate pressure is applied; and a gurgling noise or sensation when the viscera return into the abdomen. The circumstances which occasion Incarceration are—1. Thickening and hardening of the omentum, which comes to resemble the pancreas or even denser structures; 2. Adhesions between the viscera and sac; 3. Distension

of the gut with intestinal matters; and, 4. The peculiar condition of the *caput cœcum*, which cannot return, except slowly, in the same way it descended, by gradual extension of its cellular connexions. The presence of a colourless elastic tumour, of unequal consistence, in the region of the inguinal canal, together with the history of the case, distinguishes the disease. Strangulation depends upon the pressure which is caused by the tough fibrous margin of the inguinal apertures or the condensed neck of the sac. The viscera may begin to suffer from the constriction immediately after their protrusion, or may not do so until long afterwards, on the occasion of another portion being suddenly forced down into the sac, or from the intestine becoming gorged with its contents. The symptoms of strangulation are a twisting burning pain referred to the umbilical region, constipation, sickness, and vomiting. The patient's countenance is collapsed, pale, and anxious. His pulse is small and feeble, his extremities are cold, and he cannot rest. The constipation does not depend altogether, as might be supposed, on mechanical obstruction of the bowels, since it is observed where the omentum alone is contained in the hernia, and does not always prove obstinate where the intestine is concerned. It seems to be owing chiefly to the perverted action of the gut consequent on the pressure which it suffers. At first there is little pain referred to the seat of the disease; but if the patient is not relieved, inflammation commences, and then the tumour becomes red, tense, painful, and tender to the touch. This inflammation may extend inwards and prove fatal, like peritonitis proceeding from any other source, or it may remain confined to the protruded viscera, and, perhaps leading in the first instance to effusion of lymph, terminate in their mortification, when the patient either dies, or recovers with a preternatural opening of the gut at the groin. The time required for the completion of this process varies extremely in its different stages. It is observed to proceed most rapidly when the patient is young and stout, and when the hernia is small and recent. It is generally more slow in opposite circumstances, but many exceptions occur, and it is never possible to predict with any precision the time that will elapse before inflammation and its consequences are induced. Mortification rarely takes place sooner than eight hours, or later than eight days after the strangulation has commenced.

The treatment of Reducible hernia consists in the use of means proper for obviating the predisposing and exciting causes of the

disease. With this view the inguinal region of the abdominal parietes should be strengthened by the mechanical support of a bandage. A timely use of this apparatus may prevent the occurrence of hernia in persons whose predisposition to the disease is manifested by a fulness perceptible in the groin during the impulse of coughing, and by a painful sensation at the same part whenever the viscera are subjected to more than usual pressure, as in making exertion with the arms, or speaking loud. The predisposition being thus guarded against, all sources of excitement must be carefully avoided. The patient should abstain from every sort of food that, by producing flatulence, causes distension of the bowels; he ought to correct any tendency that may be observed to accumulation in the intestinal canal; and he should never engage in exercises or employments that require severe bodily exertion. In the treatment of congenital hernia, it is of great consequence that the truss should be applied as early as possible, in order that the natural disposition which the parts concerned have to close at the time of birth may be allowed to exert its effect, and a radical cure be thus obtained. Beyond this age, if a bandage is ever required, it can very rarely be afterwards dispensed with.

In the treatment of Incarcerated hernia, the object should be to remove the obstacles which oppose reduction. The intestines should be unloaded by the free administration of purgatives and injections. If there is reason to suppose that the resistance to the return of the protruded parts depends on thickening and induration of the omentum, which sometimes can be felt through the parietes of the tumour, the patient should be confined to bed, restricted to a slender diet, and depleted from time to time by bleeding, or cathartics, with the view of producing, during the general emaciation of the body thus induced, a sufficient diminution of the omental mass to permit the accomplishment of reduction. In the case of adhesions existing between the viscera and sac, the only practicable mode of overcoming the difficulty would be to lay open the contents of the hernia, and separate their morbid connexions. Operations have accordingly been performed for this purpose, but their almost uniformly fatal result ought to deter all prudent surgeons from repeating such attempts. And if the gentle means above-mentioned should prove unavailing, it will be better to advise the patient to be satisfied with such palliation of his complaint as may be obtained from strict attention to the state of his bowels, abstinence from all violent exertions, and the support of a bag truss, than

to endanger his life by trying to effect a radical cure with the knife.

The Strangulated condition of hernia being attended not only with extreme suffering, but also with great and immediate danger, demands the most speedy and decided assistance of the surgeon. His first object is of course to effect reduction; and this he immediately endeavours to perform by a careful manipulation, which is named the Taxis. The patient should be laid reclining, with his shoulders and pelvis slightly elevated, to relax the parietes of the abdomen; and with the same intention, the thigh of the affected side should be bent upwards and inwards, as the *fascia lata* is thus prevented from causing any tension of the abdominal fasciæ to which it is connected. The hernial tumour is then to be grasped at its neck, and compressed with the points of the finger and thumb, which at the same time pull it slightly outwards. The size of the parts at the ring having been thus diminished, the pressure is to be directed gently but steadily upwards, in the direction of the inguinal canal. When, in consequence of this proceeding, the slightest gurgle is heard or felt, or the size of the swelling is perceptibly diminished, the reduction, in general, may be very soon completed. The larger the hernia is, the more may be expected from this manipulation, and *vice versâ*. There is almost always some serous effusion into the cavity of the sac, and in small tumours, especially those of recent production with acute symptoms, the bulk of the fluid bears a large proportion to that of the intestine or omentum. External pressure, consequently, however carefully employed, cannot possibly have its effect confined to the neck or any other portion of the strangulated parts, since, through the medium of the fluid, its force must be diffused over the whole surface, and therefore urge the entire mass against the narrow aperture by which it is required to return. While circumstances are thus opposed to the beneficial influence of pressure from without, it is obvious that the small size of the protrusion, which is often not larger than the point of the finger, and seldom exceeds that of a walnut in most cases, will afford little resistance to an effort in the opposite direction. It accordingly often happens that after the Taxis has failed, the tumour suddenly, and, as it seems, spontaneously disappears, no doubt through the operation of some internal change in the condition of the bowels or omentum.

Such being the case, in the event of the Taxis failing, it is obviously proper to use means that may produce some effect of the

kind requisite for *withdrawing* the protruded parts into the abdominal cavity. Of these may be mentioned a change of posture, by elevating the pelvis and bending the shoulders backwards, in order to make a drag on the strangulated viscera, together with the administration of enemata to evacuate the intestines, and thus lessen the resistance to return. Bleeding largely to diminish the contractile tone of the muscular fibres—using the warm bath with the same view—and in addition to it also employing opium or tobacco, with the application of cold externally, and the internal use of tartrate of antimony, or purgatives, were formerly resorted to, but have been superseded by the more efficient and less objectionable agency of chloroform.

The choice of means for the purpose of promoting reduction must be determined by the circumstances of the case. When the patient is strong or plethoric, it will always be right, in the first instance, to abstract a considerable quantity of blood. Repeated injections, or the warm bath, if it can be procured, should also be employed. The bowels having been thus, if possible, unloaded, and the spasmodic tension of the abdominal muscles, which is caused by the irritation of the disease, and reacts injuriously upon it by tightening the fasciæ which produce the stricture, having been subdued or diminished, the taxis is again to be tried. If it should fail, in the more favourable circumstances that now exist, the surgeon must think of removing the resistance by dividing the stricture with the knife. It is difficult to determine how long the operation may be safely deferred, as inflammation and gangrene supervene much more quickly in some cases than in others. The best course is to operate so soon as a fair trial has been given without success to the taxis, and the measures which promote it, especially bleeding, and the warm bath if it can be procured. It should be recollected—1. That the danger of the operation itself is very inconsiderable; and that, consequently, the patient should not, from fear of incurring it, be subjected to the greater risk, or rather almost certainty, of a fatal issue, which attends the disease when allowed to follow its own course. 2. That the progress of the bad consequences is usually rapid, in proportion as the hernia is small, recent, and tense. 3. That in small recent hernias there is least advantage to be expected from waiting. 4. That in large hernias, strangulated in consequence of congestion, there is most assistance to be looked for from the continued use of purgatives and injections. 5. That the operation is attended with least danger in cases where the

tumour is small and recent; and with most where it is large and of old standing.

When the operation is judged necessary, the patient should be brought to the edge of his bed, so as to present the groin in a favourable position. His shoulders ought to be elevated a little, and the thigh of the affected side is to be slightly bent. The operator having shaved off the hairs, makes an incision about three inches long, in the direction of the inguinal canal, beginning rather above the commencement of the tumour, and continued down the middle or most projecting part of it, towards the bottom. This incision is most conveniently accomplished by lifting up a fold of the integuments, together with as much as possible of the loose cellular tissue exterior to the tense parietes of the tumour, and running the knife through it with the back turned towards the sac. If the superficial epigastric, or any other artery of the integuments which may have been cut, threatens to bleed much, it should be tied before going further. The surgeon has then to divide the layers of fasciæ which cover the sac; and the old method of doing this was to cut them successively upon a grooved director thrust under them, so as to elevate portion by portion. Instead of a practice so tedious and perplexing, it is better to dissect down to the peritoneum, either by cutting through the fasciæ as they lie stretched upon the sac, with the hand unsupported, as Scarpa advised, or by raising them with the forceps, cutting the fold thus elevated with the knife held parallel to the sac, and then dividing each layer in succession, upwards and downwards, to the extent of the external incision. It is generally said, that the peritoneum may be recognised by a bluish appearance which it presents, owing to the presence of fluid contained within it, and by its more loose connexions than those of the superjacent parts; but these characters are deceptive; and it is fortunately not necessary that this recognition should be effected previous to opening the sac. If it is opened in the same way that has been recommended for cutting through the fasciæ, there will be no danger of wounding the contained viscera; and so soon as they are exposed, the dark colour of the intestine, and the smooth glistening internal surface of its peritoneal covering, which contrasts remarkably with the rough and bleeding external surface of the sac, and those of the fasciæ, independently of any other signs, will at once assure the surgeon that he has opened the sac. When the hernia is small, its coverings and the sac ought always to be divided first at the fundus, or bottom of the tumour, as they are

there most apt to be separated from the intestine by serous fluid, which is almost always present in more or less quantity, and sometimes constitutes the principal part of the swelling. In a small hernia also, the sac should be opened throughout its whole extent; but if it is large, merely such a portion of its neck as may be sufficient for allowing the stricture to be reached and divided. If the presence of fluid could be depended upon there would be no danger in opening the sac; but as it is occasionally, though certainly very seldom, absent, so that the peritoneal covering lies in close contact with the strangulated parts, it would be extremely imprudent in any case to operate with reliance on the protection which is thus not certainly afforded. The safest mode of proceeding is to pinch up a small portion of the sac with the forceps, and then to divide it, holding the knife parallel with the surface of the tumour. Wherever an aperture, however small, is made, fluid, if any is contained in the cavity, escapes, and the smooth shining surface of the contained viscera is readily recognised. While the forceps still retain their hold of the membrane, a blunt-pointed curved bistoury should be introduced and carried to the requisite extent, with the additional protection of the operator's finger interposed between it and the intestine.

After the protruded viscera have been exposed, the next step of the operation is to divide the stricture. This might be done in any direction, were it not that the epigastric artery and spermatic cord, lying in the neighbourhood of the neck of the sac, limit the choice within more narrow bounds. When the hernia protrudes through the internal opening of the canal, it is seated anteriorly to the cord, and has the epigastric artery on the pubic side of its neck. In cases of old standing, where the tumour attains a large size, the spermatic vessels are sometimes separated from each other, and found on the lateral, or even anterior part of the sac. In such cases, too, the obliquity of the canal becomes much diminished, and it is often at length impossible to tell, by external examination, whether the hernia is external or internal; in other words, whether it has passed through the whole course of the canal, or escaped directly through the external ring. When it is of the latter or ventro-inguinal kind, the cord lies on the iliac side of its neck, behind which it crosses obliquely downwards, and the epigastric artery is also on the same side running upwards and inwards. It appears, therefore, that if the stricture were divided by cutting towards the pubis, the epigastric would be endangered in the former case; and that, if

the knife were carried outwards, it would in the latter subject both the epigastric artery and the cord to the risk of injury. As it is often difficult, and sometimes impossible, to ascertain positively, either from the examination of the tumour, or from its previous history, whether the vessels are situated on its iliac or pubic side, the safest plan is always to cut upwards, in which direction there can never be any risk incurred. The simple probe-pointed bistoury, which has been employed for the preliminary part of the operation, is the most safe and efficient instrument for dividing the stricture. The surgeon should introduce the fore-finger of his right or left hand, according to circumstances, between the sac and viscera as high as he can, and then, feeling the stricture with its point, carry up the knife with its side turned towards the finger, until it is insinuated between the intestine or omentum and the sac, when, turning its edge upwards, he raises the handle gently but steadily, and repeats this process until he perceives that there is a free passage for his finger into the abdomen.

The late Mr Aston Key, and Mr Luke of London, have endeavoured to lessen the danger of the operation by dividing the constriction without opening the sac. The advantages attributed to this procedure, from leaving the serous membrane entire, seem more than counterbalanced by the risk of wounding the intestine in dividing the stricture, the evils which may result from returning the strangulated parts in an improper condition, and the mischief that may arise from abortive efforts to effect reduction, when it is impeded by adhesion, or other obstacles within the sac. On the whole, I am inclined to think that, as a general rule, it is better to open the sac; and that the procedure in question should be restricted to the treatment of large hernial protrusions, especially in unhealthy hospitals, where a disposition to inflammation of the serous membrane may be inferred from the frequency of erysipelas and phlebitis.

The third step of the operation consists in the management of the protruded viscera. If the hernia is recent, and inflammation has not been excited, the intestine and omentum present nearly their usual appearance, except that the former is more or less thickened in its coats, and has a dark, purple, or brownish colour. In such circumstances, the gut should be returned first by gentle pressure, similar to that employed in the taxis, and then the omentum. If effusion of lymph has taken place on the surface of the intestine in consequence of inflammation, the reduction may be

performed as in the former case, but, of course, with a less favourable prognosis. If old adhesions, existing between the surfaces of the intestine, or between them and the sac, oppose reduction, they ought to be divided when this is practicable, and when it is not, the parts must be left to themselves; the integuments being brought together, or simply covered by a pledget of ointment. It might be expected that more of the intestines would thus be permitted to escape, but it is found that when the stricture has been freely divided, the functions of the bowels restored, and the patient confined to the horizontal posture, the protrusion gradually diminishes, and finally withdraws itself into the abdomen. The same practice is proper when the *caput cœcum* has descended. Should the omentum be so thickened and indurated as not to permit reduction, it may be cut away as far as is necessary, any vessels that require ligatures being tied. But from what has fallen within my own observation, I am quite sure that it is better either to return the omentum, if possible, or to leave it still remaining in the sac, than to practise excision of the indurated portion, since there is thus incurred a risk of several bad consequences. In the *first* place, whether from the wound alone or the ligatures, which are frequently required in considerable numbers, inflammation is apt to be excited; and, *secondly*, that most troublesome and dangerous occurrence, ulceration of the intestine, is apt to happen, probably from the bowel adhering to the wounded part of the omentum, and losing the protection of its serous covering, which is slow to undergo the ulcerative process. Lastly, when the intestine is discovered by its soft consistence and fetid odour to be in a mortified state, any attempt at reduction would be highly imprudent, since the patient's only chance of escape from the fatal effusion of its contents into the abdominal cavity, depends upon lymph being thrown out and around the mouth of the sac. If this barrier be broken up, death will inevitably happen, and therefore the surgeon should either leave the contents of the hernia as he finds them, or limit his interference to laying the gut freely open, if it is not so already, after which a soft poultice, or pledget of emollient ointment, may be placed on the part. After the operation, unless circumstances should require the wound to be kept open, its edges ought to be drawn together by stitches, and have a thick compress of folded lint supported by a bandage applied over them.

When things go on well, the patient experiences relief almost immediately after the operation. The tormenting pain of the umbi-

lical region, the sickness, and the vomiting subside, the warmth of the body becomes uniformly diffused, the anxious expression of the countenance disappears, and a full, soft, moderately frequent pulse gives further indication of the salutary change that has taken place. In the course of an hour or two, one or more, usually several, copious evacuations of the bowels, shew not only that the gut has been relieved from mechanical obstruction, but that it has been restored to the due performance of its functions. Tenderness of the abdomen, or uneasiness felt in it independently of pressure, will suggest the immediate application of warm fomentations; and if it should increase, or be accompanied with acceleration of the pulse, heat of skin, thirst, anxiety, or restlessness, general bleeding and leeching of the abdomen must be resorted to without delay, decidedly and freely, so as if possible to subdue the incipient peritonitis. Opium and calomel ought at the same time to be administered in doses proportioned to the urgency of the circumstances. In consequence, probably, of the pressure which has been sustained by the gut while strangulated, and which there is reason to believe generally occasions a certain degree of constriction in the canal for a considerable length of time subsequent to reduction, the patient is frequently annoyed for days or weeks with occasional symptoms of chronic inflammation, for which gentle aperients, administered by the mouth and rectum, leeching, and the counter-irritation of blisters, are the best means of counteraction. It is not prudent to get out of bed, or, at all events, to quit the horizontal posture, until the wound is so far healed as to permit the wearing of an efficient truss, which can hardly ever afterwards be dispensed with.

When sloughing of the contents of the hernia takes place, a discharge of the intestinal matters always ensues for a time through the opening thus established in the gut. The cavity of the sac gradually diminishes, its orifice contracts, the integuments surrounding it become callous, and a preternatural anus is formed. If only a part of the circumference of the intestine has been protruded, the remaining portion allows some of the contents of the canal to descend naturally, and by degrees more of them, until little and at last none are voided in the groin, the opening of which closes, and then the patient obtains a complete cure. The process of reparation is accomplished with difficulty, in proportion to the extent of gut that has been destroyed; and when its whole circumference has sloughed, a complete loop of the intestine having been strangulated, it can hardly be effected without some artificial assistance. In this

case the two contiguous walls of the gut constitute a septum which directs the flow of matters passing through the canal so as to make them issue at the preternatural orifice; and sometimes the upper part of the tube is inverted, and protrudes through it, forming a tumour of various size in the groin. Different methods have been employed for dividing the septum, and thus promoting the natural changes that lead to recovery. Incision is dangerous from the risk of cutting too much, and allowing the intestinal matters to be effused into the cavity of the abdomen. A ligature passed through the septum by means of a needle, which was first thought of by Dr Physick of New York (1802), is more safe in the first instance, but must subject the patient to the chance of symptoms similar to those of strangulated hernia; and the plan of M. Dupuytren (1813) seems to be on the whole the best. It consists in compressing the septum between the blades of forceps made to meet very accurately, the one being received into a groove of the other, and regulated in their approximation by a screw. The pressure is thus completely under control, and can be increased, diminished, or altogether withdrawn according to circumstances.

The sloughing of a hernia is not the only cause of preternatural anus. It may be produced also by ulceration of the intestine after it has contracted adhesions to the parietes of the abdomen, or by wounds. It is always a source of extreme annoyance, and sometimes occasions dangerous symptoms, by the aperture proving inadequate to discharge the contents of the gut, while they are prevented from descending by their natural route. The treatment, therefore, deserves much attention. In the first instance, it is sufficient to keep the part clean, and prevent eversion of the upper extremity of the gut by applying gentle pressure, which is also useful by directing the feculent matters into their old channel. If the gut has become everted, it ought, if possible, to be immediately reduced; and in case this cannot be accomplished, its more gradual return must be promoted by permanent pressure, slender diet, and the horizontal posture. Should the aperture not contract, though there is no protrusion of the intestine, it may be concluded that a septum exists between the two extremities of the tube above or below the aperture; and its situation having been ascertained by careful examination, the compressing instrument of Dupuytren is to be cautiously employed. The blades of the forceps should be at first very gently approximated, and never tightened so as to occasion any disagreeable symptoms. When the piece included

is detached by ulceration, and the forceps fall off, the case must be treated by gentle pressure and attention to the bowels, as if the septum had not existed.

Femoral Hernia.

The femoral vessels descending along the inner margin of the *psoas magnus* rest upon a fascia which covers that muscle, together with the neighbouring *iliacus internus*, and also lines the cavity of the pelvis. This *iliac fascia*, as it is named, is united to the *fascia transversalis*, so as to appear quite continuous with it, when both are brought into view by stripping off the peritoneum from the inner surface of the abdominal parietes. They leave, however, an oval aperture to let the vessels pass through them, which it is necessary to consider particularly. The union of the two fasciæ is continued from the pubis for about an inch and a-half towards the ilium, in the direction of the *linea ileo-pectinea*, where it terminates by a sort of crescentic margin that is seen very distinctly when the parietes are held up and surveyed from the inner side, after the peritoneum has been removed. Where the fasciæ thus meet together, they are intimately and inseparably connected with the reflected margin of the tendinous fascia of the abdomen (tendon of the external oblique) which is attached to the tuberosity and crest of the pubis, and also with the superficial fascia of the abdomen, together with the *fascia lata* of the thigh. On the iliac side of this crescentic margin, with the interposition of some loose cellular substance and fat, the vessels lie, resting on the *fascia iliaca*, which here becomes attached to the bone, and covered by the union of the three abdominal fasciæ, which form a bridge over them that has been named the crural arch. Between the vessels and spinous process the iliac and *transversalis fasciæ* again unite, and allow the *iliacus internus*, together with the *psoas magnus* muscle, to pass under them to the *trochanter minor*. The fasciæ are here closely connected with the vessels, or rather with their sheath of dense cellular substance, in which they insensibly lose themselves when traced by dissection. The vessels are now, properly speaking, in the thigh, and become covered with the *fascia lata*, which has an oval aperture in it on their pubal side, immediately below Poupart's ligament, through which the *vena saphena* finds access to the femoral trunk. The *fascia lata*, at the margin of this aperture, loses itself on the sheath of the vessels. On their pubal side it passes up, resting on the pectineus muscle, and becomes continuous

with the iliac fascia; and on the iliac side, while uniting directly with the abdominal and pelvic fasciæ, it sends a falciform process inwards over the vessels to the pubis, so as thus to enter into the formation of the crural arch throughout its whole extent. It thus appears that the femoral is separated from the inguinal canal merely by the *fascia transversalis* and reflected margin of the tendinous fascia (tendon of the external oblique).

When the viscera protrude through the space between the vessels and crescentic margin of the crural arch, they constitute what is called a Femoral Hernia. The sac in this case is covered by no fascia, properly speaking, having superjacent to it merely the loose cellular substance which occupied the passage, and the thick mass of cellular substance, glands, and fat, which lies in the triangular hollow at the upper part of the thigh between the pectineus and sartorius muscles. This irregularly laminated and tough tissue, when stretched by the tumour, often presents, on dissection, the appearance of layers, but these are very variable in number, as well as thickness, and cannot be distinguished in an operation. The fasciæ, therefore, are interesting in regard to femoral hernia, merely in so far as they constitute the stricture that opposes the reduction of the bowels.

The causes of femoral, like those of inguinal hernia, are predisposing and exciting. The predisposition to femoral hernia is nearly as much greater in the female as that to inguinal hernia is in the male, owing to the breadth of the pelvis in the former sex, and the consequent width of the female apertures. The exciting circumstances are similar to those that have been mentioned, but are apt to be assisted in their operation by the distended state of the abdomen to which females are liable from pregnancy; and many of the femoral hernias which occur in practice are accordingly referred to the violent expulsive efforts of parturition. The ileum and omentum are the parts usually protruded. The tumour is generally of a small size, and sometimes can be discovered only by feeling in the situation where it is suspected. On account of this circumstance, which is apt to conceal the disease from the patient, and also because females are apt to be prevented by feelings of delicacy from disclosing its existence, it is prudent on all occasions, where symptoms indicative of hernia are complained of, to insist upon an examination of the groins.

The diagnosis of femoral hernia is often more difficult than that of inguinal. When reducible, it may be confounded with psoas

abscess pointing under Poupart's ligament, and in the two other conditions of incarceration and strangulation it is frequently distinguished with difficulty from swelling or inflammation of the inguinal glands. If the tumour depends on a reducible hernia, it will disappear under moderate pressure, or by assuming the horizontal posture; but if it is owing to a collection of matter, though lessened perhaps, it will not be entirely removable by pressure, however carefully applied, so long as the patient remains erect. From chronic swelling, or acute inflammation of the glands, it may be distinguished by the thickness and fixture of its neck—its more smooth and globular surface—and generally by its history. If a hernia, the tumour will either have existed for a length of time previously, and given indication of its nature by some of the characteristic symptoms, or have appeared suddenly in consequence of a violent exertion. Glandular swellings again, if chronic, will probably have had their nature ascertained, and if recent, are usually connected with some source of irritation that leads to their recognition. It is important, however, to know that the glands *may* become suddenly large and painful in consequence of the strain from a violent effort, in which case sickness, vomiting, and constipation, are not unfrequently induced by the irritation. Enlarged glands also occasionally exist along with a hernia, and render its diagnosis by examination extremely difficult, and even sometimes impracticable. In all cases of doubt, when other means fail in affording relief, it is the duty of the surgeon to cut down upon the swelling, and ascertain its nature. The symptoms of femoral are the same as those of inguinal hernia. But it is observed, that the bad consequences of strangulation are particularly severe and rapid in their progress, which is no doubt to be ascribed to the small size of the protruded portion of intestine, and the extreme tightness of the stricture.

The treatment of femoral hernia is to be conducted on the same principles which have been fully explained above. If it is reducible, a truss should be carefully worn afterwards; and it is here even more necessary than in obviating the predisposition to inguinal rupture to fit the bandage properly. The cushion should be more convex, and it may be requisite to prevent its displacement upwards by an additional strap passing round the thigh. When incarcerated, it should be subjected to the measures that favour reduction; and if it resists, must be prevented as much as possible from increasing by the compression of a suspensory bag. It may be

observed, that femoral hernia is rarely met with in this state. Lastly, in case of strangulation, the taxis, together with its subsidiary means, if necessary, must be had recourse to without delay, so that no time may be lost in dividing the stricture, if this should prove the only resource.

In performing the operation it is generally better, on account of the smallness of the tumour, and thickness of the superjacent parts, to make, instead of a simple incision, one in the figure of the letter T. The transverse part of it should be as high as the neck of the swelling, that is, close to Poupart's ligament, and is most readily effected by lifting up a fold of the skin, together with as much as possible of the parts below that can be separated from the sac, and running a knife through it with the back turned towards the sac. The surgeon may then cut safely from the centre of this incision downwards, to the same depth with it. He next lays aside the two small flaps thus formed, and proceeds to expose the sac, by raising and dividing with the forceps and knife the layers of condensed cellular substance which cover it. If glands come in the way, they must be dissected off the hernial tumour; and when the sac is approached, the operator should be particularly careful to elevate the layer he wishes to divide at the fundus or most projecting part of the bag, as there is here most fluid between it and the enclosed intestine. In cases of femoral hernia requiring operation, the contents of the tumour are almost always recently protruded, and therefore seldom present those adhesions or other morbid alterations which frequently render the inguinal operation so embarrassing.

The direction in which the stricture should be divided has afforded fruitful subject of discussion. If the knife is carried upwards, so as to cut through the crural arch, it must evidently endanger the spermatic cord or round ligament. This, therefore, which was the old operation, is decidedly objectionable. Gimbernat of Madrid observed (1793), that the stricture in femoral hernia on the pubic side of the neck of the sac was not situated, as had been erroneously believed before, at the tuberosity of the pubis, but at the distance of between one and two inches from it, and was formed by what is now called the crescentic margin of the crural arch. The attachment of the fasciæ to the bone, between this point and the tuberosity of the pubis, has been named Gimbernat's ligament, —an appellation which, by conveying the idea of a distinct independent structure, has occasioned much confusion. Having ascertained this important anatomical fact, Gimbernat introduced a new

method of relieving the stricture, which was to cut inwards from the neck of the sac towards the pubis. He operated very rudely, by passing a grooved director and bistoury between the intestine and stricture into the abdomen, and then separating them so as to make a very free division of the fasciæ, and thus endanger the bladder, or even the uterus if distended. The principle of the operation, however, being good, was adopted in practice, and would probably long ere now have been invariably acted on, were it not that, in *post mortem* examinations of femoral hernias, the obturator artery has been found rising from the epigastric or external iliac and encircling the neck of the sac. This origin of the artery is now ascertained to be far from unusual, but there is reason to doubt that the vessel will often allow the hernia to protrude between it and the trunk from which it rises, so as to lie on the pubal side of the sac, and be in the way of the knife; and even though it were to be so situated, there seems little danger of cutting its coats in dividing the stricture, provided this part of the operation be properly performed. The tumour, which is generally very small, depends principally on fluid accumulated in the sac, and the portion of intestine subjected to strangulation is often no larger than the point of the finger; but even though it should equal in size a pigeon's egg, which it seldom exceeds, a very slight dilatation of the stricture is sufficient for permitting reduction. Instead of the coarse and dangerous procedure of Gimbernat, therefore, the division of the tight edge of the fasciæ should be effected very gently and cautiously. The surgeon having introduced his fore-finger into the sac close up to its neck, with the nail turned towards the intestine, feels for the crescentic margin of the fasciæ, or rather for its situation, since in cases requiring an operation the stricture is too tight to permit the smallest part of the finger to be passed through. He then carries up a blunt-pointed slightly curved bistoury along his finger, towards which the flat side is turned, and carefully insinuates its point within the stricture, which being accomplished, he turns the knife so as to direct the cutting edge to it; and if sufficient dilatation is not thus obtained, he presses the edge of the knife on the tense fibres without using any sawing motion. As room is gained, he presses his finger gradually forwards, until he feels that the point is fairly within the abdominal cavity, when he may be sure that enough has been done. It often happens that, immediately upon the return of the protruded viscera, a quantity of serous fluid escapes from the abdomen, which has an alarming

appearance, but is not of the slightest consequence. The after-treatment of the patient should be conducted on the same principles which have been explained in regard to inguinal hernia. It may here not be improper again to notice the question, whether, in operating for hernia, it would not be better to relieve the stricture without cutting into the cavity of the peritoneum. The advantage contended for in favour of the latter practice is its lessening the risk of inflammatory consequences. In opposition to it many strong objections will readily appear,—as, in the *first* place, the difficulty, or rather impracticability of safely dividing a tight stricture without the assistance obtained from introducing a finger into the sac as a guide for the knife; *secondly*, the inefficiency of pressure to reduce the protruded parts, unless the orifice through which they have escaped be rendered very free indeed, so long as it operates through the medium of fluid contained in a bag; *thirdly*, the fear of returning the sac along with the viscera, in which case strangulation may still be maintained by its narrow neck; *fourthly*, the ground for believing that the neck of the sac is in general much concerned in causing the strangulating constriction, so as to require division no less than the fascial stricture itself; and, *lastly*, the chance of returning the intestine in a state improper for reduction, or of being foiled in doing so from adhesions or other morbid changes, requiring free inspection, and the use of the knife for their removal.

Umbilical Hernia.

Children are sometimes born with a malformation of the abdominal parietes, which exposes the peritoneum of the epigastric region to view, and allows the viscera to protrude, notwithstanding any pressure that may be employed to prevent them from doing so. Such imperfectly formed beings generally die soon after birth; and if they survive, must labour permanently under the inconvenience which attends the unprotected condition and displacement of their bowels; all that art can do being to afford some mechanical support, where the parietes of the abdomen are defective, by means of a firm case of leather or other suitable material. But, independently of this defective structure, the viscera may be protruded through the umbilical aperture, or passage for the vessels of the fœtus, the thin skin which is formed after the separation of the cord being distended by the sac of peritoneum. Such an occurrence can take place only within a short period after birth,

since the umbilical opening subsequently becomes obliterated, and occupied by a firm unyielding cicatrix. Hernia occasionally appears in the adult near the umbilicus; but then it is always situated in a preternatural aperture, and is said to be Ventral. True umbilical hernia in the adult is always congenital.

In the treatment of this species of hernia, it is of great consequence that reduction should be effected and maintained while the aperture still retains its disposition to become obliterated, so that a radical cure may be effected, and the patient saved from the necessity of wearing a bandage permanently. In children where there is no malformation, and merely a relaxation of the umbilical opening, this may in general be easily accomplished, by returning the protruded viscera, then placing a conical-shaped compress, such as a nutmeg enveloped with lint, on the opening through which they passed, and, lastly, affording sufficient pressure by applying cross straps of adhesive plaster. This attains the object better than a circular bandage, which necessarily compresses the general cavity of the abdomen, and thus, though it counteracts the predisposition by strengthening the parietes, tends to excite the disease. In the slight degree of this complaint, usually met with in infants, which merely presents the appearance of a thimble-like protrusion from the umbilicus, it is not necessary to employ any means of treatment, as the parts soon assume a normal state through spontaneous contraction. In adults such simple measures are not sufficient, and more powerful pressure is required. The best apparatus for the purpose consists of two broad circular cushions, one of which is placed on the back, and the other opposite the seat of the hernia, which may be connected by a spring with any requisite degree of force. Additional security for this bandage can be readily obtained, if found necessary, by means of straps passed under the perineum, or brought over the shoulders.

Incarcerated and strangulated umbilical hernia should be treated on the same principles as those which have been explained. When the operation is judged requisite, a crucial incision should be made through the integuments, having the most prominent part of the tumour for its centre, unless the hernia is very large, when it will be sufficient to make a simple incision two or three inches long, at the base of the swelling, directed towards the centre. The sac is to be exposed and opened in the same way that has been already described, and the stricture may be divided on any side, or, what is better, on several sides, so that no one is cut very extensively.

The omentum is in this situation apt to cover the viscera, and ought to be carefully disengaged from them before being either cut away or reduced.

Ventral Hernia.

What has been said regarding umbilical hernia will apply in all respects to ventral hernia, with the exception, that a radical cure is impracticable, and that, as the disease is almost exclusively confined to adults, some powerful means of compression are always required. Protrusions of this kind are not common, and when they do occur, are generally situated in the *linea alba* near the umbilicus; but the records of surgery shew, that they may take place in almost every part of the abdominal parietes.

Hernia Dorsalis, or through the Ischiatic Notch, *Hernia* of the *Foramen Ovale,* and *Hernia* of the *Perineum,* are so extremely rare that it does not seem necessary to detail the particulars of the few cases in which they have been observed. In a case of perineal hernia that came under my notice, the patient, a middle-aged female, made a narrow escape, from having the tumour opened instead of an abscess. The swelling was larger than a turkey's egg, and lay between the anus and tuberosity of the rectum.

Internal Hernia.

Under this title are comprehended two marked conditions, very different in regard to their diagnosis and treatment. In one of them the strangulation is caused by the constriction of some preternatural adhesion or band, which has resulted from inflammation taking place within the abdominal cavity. On such occasions, interference, though occasionally attempted, does not seem warrantable, on account of the obscurity which must prevent the diagnosis from ever being quite certain, the difficulty of disentangling the intestine—often a tedious and operose process, even in the dead body—and the extreme danger resulting from such exposure, handling, and cutting of the viscera. Even in circumstances apparently the most desperate, the chance of spontaneous recovery must exceed that of escape from the effects of an operation attended with so much risk and so little promise of success.

In the other form of the disease, which may more correctly be denominated Internal Hernia, the case is very different, the seat of constriction being the neck of a sac, which may be distinctly recognised and is safely accessible. This sac is formed by protrusion of

the peritoneum through one of the apertures of the abdominal parietes, which constitute the ordinary seat of hernia, more especially that of the inguinal canal, and produces the effect in question by having been reduced into the abdomen together with the portion of intestine contained in it. In one case that came under my care, the sac had not been protruded for many months previous to the symptoms of strangulation, and therefore may perhaps have for some time existed in an empty state. But in general the reduction takes place during the period of strangulation, and is effected by external pressure employed for the taxis. The diagnosis is therefore rendered distinct by the symptoms persisting after the tumour disappears, and may usually be confirmed by carefully examining the seat of protrusion, where a sense of fulness or resistance is perceived when pressure is made over the internal tumour.

When the history of the case and the existing symptoms afford ground for believing that the sac has been reduced, together with its strangulated contents, no time should be lost in affording relief. For this purpose a free incision having been made, so as to expose the spermatic cord, the operator introduces his finger through the external ring under the tendinous expansion of the external oblique muscle, and divides it directly upwards with a blunt-pointed bistoury, to the extent of an inch or more, if necessary, to bring the bottom of the sac into view. It generally then protrudes, and admits of being treated as in ordinary cases of hernia; but if it does not do so, even when the patient coughs, may be readily seized with forceps, and drawn fairly into view. In the case above alluded to, where the strangulation had taken place within the abdomen, I found no difficulty in executing the process as just described, and with complete success. It is matter of much regret that this mode of relief has been adopted in a comparatively small proportion of the cases requiring it which have hitherto occurred, and in general at a period of the disease so advanced as to preclude any chance of recovery; but the attention which has of late years been devoted to the subject will, it is hoped, render the practice in future more satisfactory and creditable to the art of surgery.

Iliac Abscess.

Collections of matter are sometimes formed in the iliac or inguinal regions, lying between the parietes of the abdomen and the peritoneum. As the gut on the right side is in this situation partly uncovered with peritoneum, there is a risk of ulcerative

absorption being induced in its coats by the pressure of the confined fluid, so as to form a preternatural opening into the *caput cæcum*, which may become a stercoraceous fistula if the integuments also give way. To prevent this occurrence, it is right in such cases to make an early aperture. This complaint is met with most frequently in females soon after delivery, but is not confined to this condition; and I have even met with it, though certainly very seldom, in patients of the other sex. The abscess is generally of a subacute character, and, from its insidious formation, is apt to escape recognition.

CHAPTER XVIII.

PELVIS.

Imperforate Anus.

DEFICIENCY or imperforation of the anus is a congenital disease, and exhibits several varieties which must be distinguished in practice. Sometimes the rectum is completely formed, with the exception of having its orifice closed by a thin membrane, which allows the dark colour of the meconium to be discerned through it. This obstruction, instead of existing at the extremity of the gut, may be situated a little above it, so as to require the introduction of a finger or probe for its discovery. The rectum is also occasionally found to be deficient at its lower part, becoming nearly or altogether impervious at the distance of an inch or more from where the anus ought to be. In such cases, there is not unfrequently a communication between the intestine above the obstructed part and the vagina of the female, or the urinary bladder of the male, the former of which complications has sometimes proved sufficient for affording passage from the bowels during the course of a long life.

The symptoms of imperforate anus are swelling and tension of the abdomen, vomiting, and absence of the usual evacuations from the bowels. If the child is not relieved by having an aperture effected for the escape of the confined feculent matters, it must speedily perish,—and an examination of the rectum should therefore be always instituted without delay, when there are symptoms indicative of obstruction, and more especially when there is no discharge of meconium.

In case of simple closure, without deficiency of the gut, the membrane should be freely divided in a crucial direction with a probe-pointed bistoury, guided on the finger. To prevent contraction of the wound, it will be necessary to introduce daily, until the cure is completed, a tent of lint smeared with some unctuous matter. If there is no appearance of an anus, and the lower part

of the rectum is wanting, the prognosis must be very unfavourable, since such a malformation is usually associated with other imperfections of the system; and though it should not be so complicated, is remedied with great difficulty, as the opening made by incision through the integuments and subjacent tissues, even if it reaches the rectum, and suffices in the first instance for allowing the evacuations, is very apt to contract, or become almost obliterated notwithstanding every care that can be taken to prevent it from doing so. The child should be placed upon its back, and have its thighs held up so as to expose the parts fairly to view. The surgeon then makes an incision about an inch in length in the mesial plane, having its posterior extremity about half an inch distant from the *os coccygis*. Making way with the knife, he introduces his finger in the direction of the hollow of the sacrum,—and if the gut is near, he will discover it by the fluctuation of its contents. If he succeeds in puncturing the coats of the intestine, the opening is to be enlarged to a suitable extent, and prevented from closing by the introduction of a tent. But if he fails in finding the gut within the distance of at most two inches from the surface, he need not prosecute the search further. In cases where a communication exists between the rectum and bladder or vagina, assistance may be derived in discovering the obstructed extremity by introducing a director through the preternatural passage into the cavity of the intestine. There are some cases on record in which life has been preserved by cutting into the colon, but such attempts can hardly be recommended.

Stricture of the Rectum.

Stricture of the rectum sometimes, but very rarely, exists as a congenital imperfection, and almost always depends upon changes in the structure of the coats of the intestine taking place in the progress of life, especially during its middle and later periods. Like stricture of the œsophagus, it may be caused either by simple contraction, with thickening and induration of the gut, or by morbid degeneration of its constituent tissues, in which case the resulting tumour is usually of a carcinomatous nature.

The symptoms of simple stricture are painful and imperfect evacuations of the bowels,—the desire to empty the rectum continuing after the most powerful and prolonged efforts of expulsion,—the discharge of fluid matters with great force, as if from a squirt,—the appearance of the solid evacuations in the form of slender cylinders or small round masses,—and the admixture of a

large quantity of mucus, often bloody, with the feculent excretions. The disease generally manifests itself very insidiously, and before long is usually accompanied with a distended state of the abdomen, which is owing partly to retention of the intestinal contents, and partly to a tympanitic condition induced by the irritation. The desire to empty the bowels becomes at length almost incessant, and the frequent attempts which are made to do so being seldom followed by any evacuation except of fluids, there is a risk of erroneously supposing that the patient labours under diarrhœa, and with this view of prescribing astringent or other kinds of constipating medicines, which have a tendency to increase the distension of the intestine. In all cases of doubt, an examination should be made with the finger or a bougie, to ascertain positively whether or no there be a stricture. It is generally found about two inches or two inches and a half distant from the orifice, but may be situated much higher up; indeed, some practitioners allege that they are able to detect constrictions of the sigmoid flexure of the colon. The greatest tact and dexterity cannot insure even a moderate approach to certainty, in exploring the width of a canal so capacious and loosely connected as the upper part of the rectum and the sigmoid flexure of the great intestine, as the coats are extremely apt to be pushed before the point of the bougie, and in different circumstances lead to the belief that there is a stricture when there is none, or that there is no contraction when it actually exists. It is often erroneously supposed that a stricture exists about five or six inches up the gut, owing to the resistance caused by the promontory of the sacrum to the introduction of a bougie. The difficulty of obtaining satisfactory evidence as to the existence of stricture in these situations is the less to be regretted, as it is almost always seated within reach of the finger, which cannot be deceived; and if beyond this extent, may be deemed quite irremediable. Unless the patient be relieved, general emaciation is gradually induced by the continual distress and derangement of the intestinal functions. Hectic irritation follows, and death may be the ultimate effect, either from gradual exhaustion or from inflammation of the bowels. The progress of the disease is usually very slow, and years may elapse before the symptoms are sufficiently severe to excite attention, their insidious approach rendering the patient unaware of their presence, even when distinctly marked. In carcinomatous contraction of the rectum, the patient suffers the symptoms which have been described, and also those attendant upon that kind

of morbid degeneration, viz., lancinating pains, not constant but severe, an almost cartilaginous hardness of the rectum, which is felt if the finger be introduced to the diseased part, and frequently extends to the skin surrounding the anus; also, when the disease has advanced to the ulcerated stage, a fetid sanious discharge from the anus, together with involuntary evacuation of thin feculent matters. In females, a communication with the vagina is often established, and allows the contents of the bowel to escape by it. The appearance of the patient further characterises the nature of the case, being thin and cachectic-looking, and exhibiting the greenish-yellow complexion usually observed in persons labouring under malignant disease.

In treating simple stricture of the rectum, if it should appear that the contraction depends on congenital malformation, which, it is important to know, sometimes escapes observation until an advanced period of life, the best course is to divide the constriction freely with a knife, and afterwards interpose dressing sufficient to prevent immediate closure of the wound or its subsequent contraction. But if the stricture be the result of diseased action in the coats of the gut, which has caused thickening and induration of them, the best remedy consists in the introduction of bougies successively increased in size, which, by inducing interstitial absorption in the parietes of the intestine, gradually restores them to a natural state. Bougies for this purpose are employed of various materials, such as steel, elastic gum, wood, and glass. The two first are the best. They should be slightly curved to facilitate their entrance into the rectum, and, if metallic, have a bulging extremity to render their passage through the stricture more distinctly perceptible. Before being used, they ought to be heated by immersion in warm water, and anointed with some unctuous substance. There is no advantage in allowing them to remain for any length of time after being introduced. They should therefore be immediately withdrawn, and ought not to be employed again before an interval of three or four days. Cancer of the rectum is no less incurable than in other situations, and, of course, could not be excised without inflicting a mortal wound, unless of small extent, and confined to the verge of the anus; all, therefore, that can be done for the patient in such unhappy circumstances, is soothing the irritation of the disease by opiate injections, the hip-bath, and gentle laxatives.

Fissures and Ulcers of the Rectum.

M. Boyer, in his System of Surgery,* describes, under the title of Gerçure, or fissure of the anus, a very troublesome affection, which had previously been almost entirely overlooked. It consists, according to him, of one or more small superficial ulcerated chops, lying in the direction of the radiated folds of the anus, but rather more internally, so as not to be visible without a forcible separation of the nates. The distinctive symptoms of the disease are, pain in the region of the anus, aggravated during evacuation of the bowels, and such a close constriction of the sphincter as renders the introduction of a finger, or even a much smaller body, insufferably painful. It may occur at any age, but is most frequently met with at and before the middle period of life, and in males much more frequently than females. The patient at first merely feels pain for some time after evacuations of the rectum, and suffers no further inconvenience in the intervals between them. As the disease advances, he experiences more severe and continued distress; pressure of any kind, as that which proceeds from sitting, occasions great uneasiness; and constipation is induced, which, by causing induration of the feculent matters, renders the symptoms still more intense. Mucus, sometimes tinged with blood, is copiously discharged; when the nates are separated, the anus appears to be absent, owing to the close contraction which it suffers from the inordinate action of the muscle; and if an attempt is made to introduce the finger, the patient involuntarily springs beyond the surgeon's reach. Any circumstances productive of local or general irritation tend to aggravate the patient's suffering; and those of an opposite kind occasionally procure for him intervals of comparative ease. The pain is especially referred to the situations which the chops occupy. The causes of the disease are not well ascertained.

For the cure of this complaint, Boyer considered it necessary to divide the *Sphincter ani*, and such has been deemed the only certain means of remedy. Beginning my practice under this impression, I gradually limited the extent of incision, and have long felt warranted to state, that so far from division of the whole muscle being required, cutting the mucous membrane alone is sufficient. In short, the essential of the operation is, converting the fissure into an incision; and for this purpose, instead of the deep gash described

* Tom. x. p. 125. (1825.)

by M. Boyer, I merely insert the point of a sharp-pointed curved bistoury at the lower end of the chop, and bring it out at the other extremity, so as to pass under the base and insure its complete division. The small wound thus inflicted scarcely requires any dressing, and the patient is at once relieved.

There is a form of this disease which frequently occurs, but is seldom recognised, though the symptoms are well marked, and the sufferings of the patient so great that its discovery is of no small consequence, especially as the remedy is equally simple and certain. This is an ulcer seated immediately within the sphincter, where, of course, it cannot be brought into view by the most forcible separation of the nates, and admits of detection only by examination with the finger gently introduced, and carried round the circumference of the gut, so as to feel the condition of its surface. The ulcers have an elongated form, and rarely exceed half-an-inch in length, not deep, but indurated at the margin, which facilitates their recognition. The patient's acute pain when pressure is made on the ulcerated surface also assists in the examination.

The symptoms of this ulcer of the rectum are similar to those attending fissures of the anus. There is the same pain *after* going to stool,—the same uneasiness in sitting, when the patient may be observed to rest with one hip on the corner of his chair,—and the same slimy discharge from the bowels. Uneasy feelings in the urinary organs are very generally complained of, especially a disagreeable sensation in the perineum, and frequent desire to make water, with more or less pain in doing so. I have met with instances of twenty or thirty years' misery from this source, aggravated by an endless variety of treatment, sometimes sufficiently severe, directed to the urethra by fashionable practitioners in this department of practice both at home and abroad.

When the presence of such an ulcer has been recognised, the patient may be relieved by the following no less simple than certain procedure. The operator having gently insinuated the point of his fore-finger, well-oiled, far enough to feel the exact situation and extent of the ulcerated surface, places the point of the sharp curved bistoury at the margin of the anus, and pushes it upwards so as to pass under the base and issue into the gut above the summit of the ulcer, after which the incision is completed. It thus resembles that which has been described above for the remedy of *Fissures*, and requires the same treatment, or, rather, is equally independent of any.

Foreign Bodies in the Rectum.

Foreign bodies are introduced into the rectum either by descending through the intestinal canal, or by being forced through the anus. They are prevented from escaping by their size, or shape, or by both of these circumstances. Concretions of indigestible matters, swallowed along with the food, or indurated masses of the ordinary feculent substance, may obstruct the gut. Fish-bones and other hard bodies of a spicular form, after passing through the whole length of the intestines, are sometimes detained by the *sphincter ani*. Pieces of wood, glass, earthenware, and other matters, have been accidentally lodged in the rectum, by patients endeavouring to procure evacuation of their bowels, and still more rude articles have been forced into it in consequence of falls on the breech. The symptoms of course vary with the bulk and figure of the foreign body. If it merely obstructs the passage, the patient suffers only from constipation, together with more than usual uneasiness and sensation of weight in the region of the rectum; and if the coats of the gut are punctured or lacerated, the additional symptoms of bloody mucus, or blood discharged by stool, and pain more or less acute, will indicate the nature of the case. But the only method of acquiring certain information as to the state of matters is to make an examination with the finger, and this ought always to be done when there is any reason to suspect the existence of a local cause of irritation or obstruction in the rectum.

For effecting the removal of foreign bodies from the rectum, different means must be employed, according to the circumstances of the case. Feculent masses should be softened by repeated injections of soap and water,—after which they are, if possible, to be broken down with a scoop, the handle of a spoon, or forceps, or, if this cannot be effected, extracted entire by the same means. Hard, pointed substances are best withdrawn by straight or slightly curved forceps, guided with the finger, so as first to dislodge, and then extract them. If they cannot be got out entire, another pair of forceps should be employed to break them into fragments, while the principal portion is held steady with those first introduced. When the difficulty proves extreme, it will be much better to make a free division of the integuments and sphincter, than subject the intestine to the risk of injury from violent efforts at extraction.

Hemorrhoids.

By Hemorrhoids, or Piles, are understood tumours of different kinds which are met with at the verge of the anus, either without or within the sphincter,—in the former of which cases they are said to be external, and in the latter internal. They sometimes depend on a varicose condition of the hemorrhoidal veins, which form round, tense, dark-coloured swellings,—but they more frequently consist of a morbid growth of the skin or mucous membrane, and subjacent cellular tissue. When external, they are of a round or flattened form, and except when suffering from inflammation, possess the natural appearance and consistence of the part. When internal, they are very vascular, generally of a florid colour, and uneven on the surface like a strawberry. External hemorrhoids occasion little inconvenience, unless irritated or inflamed, when they become much enlarged, round, tense, and extremely painful, especially if subjected to pressure. But those of the internal kind are productive of more continued distress, by protruding from slight exertions, or bleeding at stool, or exciting sympathetic uneasiness in the urinary organs. These symptoms are not always equally severe, but, while hardly ever absent altogether, are apt to suffer occasional exacerbations, in consequence of general or local irritation, which constitute what are called fits of the piles. They exist sometimes together, sometimes separately, and one patient may complain merely of protrusion of the bowel, or bleeding from it, while another refers his sufferings entirely to the bladder. The disease is often not detected until an examination is made by the surgeon, and this, therefore, should always be done when the symptoms are at all suspicious.

The circumstances that chiefly tend to produce, and also aggravate hemorrhoidal excrescences, are excitement of the digestive and generative organs, constipation, sedentary occupations, pregnancy, and exposure to cold or wet, which, by deranging the actions of the system, is apt to excite local inflammation, especially in parts having already a morbid disposition. It follows that the most effectual means of preventing the disease consist in using regular diet and exercise, avoiding excesses of every kind, and obviating constipation, if it should occur, by suitable medicine or regimen. Similar attention will palliate the symptoms; but during the paroxysms it is often necessary to maintain the horizontal posture, to facilitate the evacuation of the bowels, by administering laxative doses of castor oil and emollient injections, and to allay

the inflammatory condition of the parts affected by warm fomentations, the hip-bath, and leeches applied round the margin of the anus. Much relief is often obtained in the chronic state of the complaint, by regularly injecting a pint of water a little before the ordinary time of having a stool, or applying to the tumours an astringent ointment composed of powdered galls and axunge, or by introducing occasionally as large a bougie as can be passed. But to effect a radical cure it is necessary to remove the excrescences, which may be done either by the knife or ligature. In regard to external piles there can be no doubt that excision is the preferable mode, being much more speedy, and attended with less pain. It may be performed either with a knife or scissors, while the excrescence is held steady with a hook, forceps, or the finger and thumb. There is seldom bleeding of any consequence, and if a vessel should throw out a jet, it can be readily tied. The excision of hemorrhoids from within the sphincter, owing to the greater vascularity in this situation, and the difficulty of applying pressure or styptics to the cut surface, is attended with the danger of hemorrhage so profuse as to be very alarming, or even prove fatal, and is also apt to excite a no less dangerous inflammation. In such cases the ligature ought to be preferred, as it is perfectly safe, and has the advantage of so altering the structure of any portion of the excrescence that may have been permitted to remain, through the inflammation, and consequent adhesive effusion or sloughing which is caused by its irritation, as to prevent a relapse of the disease. When the patient, by straining at stool, has caused the whole mass of excrescences to protrude, the surgeon should tie them close to their roots with silk threads as tightly as he can. He may do this either by transfixing them at the base with a needle, and then including a half of each in one of the threads, or if they are small, seizing them with a hook or forceps, and applying single ligatures. The overted gut and tumours should then be carefully replaced, and the patient should not quit the horizontal posture until the ligatures separate. If he suffers much irritation, which is seldom the case, he will derive most relief from doses of the muriate of morphia, repeated as often as may be necessary, and the hip-bath. Retention of urine is a frequent consequence of the operation, and may require the introduction of a catheter. In the piles depending upon a varicose state of the veins, relief may be afforded during the inflammatory paroxysm by puncturing the distended vessels and squeezing out their coagulated contents.

Polypus of the Rectum.

Vascular growths from the mucous lining of the rectum, having a rounded form, and narrow elongated neck, so as to resemble a cherry, are occasionally met with in the vicinity of the anus. They protrude at stool, and occasion various unpleasant feelings, besides sometimes giving rise to copious hemorrhage. They should be removed by ligatures, which may be applied either simply or by transfixion.

Prolapsus Ani.

Prolapsus Ani denotes a protrusion of the intestinal coats through the anus, so as to constitute an external tumour. The extent to which this occurs varies from the slightest eversion of the mucous membrane immediately within the sphincter, to the descent of the whole thickness of the gut for a considerable part of its length. In cases of the latter kind it is probable that the sigmoid flexure of the colon is the part of the intestine that protrudes, since it is difficult to conceive how the rectum could suffer the requisite displacement. Whatever portion is forced beyond the sphincter has its circulation impeded, and consequently becomes thickened and livid. When the mucous membrane alone is everted, it presents the appearance of a ring; but when there is prolapsus of all the coats, the tumour is globular, varying from the size of an egg to that of a child's head, and affords a copious secretion of bloody mucus, which very much resembles red currant jelly.

Prolapsus of the whole thickness of the gut, or what may be called complete prolapsus, occurs chiefly in children and aged persons, especially females of relaxed frame. That of the inner membrane, or partial prolapsus, is generally observed in the vigour of life. The exciting causes of the former are, in children, severe or long-continued straining at stool; and in adults, generally, violent exertions, as in lifting weights on the back. Some local irritation, as that of ascarides in the rectum, or stone in the bladder, is often concerned in producing the disease in young persons, especially when it attains a great extent. The partial prolapsus, which is usually met with in adults, depends upon the presence of hemorrhoids.

An attentive consideration of the circumstances which have just been mentioned will indicate the preventive and remedial measures that promise to be most beneficial. In treating the complete prolapsus of children, it is necessary, in the first place, to remove any local source of irritation that may be discovered to exist; and, should there not appear to be some such exciting cause, the patient

must be prevented from straining long or violently at stool, by having his bowels kept in an easy state, and by being placed on an elevated seat, which will not permit his feet to touch the ground, and consequently render it difficult for him to bend his body forwards, which makes the pressure of the diaphragm act more directly on the contents of the pelvis. The partial protrusion that occurs in adults, requires for its remedy the removal of hemorrhoidal excrescences, whether external or internal,—the prevention of constipation by suitable regimen and medicine,—and the use of injections thrown into the rectum. When there is much relaxation, and consequent tendency to prolapsus, it will be observed that the integuments round the margin of the anus, when the gut has been replaced, are not tense and smooth, but loose, and thrown into radiating folds. M. Dupuytren proposed to cut away some of these folds, and, by thus diminishing the extent of the redundant skin, while consolidation of the remainder was induced by the adhesive process following the inflammation excited by the operation, radically cure the disease. Mr Hey of Leeds, with a similar view, removed the whole of the loose skin. This excision is easily performed, and though not so effectual as might be desired, ought to be tried when other means have failed in affording relief. Scissors curved on the side are the most convenient instruments for the purpose, and superficial dressings ought to be applied after the operation. Sometimes the ring of the prolapsed membrane, from inflaming, becomes permanently protruded, and the patient, who suffers constant pain, can neither walk nor stand. In these circumstances, the whole of the protrusion may be cut away with perfect safety and complete relief, immediate as well as permanent. The disease is best treated, however, when in its ordinary state, and free from inflammation. It is then easy to ascertain the exact extent of hemorrhoidal swelling concerned, and employ the requisite measures. In every case, the whole of the internal piles should be removed by ligatures, and after they have been tied, any of the external kind that appear are to be carefully cut away, together with the loose redundant integument surrounding the orifice of the gut. In all operations at this part, it should be a rule never to leave any hemorrhoidal growth, either external or internal, since the portion permitted to remain will be almost sure to inflame and prove troublesome.

The tumour that is formed by prolapsus of the whole thickness of the intestine, whether occurring in children or adults, is in general very readily reduced by slight pressure, provided the expul-

sive efforts have ceased, and the patient assumes the horizontal posture. Occasionally, however, from the parts being allowed to remain for hours, or even days protruded, the intestinal coats become greatly thickened, consequently increasing the size of the swelling, and rendering replacement of the gut more difficult. A manipulation, similar to that of the taxis, must then be carefully employed, after the surface of the tumour has been lubricated with oil. The neck, or part next the anus, is steadily compressed with the fingers, and then pushed upwards through the ring which is formed by the sphincter. Successive portions are to be returned in the same way, until the remaining portion is so small as to admit of being pushed up at once.

Fistula in Ano.

Abscesses frequently form in the neighbourhood of the anus, and, owing to the laxity of the cellular and adipose textures in this situation, are apt to diffuse their contents extensively up along the gut, and into the hip or perineum. When evacuation is allowed to take place naturally by ulcerative absorption, the opening is generally external; but sometimes it is formed through the gut, and not unfrequently there is both an external and internal aperture, the formation of the latter being usually secondary to that of the former. After the matter is discharged, the cavity of the abscess rarely, or rather never, heals spontaneously, but remains contracted in its capacity and thickened in its parietes, constituting a sinus which is named *Fistula in Ano.* The fistula is said to be Blind External, Blind Internal, or Complete, accordingly as it has merely an external or internal opening, or both the one and the other. The external orifice is variously situated, but generally exists at one side, and is seldom either before or behind the anus. It is usually small, and surrounded with an elevated induration, more or less distinct. The internal opening was thought equally variable in respect to its distance from the anus, and was searched for at the highest part to which the sinus reached. M. Ribes ascertained the important fact, that, if existing at all, it is almost invariably seated about an inch or little more from the anus, and can hence be brought nearly or altogether into view by forcibly separating the nates. It is generally small, and often extremely so, permitting a probe to pass not without difficulty.

The symptoms of the primary abscess are pain, hardness, and slight diffused swelling in the neighbourhood of the anus, from

which relief is obtained upon a discharge of matter taking place externally, or from the gut. There is great variety in the degree of acuteness, and in the progress of the disease, the pain being sometimes very severe, and at others hardly perceptible, while evacuation may be accomplished in the course of a week, or not until the expiration of months. The remaining sinus affords a thin discharge, which is sometimes very copious, and at others so scanty that the patient might suppose he had got quite well, were it not for a slight staining of the linen, and an uneasy sensation felt now and then in the parts affected. The unceasing action of the sphincter, which tends to separate the sides of the sinus, and the passage of liquid or gaseous matters from the intestine through it, not only prevent the cavity from closing, but render its parietes thick and callous from the interstitial effusion of lymph, which is induced by the continued irritation thus occasioned.

The causes of abscess in this situation are chiefly the inflammation of hemorrhoids, remaining long in a sitting posture, constitutional disturbance, and local irritation from foreign bodies arrested in the rectum. Males are more subject to the disease than females, who comparatively rarely suffer from it. It occurs most frequently during the vigour of life, between twenty and fifty years of age, and is very often met with in phthisical persons, whether owing to the irritation that is occasioned by the morbid state of the lungs, or dependent on the ulceration of the intestines, which generally exists in such cases, it is difficult to decide. Children, and even infants, are not exempt from it.

In treating the inflammation which precedes the abscess, bleeding from the part is never found to be productive of any advantage, and, on the contrary, seems to have an injurious effect in rendering the morbid process more slow and unmanageable. Warm fomentations, gentle laxatives, and emollient injections, afford most relief, and if they do not succeed in resolving the inflammatory action, hasten its termination in suppuration. When fluctuation can be distinctly perceived, a free opening should be made with the knife to prevent extension of the matter in the cellular substance, after which a poultice may be applied for a few days, and then simple dressing. Various methods have been followed in treating the subsequent sinuses or fistulas. Injections and ointments of every sort have been introduced into them, but seldom if ever with any permanent advantage; and it is now admitted, that, except through means of the knife, a cure is next to impracticable. Incisions were

formerly practised with another view, which was to remove the callous walls of the cavity, from the erroneous idea that they depended upon a peculiar morbid action, instead of being simply the result of continued irritation. The practice founded on this mistaken principle was no less unsatisfactory than severe, as the recovery after operation always required a long time, and often proved incomplete. Simple division of the septum between the sinus and gut, which is the practice now employed, has been performed in a manner much more painful, difficult, and uncertain than was necessary. This arose from its being thought requisite to cut the gut as high up as the sinus extended, and to dress the wound with irritating applications, in order to promote the removal of its callous edges and surface. It is now known, that the induration depends entirely upon the irritation of the sinus; also, that the internal opening is always very near the orifice of the gut; and that it is sufficient to divide the part of the septum which lies between the external and internal openings; lastly, that unless the internal opening be comprehended in the incision, the division of the septum, however free, will fail in affording a permanent cure. It may be added, that where an internal opening does not exist, a remarkable thinness of the septum, which seems here to consist merely of the mucous membrane, is always observed at the place where the aperture is usually situated, and in such cases it is found sufficient to cut thus far. The operation which is now performed for *fistula in ano* being established on these principles, is extremely simple and easy, and is not attended with either much pain or risk of bleeding. It does not require any of the complicated instruments formerly employed, and is readily effected by a blunt-pointed curved bistoury. The patient should be placed with his body bent forward, and his arms leant on a table or the back of a chair, unless the fistula is on the left side of the anus, and the surgeon cannot use the bistoury with his left hand, in which case the patient must be laid on his back with the thighs drawn up. The surgeon introduces his fore-finger into the gut, and then searches with a probe in the fistula for its internal opening, or, if there is none, for the thin denuded membrane where it would be, if present. Having withdrawn the probe, he insinuates the bistoury, carefully conveys its point through the internal opening, or, if none exists, pushes it through the septum, and then resting the back of the blade upon his finger, brings the point of the knife out at the anus, after which the septum may be divided quickly and easily. In difficult cases

it is better to let the probe remain, and cut it out while still passed through the internal opening. Any sinuses running into the hip or perineum ought next to be laid open. Pieces of lint should be placed between the cut edges, and renewed for a few days until granulation is established, when superficial dressings are sufficient. In cases of blind internal fistula, which are rare, it would be found very difficult to comply with the directions generally given, to guide a probe up the gut into the sinus, and make its point protrude in the hip, to shew where the knife should be introduced to make the fistula complete. Such a process is fortunately quite unnecessary, as the seat of the sinus can always be readily recognised by its softness, compared with the firmness of the surrounding parts, especially those in the immediate neighbourhood, which constitute the walls of the cavity, and are indurated by the effusion of lymph. At the centre of this part, which is felt most soft and yielding, an incision should be made, and then the operation may be completed, as if there had been an external opening in the first instance.

Fistula in ano, depending upon caries of the sacrum, or connected with phthisis, is of course incurable; but partial relief may often be afforded by giving the matter free vent for its discharge. It may be observed, that when the obstinacy of the fistula depends on other causes besides those of a local kind, and particularly the one last mentioned, the external orifice is generally large, and surrounded with thin flabby integuments.

Retention of Urine.

1. *Retention from deficiency in the expulsive power of the Bladder.*

The urinary bladder may be weakened in various ways, so as to effect the evacuation of its contents imperfectly, or not at all. Mere inordinate and long-continued distension, by over-stretching the muscular fibres, destroys, more or less completely and permanently, the contractility of the organ, and in a corresponding degree renders the patient unable to void his urine. When the retention is complete, the bladder is distended until it contains several pounds, and forms a large tumour, which may be seen and felt in the hypogastric region. The cellular and other tissues then resisting farther extension, the ureters and pelvis of the kidneys are distended, after which the secretion of urine being opposed by the pressure of that already accumulated, the patient's state re-

mains without much alteration, until evacuation is effected artificially, or takes place through ulcerative absorption of the coats of the bladder. In this state the patient suffers inexpressible distress from a constant desire to empty his bladder, and from the incessant efforts, violent but abortive, which it induces him to make. Small quantities of water dribble away by drops from time to time, as the secretion slowly proceeds, but the tumour suffers no diminution of size or tension. Exposure to cold or wet, and injuries of the spine, give rise to the same powerless condition of the bladder; and if there be any mechanical obstacle to excretion previously existing, as from stricture of the urethra, swelling of the prostate gland, or tumours pressing on the canal, or if the expulsive power of the bladder be weaker than usual, this effect is still more readily produced. In old age the bladder is apt to lose its tone, and expel the urine imperfectly. The patient observes that he makes water more frequently than before,—that he does so in smaller quantity at one time,—that the stream is not forcible, but small and dribbling,—and that he passes more or less of it during his sleep. It is the last symptom which generally first attracts notice, and leads to the more careful attention that detects the others. The obvious explanation of it is, that the bladder never being fully emptied, but merely having the excess expelled, which its feeble power, aided by the compression of the abdominal muscles, is able to command, and becoming distended beyond this extent during sleep, while the resistance of the voluntary muscles at the neck and membranous part of the urethra is no longer opposed to its evacuation, the water flows away gently without awakening the patient.

The treatment of this palsied state of the bladder, whatever be its cause or degree, absolutely requires, in the first place, that the water should be drawn off, since it is only by being allowed to contract that the muscular fibres can recover their usual power. This is effected by introducing a catheter, which may be either flexible or rigid,—the former being made of elastic gum, and the latter of silver. Unless there is reason to suspect some morbid alteration in the width or direction of the urethra,—the mode of discovering and treating which will be explained hereafter,—an instrument should be selected equal in size to the ordinary width of the canal. Different surgeons prefer different curvatures of the catheter; but it may be observed in general that it is passed most readily when the bent part is short. The patient should be laid reclining,

or made to stand erect with his back supported. The surgeon, holding the penis between the thumb and fingers of his left hand, introduces the point of the catheter, lubricated with oil, into the urethra, and pushes it gently onwards, at the same time stretching the penis until it reaches the bulb. He then relinquishes his hold of the penis with the left hand, applies the points of its fingers to the perineum at the verge of the anus, and bringing the catheter into the direction of the mesial plane, withdraws the handle from the abdomen, so as to make the point ascend from the dilatation at the bulb, into the more narrow membranous part of the canal. By simply continuing to depress the handle, and supporting the perineum, or introducing his fore-finger into the rectum, so as to elevate the point more effectually, he conveys the catheter fairly into the bladder. A surgeon who is practised in the operation will find it more convenient, when the patient is standing, to introduce the catheter as far as the bulb with the convexity upwards or towards the pubis; and then, by making the handle describe a semicircle, turn it into the same position as when passed thus far the other way. The subsequent part of the process should be conducted in the manner which has been already explained. The danger to be dreaded in performing this operation consists in forcing the point of the catheter through the lining membrane of the urethra into the spongy texture which surrounds it. The false passages thus made occur most frequently about four inches from the orifice, owing to the handle of the catheter being too soon depressed;—at the bulb, from its not being depressed sufficiently, whence the point is pushed between the membranous part of the urethra and the rectum;—and just before entering the neck of the bladder, from the point not being sufficiently elevated while urged forwards, which forces it into the substance of the prostate gland. Attention to these sources of error will guard the surgeon against making false pasages, and enable him to avoid them if already formed.

It seldom happens that one evacuation of the bladder is sufficient for the patient's recovery. He feels completely relieved at the time, but soon begins to suffer again from the symptoms of distension; as the bladder, even when in the soundest state previously, is slow in regaining its contractile power. The catheter, therefore, must be introduced once or twice a-day, until it ceases to be required; and the tincture of the muriate of iron may be given alone, or together with *Uva ursi*, from time to time. If the cure should

never be completed, as in cases where the palsy arising from distension is complicated with the weakness of old age, it will still be right to draw off the water regularly, especially at bed-time, to prevent its involuntary discharge during sleeep.

2. *Retention of Urine from Irritation and Spasmodic Contraction at the Neck of the Bladder.*

When the ordinary resistance to the passage of the urine is increased by inordinate contraction of the muscles, which in the healthy state oppose the expulsive power of the bladder, the fluid is retained, and gives rise to the same symptoms as in the former case, but generally in a very acute form. The muscles concerned in producing this effect are the sphincter of the bladder, and Wilson's muscles, which descend from the pubis and embrace the membranous part of the urethra. The causes which excite their excessive action are irritations, sometimes indirectly applied, as those proceeding from exposure to cold, the use of stimulating food or drink, or the employment of cantharides; but more frequently of a local kind, as from inflammation of the extremity of the urethra, spreading back towards the bladder, or from the injurious effects of instruments introduced into the canal. If these circumstances operate on a person whose urethra is previously diseased, and more especially if it should be already contracted from any cause, the retention of urine will of course be more readily and completely induced. From the nature of the exciting circumstances, it may be inferred that, along with the muscular constriction, there is a thickening of the mucous membrane, depending on vascular engorgement, which contributes to the effect, and must be kept in view during the treatment.

As the disease depends on irritation, soothing measures ought always to be employed in the first instance. Mild and anodyne injections thrown into the rectum, the hip-bath, and venesection, if the pulse should require it, often prove sufficient to afford relief. Should they fail in doing so, and the symptoms are urgent, it will be necessary to draw off the water by the catheter, since the additional irritation thus occasioned is more than counterbalanced by the good effect of emptying the bladder, which, when stimulated by distension, reacts upon the spasmodically contracted muscles at its neck, and increases their resistance. The instrument used on this occasion should be neither full-sized, as the urethra is not only compressed by the muscles, but also swollen and contracted, nor

very small, as the excited and congested membrane is softer, and, consequently, more easily torn than usual. It should be passed very gently, and with great care to avoid the erroneous directions of its point, which have been mentioned above, and in this case are extremely apt to occasion breaches, that increase the difficulty of the operation, by exciting still more irritation, by causing hemorrhage, and by misleading the surgeon in his future attempts. The relief afforded by evacuation is seldom permanent, the irritated state of the organs giving rise to a deceitful feeling of distension, and rendering the patient very soon desirous of having the catheter again introduced. To obviate these uneasy symptoms, an opiate injection ought to be thrown into the rectum immediately after the instrument is withdrawn; and the operation ought not to be repeated oftener than there may be reason to suppose that the urine has accumulated to an injurious extent. To counteract the constipating effect of the opium injection, and remove any source of irritation from the intestinal canal, a table-spoonful of castor-oil should be given every day or two, according to circumstances. The food of the patient should be of the least stimulating kind; and he should drink freely of mucilaginous diluent fluids, such as barley-water, containing small quantities of carbonate of soda,—nitrous ether,—or camphor mixture. Bodily fatigue and exposure to cold must be strictly avoided.

Stricture of the Urethra.

Strictures of the urethra were formerly attributed to fleshy excrescences obstructing the canal, and spasmodic contraction of the fibres lying in the substance or on the external surface of the urethra. It is now almost universally admitted, that they invariably depend upon narrowing and thickening of the lining coat, from lymph being effused and organised in its interstices. There is thus produced a constriction, varying in tightness from the slightest perceptible diminution of capacity to almost complete closure,—and in extent, from the breadth of a thread to the length of an inch or more. In some very rare cases the stricture has been found on dissection to exhibit what is called a bridle form, there being a fibrous band stretched across from one side of the canal to the other, in consequence, no doubt, of lymph having been effused into the interior of the canal, and organised there. The most common seat of stricture is anterior to the bulb, about five inches from the orifice. The one next in frequency is between two and three inches from the

orifice. The other situations particularly exposed to its occurrence are the neck of the glans and orifice of the urethra. Two or more strictures are often met with in the same urethra, but when this is the case, one of them in general proves the most confirmed of the whole. The cause of strictures can seldom be positively ascertained. There is no doubt that a very large proportion of them occur subsequently to gonorrhœa, but whether this be in consequence of the disease, or the means employed to remedy it, admits of question. It may be safely stated, that inflammation, or at all events excitement of the urethra, precedes the adhesive process which establishes the thickening and induration, and whatever tends to produce this condition of the membrane will expose to the risk of stricture. Severe gonorrhœas, in which the inflammation spreads back along the urethra,—irritating injections, allowed to enter the passage too far,—frequent indulgence in venery,—stone in the bladder or other parts of the urinary organs,—and habitual addiction to a diet that stimulates the parts concerned, may thus be regarded as causes of stricture.

Besides this true organic stricture, the urethra is liable to a temporary constriction, which has usually been attributed to spasmodic secretion of the surrounding muscles, although congestion of the vessels may probably have a considerable share in producing the effect. Independently of the perineal muscles, however, there can be no doubt that the urethra, both in health and disease, possesses a contractile power, which, under the influence of irritating circumstances, may prove excessive, so as either to produce the symptoms of stricture or to aggravate those proceeding from a permanent constriction.

The symptoms of stricture are, 1. Difficulty in making water, owing to the resistance which is opposed to its escape by the narrow part or parts of the canal. The bladder, therefore, is slowly emptied; and its muscular coat becomes greatly thickened, so as to present an appearance similar to that of the ventricles of the heart on their inner surface. 2. Small size of the stream, which is usually spiral, forked, or dribbling. 3. Pain, generally experienced during micturition, and seldom afterwards. 4. Frequent desire to evacuate the urine, which is most remarkable during the night, from the circumstance of persons in health not requiring to do so between the time of lying down and getting up. The patient also often complains of pain *in coitu*,—of a thin gleety discharge from the urethra,—of swelling and pain of one or both testicles,—of uneasi-

ness about the loins and limbs, and of muscular weakness of the latter. He frequently suffers feverish attacks of short duration, but considerable intensity, resembling in all respects the fits of an ague. It is observed that the severity of all these symptoms increases when the patient is subjected to irritation, whether general or local, and diminishes in opposite circumstances.

A very distressing and not unfrequent consequence of stricture in the urethra is abscess, followed by fistula of the perineum. The canal is always much dilated behind the contracted part, and sometimes suffers perforation from ulcerative absorption, so as to allow the urine to enter the cellular substance. But instead of being formed by this process, the abscess is much more frequently called into existence merely by the irritation resulting from the stricture, which excites inflammation and suppuration in the cellular substance, or glands adjacent. In either case the result is the same; and a sinus is formed, leading from the urethra, generally the membranous part of it, to the surface of the perineum. The urine, in a larger or smaller proportion, passes through this preternatural canal, the parieties of which, owing to the continued irritation thus produced, become thick and hardened, so as to resemble cartilage. The urethra becomes more and more contracted,—new abscesses are formed,—the number of sinuses is increased,—and at length the whole perineum is perforated with openings, which discharge pus mixed with urine, and the seminal fluid also if it happens to be ejected; while all the neighbouring parts are not only thickened and indurated, but almost constantly inflamed, and engaged in the formation of abscesses.

The treatment of stricture, until lately, has been conducted chiefly through means of Caustic, Internal incision, and Dilatation. Caustic has had the support of many powerful advocates. Wiseman proposed it so long ago as in his day, under the supposition that the disease depended on the growth of fleshy excrescences from the inner surface of the urethra. John Hunter recommended it for destroying the callous contracted state of the canal, which he more correctly regarded as the cause of obstruction. Sir E. Home, Lallemand, and other surgeons of recent times, have earnestly supported it by their practice and writings. But from having been generally employed, it has now, in this country at least, fallen almost entirely out of use, which is not surprising when its disadvantages are considered. The mode of application usually practised was to insert a bit of lunar caustic, or potass, into the extremity of

a wax bougie, and fix it in its place by pressing down the edges of the excavation made for its reception. The bougie was then passed quickly down to the stricture, the seat of which had been previously ascertained, and allowed to remain pressed against the obstruction for a few seconds, so as to let the escharotic effect be produced. The operation being repeated as frequently as the irritation induced by it permitted, at length enabled a full-sized instrument to pass. It may be readily imagined that the process of cure thus conducted was necessarily very tedious, painful, and dangerous. The successive applications of the caustic required intervals of several days, and the cure was seldom completed without very many operations of this kind; sometimes a hundred, or more. The irritation produced by the caustic not only excited excessive pain, but subjected the patient to the risk of complete retention of urine, swelled testicle, and other bad consequences; and if the caustic happened to drop out of the bougie, violent inflammation, with various injurious effects on the neighbouring parts, abscess of the perineum, &c., were apt to be induced. Modern improvements in the apparatus for applying the caustic have in some measure obviated these objections. Instead of being carried down to the stricture by the simple but insecure means above-mentioned, it has been introduced into the strictured portion of the canal more accurately, safely, and efficiently, by various instruments, constructed on the following principle:—A catheter, straight or curved, of full size, has a small perforation in its round extremity, to which a wire is fitted, so that when pressed at the handle of the instrument, it may be caused to project. This wire has a slit a little way from the point for receiving the caustic, and when thrust out at the opening of the catheter, after it has been pushed down to the seat of the stricture, will, if successfully managed, apply the escharotic substance to the surface of the morbidly contracted part of the canal. But although the application may thus be rendered more secure from harm, its beneficial effects are still in the highest degree unsatisfactory.

Division of the stricture by internal incision has been proposed and practised at various times, by introducing a canula with enclosed lancet blade, which may be protruded after the sheath has been conveyed down to the stricture. Mr Stafford advocated this operation, and improved it by the invention of ingenious instruments for its performance; but the objections which have been alleged to the caustic apply still more strongly to such a mode of treatment,

since it can never be safe, even in the hands of the most expert operator, and has proved to be productive at the best of only temporary benefit. A French surgeon named Reybard has modified this process by using instruments of an enormous size, the cannula being equal to a bougie of the full magnitude, and containing a blade large enough to cut through not only the urethra but also the *corpus spongiosum*. The disastrous effects of such a preposterous engine are fortunately prevented by the obvious impracticability of its employment for the remedy of *stricture*. Another mode of incision has been long practised for contractions deemed impracticable. This was named Boutonnière, or the button-hole operation, and consisted in passing a bougie or catheter down to the obstruction, and cutting beyond its point, so as to open the distended canal. It was extremely embarrassing in the execution, very dangerous from the risk of hemorrhage and extravasation of urine, and hardly productive of more than temporary relief.

Dilatation has been long employed to remove strictures of the urethra, and even before it was known to be the cause of amendment. When fleshy excrescences were regarded as the source of obstruction, bougies, armed with caustic, or medicated, as it was termed, with various ingredients believed to have the power of promoting absorption, were introduced into the passage. The caustic, no doubt, produced its peculiar effects, but the other materials were found at length to be quite useless; and it became apparent that the good effects which attended their employment depended entirely upon the mechanical pressure of the instrument. Though the direct effect of a bougie is merely mechanical, the removal of the stricture depends on a vital process which is thus excited, and not on simple stretching. The pressure excites interstitial absorption of the thickened walls of the canal, and hence it is, that when an instrument of a certain size has been passed with difficulty, a larger one can often be readily introduced by a subsequent attempt a few days afterwards. Such being the mode in which benefit is derived from the use of simple bougies in the treatment of stricture, it is evident that they must be employed so as to produce merely such a degree of irritation as is sufficient for giving rise to absorption, since more than this might be apt to occasion interstitial effusion instead of absorption, and aggravate the stricture instead of relieving it. The bougies, therefore, should not be introduced too frequently, or too forcibly, or for too long a time; and their use should not be persisted in when the parts or sys-

tem are particularly irritable. Metallic bougies are best calculated for the purpose, being the most smooth, and easily guided. They may be made solid of steel and hollow of silver, or of the compound metal named Berlin silver, which I have found to answer very well for the purpose, being sufficiently rigid, taking a fine polish, and not being liable to rust. They should be gently passed down to the obstructed part, in a series of gradually decreasing sizes, until one can be introduced into the bladder, after which it ought to be immediately withdrawn. In the course of two or three days, when all the irritation that has thus been excited seems to have subsided, the same instrument may again be introduced; and after it is withdrawn, another of somewhat larger size. By proceeding in this way, the cure, in moderately favourable circumstances, may be completed within from three to six weeks. The grand error to be avoided is that of proceeding too hastily, which not only defeats the practitioner in attaining the object he has in view, but exposes the patient to the danger of hemorrhage, complete retention of urine, swelled testicle, feverish attacks resembling ague, and other unpleasant consequences. The urethra should always be dilated to its full size, as a relapse is otherwise apt to happen; but any further extension than this can do no good.

There are two forms of stricture in which the bougie has been found inadequate to afford relief. In one of these the canal, especially at the seat of contraction, is so extremely irritable that even the most gentle use of instruments gives rise to violent and dangerous disturbance of the system, with rigors followed by fever, and frequently local inflammation. The patient, exhausted by such efforts, dreads their repetition; and successive practitioners, finding that their most careful efforts lead only to the same results, any further attempts to afford relief are at length deemed inexpedient, and the disease is allowed to pursue its course, until a fatal retention of urine, or some equally fatal operation, undertaken to prevent extravasation, terminates the complicated sufferings of such a case. In the other form of stricture which resists the ordinary means of treatment, there is an extreme degree of resiliency and tendency to contract after dilatation, so that only the most evanescent relief can be obtained through the means employed for this purpose. It may be added, that in both of these obstinate forms, the symptoms of the disease are, in general, peculiarly distressing, the urine being not only expelled with great difficulty by drops, or the smallest of thread-like streams, but also very imperfectly retained, dribbling away involuntarily by day as well as night, and causing the utmost

discomfort, by its effects on the patient's clothes and skin, exposed to the acrid moisture.

In 1844, I felt great pleasure in communicating to the profession a mode of remedy, which had afforded complete and permanent relief in a case of obstinate stricture, than which it was impossible to imagine one more distressing or more hopeless, under any other known means of treatment. In 1849, encouraged by further experience, I published a treatise on the treatment of stricture, with the view of explaining and recommending this method, and since that time have related a great many additional cases illustrative of its effects. For more particular details I may refer to these sources of information, it being sufficient at present to render the principles of practice distinctly intelligible.

It is well known that there are certain textures, healthy as well as morbid, which cannot be expanded without pain and the risk of inflammation, but may be divided by incision with ease and safety. Spasmodic stricture of the anus, and the ring at the base of the prostate, which cannot be torn without the production of fatal effects, afford examples of this kind, and illustrate the advantage of cutting, under certain circumstances, instead of dilatation. In strictures of the urethra which exhibit the irritable and unyielding or resilient characters, it therefore seems reasonable to expect advantage from dividing them freely by means of a cutting instrument, instead of persevering in vain and hazardous efforts to dilate the contracted part by bougies. Attempts to accomplish this, by introducing sheathed blades into the canal, and also by cutting from without upon the point of an instrument carried down to the seat of obstruction, had been frequently made with a different view, viz., overcoming resistance, which was supposed to render the canal impermeable, but with very unsatisfactory results, from imperfect attainment of the object, extravasation of urine, and hemorrhage caused through the want of a safe guide for the knife. In the operation which I proposed, the first and essential step was to introduce a grooved director fairly through the stricture, so that complete division of the whole thickened texture might be effected with certainty, and with security from any lateral aberration, endangering the artery of the bulb or other arterial branches, the mesial plane of the perineum, which corresponds with the raphe, being free from vessels of the slightest consequence.

But if stricture were frequently impermeable, this method must have been limited in its employment, and incapable of affording relief in those cases which chiefly required it; and, therefore, so

long back as 1844, I expressed my persuasion that no stricture was truly impermeable, the exit of water being a certain sign that instruments might, through sufficient care, be introduced. This principle of practice was obviously of great importance, since conviction of its truth would obviously lead to much more prolonged and careful exploration of the passage than would be thought requisite, if belief in the existence of impermeability were entertained. For my own part, it was frankly confessed that, while sharing in the doctrine of impervious urethras, I had occasionally found them so, and performed the old operation, while ever since adopting the principle that every stricture might be permeated by instruments through time and care, I had not, either in public or private practice, met with one that proved incorrigibly obstinate.

In performing the operation, the only instruments required are a short, straight, sharp-pointed bistoury, a grooved director, and a silver catheter. The patient, under the influence of chloroform, if he pleases, being placed with his back upon a bed or table, and his limbs held up so as to expose the perineum conveniently for the purpose in view, the operator introduces the director, confides it to an assistant, and makes an incision over the stricture about an inch and a quarter in length, exactly in the central line or raphe. This incision should at once extend through the skin, subjacent cellular texture, and fascia, and be afterwards deepened if necessary, great care being taken to cut precisely in the same plane, and especially to avoid going aside beyond the director. The operator, having felt the instrument distinctly, takes it in his left hand, and guarding the knife on his right fore-finger, inserts its point into the groove, on the bladder side of the stricture. He then urges the blade through the thickened and indurated urethra, which, from its toughness and yielding disposition, is apt to elude the knife, and next, having withdrawn the director, passes the catheter into the bladder, where it must be secured by proper tapes, and a bandage round the loins. The catheter may be removed on the second day, and if rigors, vomiting, quick pulse, or other feverish symptoms, should occur during the subsequent twenty-four hours, they may be safely attributed to a temporary effect on the nervous system.

When the disease is complicated with *fistula in perineo*, the same treatment proves sufficient, as the sinuses, together with the callosities or induration surrounding them, speedily disappear after the obstruction which gave rise to them is removed. The incisions, excisions, and cauterisations, which were formerly practised, are therefore both unnecessary and improper. But if the stricture re-

quire division on its own account, the presence of a fistulous condition will of course afford no objection to this procedure. If the urethra is altogether obstructed anterior to the fistula, so that even the smallest instrument cannot be passed through it, the only remedy is to introduce a catheter as far as the canal permits, and then cut down upon its extremity from the fistula, so as to allow its passage into the bladder. A flexible catheter should then be introduced, and allowed to remain for three or four days, to prevent the recent solution of continuity from healing by primary union ; but it ought not to be left longer than this, as its presence would occasion a degree of irritation unfavourable to the cure by granulating contraction. If the instrument is introduced occasionally, with the interval of a day or two, it will prevent any chance of the canal becoming again obstructed, and not interfere with the process of reparation.

Retention of Urine from Blows on the Perineum.

Blows on the perineum are apt to occasion difficulty or total obstruction of the urinary evacuation. In some cases there is no solution of continuity effected by the violence, no wound of the integuments, or rupture of the parts within, but merely as it seems a temporary paralysis, or want of consent in the muscles concerned, in consequence of the contusion. At other times the urethra is torn, blood streams from the orifice of the penis, not a drop of urine can escape, and a tumour is formed under the integuments of the perineum opposite the injured part by blood and urine.

The treatment of such injuries is obvious, and not difficult. If there is no evidence of the urethra being ruptured, it may be expected that rest, warm fomentations, and slightly stimulating injections thrown into the rectum, will soon restore the healthy actions which have been disturbed ; and should circumstances require it, a catheter may be introduced with the same facility as usual, to relieve the bladder from distension. For some time after such injuries, a bougie should be passed occasionally to prevent contraction of the canal, which is apt to happen in consequence of the irritation caused by the blow. But if, from the discharge of blood, the tension of the perineum, and the impossibility which is experienced in attempting to introduce a catheter, it is ascertained that the urethra has been ruptured, means must be taken without delay to provide for the evacuation of the urine, which cannot be expected to take place naturally, and to prevent the fluid from passing extensively

into the cellular substance through the breach of the urethra, which would necessarily lead to the most disastrous consequences. The best mode of proceeding is to cut into the perineal tumour, and then, having brought the ruptured canal into view, to convey a flexible catheter into the bladder. It may be allowed to remain for a few days, as in the case of operating for obstructed urethra, and the subsequent treatment does not differ from that which is proper on such an occasion.

Diseases of the Prostate Gland.

The Prostate Gland is little subject to disease previous to the age of fifty-five or sixty. It is then liable to an enlargement, which in its nature most agrees with the simple vascular sarcoma, and, though often named scirrhus, has none of the characters of carcinomatous formations except an approach to their hardness. The tumour is dense and fibrous, possesses little sensibility, is not disposed to any morbid action except its own nutrition, and, though the cause of uneasiness by its pressure on the neighbouring parts, is hardly ever itself the seat of much pain. The gland seldom enlarges equally, generally exceeding in one of the lateral lobes, and not unfrequently sending a round process upwards, encroaching on the cavity of the bladder, immediately behind its neck. Sir E. Home accounted for this marked limitation of the growth to one part of the gland, by attributing it to the existence of a distinct *middle* lobe of the prostate; but in a healthy state of the part it is difficult to discern any trace of such a structure. Whatever be the true explanation of the fact, it is an important one in several points of view. Enlargement of the prostate, whether partial or general, does not necessarily or usually diminish the width of the urethra, but alters the direction of the canal so as to impede more or less the passage of the urine. When the whole gland swells, the neck of the bladder is of course elevated in a proportional degree, and the course of the urethra consequently rendered not only longer but more curved than natural. If one of the lateral lobes is more enlarged than the other, it gives the canal a bend to one side, and if the tumour is confined to the upper surface of the gland, within the orifice of the bladder, though the urethra cannot suffer any change, the excretion of urine may be considerably impeded.

The symptoms of enlarged prostate are—1. A feeling of weight and uneasiness in the lower part of the pelvis; 2. Pain and diffi-

culty in evacuating the bowels, with, it has been said, a flattened form of the feces when passed in a solid consistence; 3. Frequent and slow micturition; 4. A copious discharge of mucus with the urine, at the bottom of which it remains separate, forming a glairy mass that adheres to the vessel when the water is poured out; 5. A fetid ammoniacal smell of the urine. These symptoms, though in general always distinguishable, are seldom very well marked, except when the urinary organs suffer irritation from a local or constitutional cause. They then become greatly aggravated, and constitute what is called a fit of the disease, during which the patient has an almost incessant desire to empty his bladder, experiences extreme pain in attempting to do so, and sometimes labours under a complete retention of urine. Considerable information may usually be obtained as to the existence and degree of the enlargement, by examining the gland with the finger in the rectum, after a catheter or bougie has been introduced into the bladder. Unless this precaution be taken, the prostate is very apt to be thought enlarged when it is not altered in size.

The cause of the disease, as might be expected, seems to be excitement of the gland, either directly or through sympathy with the neighbouring parts; and it is accordingly observed chiefly in those who indulge in venereal excesses, who use a luxurious diet, or who are exposed to the stimulating influence of a warm climate. It occurs much more frequently in persons whose circumstances expose them to the evils of sedentary habits and redundant nourishment than in the labouring poor.

The treatment of enlarged prostate obviously requires the prevention, so far as possible, of all circumstances tending to promote its increase. With this view the patient should live sparingly, scrupulously avoiding all articles of food and drink which he knows from experience to have a stimulating effect on the organs connected with the gland, take proper exercise, and preserve the bowels in an easy state by means, if necessary, of gentle laxatives or injections of mild fluids into the rectum. During the paroxysms of the disease, rest in the horizontal posture, the hip-bath, leeches applied to the perineum, small doses of laudanum, or solution of the muriate of morphia, with a few drops of balsam of copaiva, opiate injections into the rectum, and a diet restricted to little more than mucilaginous drinks, are the means which prove most effectual in affording relief. Should the flow of urine not only be rendered difficult, but be altogether impeded, it may become necessary to

introduce the catheter. The instrument selected should be of a medium size, and managed so as to suit the direction which the canal takes in consequence of the elevation of the vesical extremity by the swelling of the prostate. When much difficulty has been experienced in introducing the catheter, it should be allowed to remain in the bladder for a day or two. Various medicines have been employed to induce absorption of the tumour, as iodine and the muriate of lime; but no real advantage has ever been derived from these means. It has also been proposed to cut out the enlarged prostate; but this proceeding is so inconsistent with the dictates of rational surgery, that the objections to it need not be taken into consideration.

Earthy concretions are not unfrequently found in the ducts of the prostate. They are generally of a very small size, which only in rare cases equals that of a pea, of a rounded figure, and reddish-brown colour. Their composition is invariably phosphate of lime, with a little animal matter. They usually exist in great numbers together; being either imbedded in the substance of the gland, or collected into groups which occupy the dilated ducts. The symptoms which they occasion are not well ascertained, since their existence is seldom known until it is discovered after death by dissection. On several occasions, having cut into the membranous part of the urethra to remove a concretion that was felt there, I have found the prostate hollowed out into a cavity containing calculi, which were extracted with success.

Extravasation of Urine, and Puncture of the Bladder.

When retention of urine, from whatever cause it may proceed, is not remedied, the pressure occasioned by the confined fluid at length induces ulcerative absorption, and forms a breach which allows the urine to escape into the surrounding cellular substance. This rupture, as it is improperly termed, usually takes place immediately above the obstruction; and as most cases of complete retention depend on stricture at the bulb, the aperture generally occurs in the membranous part of the urethra. When the bladder gives way in such circumstances, it does so most frequently near the neck, where there is no covering of peritoneum. The urine no sooner begins to flow through the preternatural channel, than the patient experiences relief from the distress he previously suffered, and can hardly be persuaded that he is not making water in the ordinary way. The extravasated fluid may diffuse itself in all

directions,—upwards between the bladder and pubis, and laterally by the sides of the prostate, and downwards into the scrotum. The fascia, which lies under the integuments of the perineum, prevents the formation of any tumour in this situation ; but when the fluid gets through the less dense membrane opposite the scrotum, it speedily distends the loose cellular substance, and produces a large globular swelling. The urine, after being thus effused, soon excites great irritation, the effects of which are intense local inflammation, and constitutional disturbance of the most alarming character. The distended scrotum becomes first red, and before many hours black, while the system suffers as if influenced by some deadly poison ; a quick small pulse, dark-coloured tongue, frequent vomiting, incessant hiccup, and low delirium, are the indications which betray this dangerous condition ; and death soon closes the scene unless some active means of relief are speedily and successfully administered. A free incision should be made in the perineum, through the fascia, and down to the infiltrated cellular substance. The scrotum may be scarified also, and hot fomentations ought to be applied to promote the discharge of putrid urine, blood, and sloughs ; while, at the same time, the patient's strength is diligently supported by wine and other cordials. If the urine has insinuated itself extensively into the cellular substance of the pelvis, all these means will be unavailing; but if it has been chiefly confined to the scrotum and neighbourhood, a cure may be accomplished with careful management, and after a long confinement. A surgeon should never hesitate to make free incisions in such cases, however desperate they may at first appear, since recoveries have taken place in apparently the most hopeless circumstances, when extensive sloughing was complicated with the weakness of old age.

In some rare cases, the opening is formed into the rectum, and then the patient may escape the dangerous consequences of urinary effusion which have been described ; but such an occurrence is too rare to afford any reasonable ground for expecting relief from the unaided powers of the system, or withholding the means that effect evacuation more safely. These means consist in puncturing the bladder, so as to draw off its contents without allowing them to enter the cellular substance. If the surgeon possesses the requisite tact for introducing instruments into the bladder through the urethra, and has the treatment of the case from its commencement, he will very rarely, perhaps never, be under the necessity of resort

ing to this puncture. But should he not be able to draw off the water by the catheter, either from his own want of dexterity, or from the existence of obstacles arising from mismanagement or previous organic alteration of the passage, as stricture or enlargement of the prostate, complicated with a lacerated, softened, swelled, and bleeding state of the lining membrane, caused by forcible attempts to pass an instrument, there can be no hesitation in having recourse to the operation. Puncture of the bladder, however performed, is always attended with more or less danger of urinous infiltration; but a doubtful remedy is better than none; and there are few states of disease more hopeless than complete retention of urine, permitted to follow its own course.

There are three methods of puncturing the bladder—1. above the pubis; 2. by the perineum; 3. from the rectum. The operation above the pubis is performed by making an incision an inch and a half long from the symphysis upwards, exactly in the mesial plane, and then separating the edges of the recti, or rather pyramidal muscles, with the fingers and a little assistance from the knife, and lastly pushing a trocar into the distended bladder, which can now be distinctly felt. In order to avoid transfixing the neck, it is necessary to direct the instrument not perpendicularly, but obliquely backwards, from the point where it enters the cavity behind the pubis. The rigidity of a silver tube is apt to occasion injurious irritation, particularly as it must be long, and deeply introduced, to prevent any risk of its escape from the contraction of the coats of the bladder; but the cannula must not be withdrawn without substituting some other channel for carrying away the urine, which otherwise would be very apt to enter the cellular substance. A piece of flexible catheter answers very conveniently for the purpose, and the exchange should not be effected before the end of at least twenty-four hours. The patient should lie on his side, inclining forwards, to promote the discharge of urine; and great care must be taken that the tube does not become obstructed by mucus, or in any other way. When the cellular substance surrounding the wound has become consolidated by adhesive effusion, as happens in a day or two, a plug may be fitted into the orifice of the cannula, and withdrawn from time to time; but it generally happens that the old passage is soon restored, after the bladder has been freed from the irritation of its accumulated contents.

The bladder may be punctured from the perineum by making a deep incision, a little to one side of a line extending from the bulb

to the anus, and then pushing a long curved trocar inwards in the direction of the neck of the bladder, so as to open it nearly in the same situation as when operating in the former way. There is thus a more dependent opening provided for the escape of the urine; but the operation is severe, difficult, and very dangerous in the hands of a surgeon not perfectly familiar with the relative situation of the parts concerned.

Puncturing from the rectum may have been suggested by the opening which is sometimes formed naturally between it and the bladder, or prostatic portion of the urethra. In cases of complete retention, where the parts are not altered by disease, there can certainly be no easier or more satisfactory mode of relieving the patient by operation. The bladder behind the prostate, for the extent of an inch or more, is not covered with peritoneum; and the *vesiculæ seminales*, though they meet together at the gland, diverge from each other in proceeding backwards, so as to leave sufficient space for the puncture. The *vasa deferentia* lie near the centre, and may perhaps be injured, even though the trocar is introduced exactly in the mesial plane; but any inconvenience that might be expected to result from this source ought not to be regarded as a serious objection to a proceeding which affords the only means of averting nearly certain death, especially as experience does not confirm the apprehension. When the operation is performed, the patient should be laid on his back at the edge of the bed, with his knees bent and thighs held up, so as to present the parts fairly to the surgeon, who, having anointed the fore and middle fingers of his left hand, introduces them gently into the rectum until he feels the posterior confines of the prostate. The trocar, which should be six inches long and curved, is then carried in along the channel formed by the fingers, and when its point has passed beyond the prostate, the handle is depressed, so as to puncture the coats of the rectum and bladder where they are contiguous. The cannula should be secured in its place for twenty-four or forty-eight hours, to prevent the wound from closing before the obstruction that existed in the natural passage has been removed.

In deciding upon the choice of these operations, there can be no doubt that, when the prostate is not enlarged, the one last-mentioned ought to be preferred as being the easiest, least painful, and most free from the danger of extravasation. When the prostate is enlarged, the operation by the rectum being impracticable, the puncture should be made above the pubis, unless the surgeon thinks

it better to force a passage through the substance of the gland. This proceeding may appear harsh ; but experience shews that the wound thus made may heal ; and if it be recollected that the catheter may always be passed in cases of obstruction dependent upon enlargement of the prostate, unless the surface of the tortuous canal be poached and torn by the forcible use of instruments, and that in this case the substance of the gland is already injured nearly as much as it would be by having the catheter thrust through it, the proposal will not seem unwarrantable.

In cases of stricture preventing the introduction of a catheter Sir A. Cooper recommended, as preferable to puncturing the bladder, making an incision in the perineum, and cutting upon the membranous part of the urethra, which, owing to its distension behind the obstruction, may be distinguished, and opened, so as to establish a *fistula in perineo*, that may be remedied at leisure by curing the stricture. Instead of proceeding in this way, it would be much better to open the urethra *before* the stricture, and then, with the facility thus obtained, guide a director through the contraction so as to let it be divided, with the effect of not only relieving the retention, but removing the cause that produced it.

Urinary Calculi.

The bladder and other parts of the urinary passage frequently become the seat of concretions, which vary extremely in their number, size, and composition, but almost always occasion very distressing symptoms. The measures which have been devised for their prevention and removal consequently demand much attention ; and, in order to understand them, it is necessary to be first acquainted with the origin and mode of formation of the different kinds of calculi.

The urine in its healthy state holds a number of saline substances in solution, which it deposits in part on cooling to the ordinary temperature. The quantity of this precipitate varies according to the degree in which the urine is diluted, being most observable after abstinence from drinking or profuse perspiration. It generally appears in the form of a light-coloured yellowish cloud, occupying the lower part of the vessel, or in that of a thin crust or lining, which adheres to its sides. When chemically examined, the light-coloured muddy-looking sediment is found to consist of alkaline and earthy salts, which are chiefly the phosphate of lime, and the triple phosphate of magnesia and ammonia,—the lateritious or

crusted deposit, on the contrary, consisting of uric acid, or urate of ammonia with an excess of acid. In consequence of a variety of circumstances which will be more particularly considered hereafter, the urine becomes loaded with these matters in quantities, proportions, and combinations, that give rise to concretions of various kinds. It appears that the fluid is sometimes secreted so overburdened with its acid or saline constituents as to deposit them immediately on escaping into the pelvis of the kidney, and form concretions, consisting by far most frequently of uric acid, but sometimes of the oxalate of lime. If the urine is not so loaded as to free itself immediately after being secreted, it does not afford any deposition so long as it is kept within the body and maintained at its temperature ;—but when it is excreted and cooled down to the temperature of the air, it deposits all the redundant portion in the form of a copious muddy yellowish-white precipitate, containing the earthy salts,—and a lateritious crust, consisting of the acids and acidulous combinations of ammonia. If, however, while such an excess of the urinary constituents exists, a foreign body should be present in the bladder or in any other part of the passage through which the urine flows, so as to serve as a nucleus for concretion, it will, on the well-known principle observed to regulate the separation of salts from their solvents, whether in a crystallised form or not, induce the redundant matters to withdraw themselves from the attraction of the fluid, and adhere to the surface which is presented to them. This effect, however, can occur only where there is a considerable excess of saline substance, since, when the proportion is small, it is retained in solution by the urine, at the high temperature which it has in the bladder, too powerfully to permit its precipitation by the influence of a foreign body. Urinary calculi which have attained any considerable size are hence found to consist of concentric layers, varying in composition and thickness, according to the nature and quantity of the morbid excess that existed in the urine at the time of their formation ; and, for the same reason, the rapidity with which they increase in size always bears a direct proportion to the derangement of the urinary secretion.

The circumstances which tend to occasion excess in the acid and saline constituents of the urine are chiefly the following:—1. Imperfect digestion, attended with acidity of stomach ; in which case the urine has a deep brownish-red colour, and deposits either crystallised grains of uric acid that have separated from the fluid in the kidney, or a red lateritious sediment on cooling. 2. An irritated

state of the kidneys, attended with pain of the loins, quickness of the pulse, and anxiety of the countenance; in which case the urine is copious, pale-coloured, and deposits such a quantity of the phosphates on cooling as to become turbid and white like milk. 3. A similar state of irritation, chiefly affecting the bladder, and attended with a copious secretion of mucus; in which case the urine has a very disagreeable ammoniacal odour, and deposits the triple phosphate of magnesia and ammonia, either crystallised or amorphous. The condition of the urine during the deposition of oxalate of lime, and some animal substances that will be mentioned hereafter, has not yet been well ascertained.

From an attentive consideration of these circumstances, it appears that the presence of a calculus may promote the formation of concretions from the urine—1. by affording a nucleus; 2. by irritating the bladder, increasing the quantity of mucus, and accelerating the putrefactive decomposition of the urine, during which the urea is converted into ammonia, and an excess of the triple phosphate results; 3. by causing sympathetic irritation of the kidneys, which perverts their secreting action, and leads to the formation of the earthy salts in redundant quantity; 4. by sympathetically irritating the stomach, and occasioning imperfect digestion, attended with acidity. By operating in one or more of these modes, the nucleus, when once formed, always increases, and even tends to cause the generation of new ones. The nucleus, unless when consisting of a foreign body introduced into the bladder, is almost invariably constituted by a concretion formed in the kidney. This renal calculus, in the great majority of cases, as has been already observed, is an aggregation of uric acid grains, but may also consist of oxalate of lime. It is often observed by patients, that previously to suffering from the symptoms of calculus, they were accustomed to pass red grains of uric acid,—sand or gravel as they are usually called,—and that they ceased to do so for some time before the commencement of their complaint. It is extremely difficult to account for the origin of these concretions, farther than has been already done, though there are doubtless some important causes in operation, which hitherto have not been ascertained. Calculous diseases are much more common in some districts of country than others, and all that we know in regard to the difference of these is, that where the strongest predisposition has been observed, the mineral strata of the neighbourhood were of a calcareous nature. The formation of renal nuclei takes place most frequently before puberty, and after

the age of fifty; but no time of life is altogether exempt from it. There is no temperament or variety of original constitution that seems particularly favourable to the occurrence of the disease, but there is occasionally observed some evidence of the predisposition being hereditary. Gout and stone are often connected, but they probably are so from owing their origin to the same source, viz., derangement of the digestive organs.

The symptoms of a calculus in the kidney are an almost constant feeling of uneasiness in the loins, aggravated by rough motion, and soothed by rest; the discharge of small fibrinous clots with the urine after fits of irritation, and during their continuance, tenderness of the loins, nausea or vomiting, and frequent desire to make water, which is sometimes attended with pain at the point of the penis. If, while there are such symptoms, the bladder should be examined, and found to contain no calculus, there will be strong ground of suspicion that one exists in the kidney; but there can hardly be any certainty acquired on the subject, as different morbid states, not only of the kidney, but also of other parts of the urinary apparatus, produce nearly, if not altogether, the same indications.

The object of treatment in this case is to promote the descent of the calculus into the bladder, with which view the patient should take exercise, and drink largely of diluent fluids. Advantage seems sometimes derived from conjoining the latter with a small quantity of spirits, such as Hollands, or with the tincture of cantharides; but caution must be observed in doing so lest too much excitement be occasioned. The calculus, if it remain in the pelvis of the kidney, does not increase rapidly in size, as the urine, from passing away through the ureter immediately after being secreted, has little time to deposit the excess of solid matters which it may contain. Sometimes, however, the concretion of uric acid enlarges so as to occupy the whole pelvis and infundibula, branching out like a piece of coral, or becomes incrusted with the triple phosphate. Much more frequently the calculus remains of a small size, ranging from that of a pea to that of a field bean, of an oval figure, very similar to the stone of an olive, and smooth reddish-brown surface, in which the component grains may in general be distinguished. In some rare cases abscesses have been produced by the irritation of the kidney, and in others still more rare, the matter, by inducing absorption of the parietes of the abdomen, has made a passage outwards for the stone. Exaggerated reports of such occurrences have given rise to stories of renal calculi having been cut out, and Nephrotomy

has been seriously proposed by surgeons who think more of the execution than the consequences of operations.

When the calculus descends into the ureter, unless of very small size, it occasions great local pain, and sympathetic irritation of the abdominal viscera. The patient complains of intense pain in the inguinal region of the affected side, about midway between the superior anterior spinous process of the ilium and the pubis, which is greatly aggravated by pressure or motion. There is incessant nausea, and frequent bilious retching. The stream of urine pressing behind the calculus, and widening the passage, while it forces the obstructed body forwards, at length conveys it into the bladder, immediately upon which all the uneasiness is at once removed. This process of descent, which usually occupies from twelve to forty-eight hours, may be expedited and rendered less painful by administering from time to time doses of castor-oil, with the muriate of morphia, or other preparations of opium—by throwing opiate injections into the rectum—by placing the patient in a warm bath—and by bleeding from the arm, if he is of a robust habit. Sooner or later the passage is completed, and there are few preparations more rarely met with in museums than those shewing a renal calculus arrested in the ureter.

Having arrived in the bladder, the calculi either remain there, or proceed onwards through the urethra. In the former case, they become incrusted with layers of various thickness and composition, as has been already explained, and constitute concretions which differ widely, according to the circumstances that attend their formation. The following arrangement includes the most important kinds :—

Name.	*External Characters.*	*Chemical Characters.*
I. Uric Acid Calculus, (Scheele, 1776.)	Colour, brownish-yellow; surface smooth, or elevated into small tubercles; shape generally flattened-oval; size, from that of a large egg downwards; structure laminated; very common.	Gradually consumed before the blowpipe; soluble in caustic potash, insoluble in diluted acids; but soluble in nitric acid, the solution affording, on evaporation to dryness, a bright carmine-coloured residue.
II. Phosphate of lime, C. (Wollaston, 1797.)	Colour, pale-brown; surface smooth, like porcelain; structure loosely laminated; small size; extremely rare, as forming entire concretions, but not so unfrequently constituting alternate layers with other matters.	Whitens when exposed to the blowpipe; soluble in muriatic acid; insoluble in caustic potash, and does not give off ammonia.

Name.	*External Characters.*	*Chemical Characters.*
III. Triple phosphate of magnesia and ammonia, C. (Wollaston, 1797.) (See frontispiece.)	White shining crystals, or white crust, not forming entire concretions, but coating the surface, or lying between the layers of others, and never exhibiting in its own structure a laminated arrangement.	Diminishes under the blowpipe; exhaling an ammoniacal odour, and at last suffering imperfect fusion; soluble in dilute acids, and insoluble in caustic potash, but gives off ammonia.
IV. Fusible calculus, (consisting of a combination of the two last.) (Wollaston, 1797.)	Colour, white like chalk; shape that of the cavity in which it lies; size often very large; structure laminated, or compact and friable; common, as an incrustation of foreign bodies.	Readily fused under the blowpipe into a transparent glass; partially soluble in acetic or dilute sulphuric acid, and the remainder dissolved by muriatic acid; insoluble in caustic potash, but gives off ammonia.
V. Mulberry, or oxalate of lime, C. (Wollaston, 1797.)	Colour, very dark-brown; surface rough, with large tubercles; consistence very hard; size seldom exceeding that of a walnut; structure compact, always single.	Under the blowpipe expands, and effloresces into a white powder, which when moistened, and applied to turmeric paper, causes a red stain; not soluble in pure alkalies, nor in the muriatic and nitric acids, unless finely powdered, and assisted by heat.
VI. Cystic oxide, C. (Wollaston, 1810.)	Yellow, semitransparent, glistening; structure compact; confused crystalline mass; small; very rare.	Exhales a peculiar odour under the blowpipe; very soluble in acids and alkalies.

The symptoms of stone in the bladder are—1. Pain felt in making water, especially when the last drops are expelled, and for some time afterwards, which is referred chiefly to the point of the penis, but also to more distant parts, as the inner side of the thighs, testicles, particularly the left one, and even the feet. 2. Uneasy feelings of a similar kind, but not so intense, experienced upon any sudden motion of the body. 3. Frequent desire to make water, varying in degree from slight diminution of the length of the intervals, to almost incessant calls which it is impossible to resist. 4. The urine being tinged with blood after rough motion. 5. An occasional interruption of the stream of urine. 6. A peculiar expression of suffering and anxiety in the patient's countenance. These symptoms vary extremely in their positive and relative severity, being always most intense when there is irritation of the bladder or general system, and bearing a direct proportion to the degree in which the urinary secretion is deranged;—a fact not easily explained, but very important in respect to the treatment of the disease. Thus, contrary to what might be expected, the least annoyance attends the mulberry calculus. The uric acid kind are accompanied with more, and the phosphates with most of all. As there are other diseased states of the urinary organs which give rise to complaints

more or less similar to stone in the bladder, it is necessary for obtaining certain proof of its existence to introduce an instrument into the bladder, and search it. The operation performed with this view is named Sounding, and is executed by means of metallic instruments variously formed. The one that will generally be found most convenient is a steel bougie of the size usually rated No. 7 or 8. It should be moved about methodically into every part of the bladder, while the patient lies reclining. If the point grazes against the rugæ of a thickened muscular coat, an inexperienced surgeon may be misled into supposing that there is a stone; but if it really encounters one, there will hardly be a possibility of misinterpreting the distinct sensation which is always felt, and the corresponding sound generally heard at the same time. A small stone may escape detection, from the bladder being too much distended or too much collapsed; and when either of these sources of fallacy is suspected, a catheter should be introduced to draw off the water, or convey in a sufficient quantity from a syringe or elastic bag. If the parts about the neck of the bladder are very irritable, and grasp the sounding instrument tightly, soothing measures, such as gentle evacuation of the bowels by castor-oil, opiate injections into the rectum, and the warm-bath, ought to be employed. When the prostate has suffered enlargement, a sort of pouch is generally formed behind it, in which the stone may lie so as to be hardly tangible by the sound, unless placed more within its reach, by altering the position of the patient, or elevating the bladder by a finger introduced into the rectum.

The treatment of stone in the bladder may be divided into palliative and radical. The former consists in the use of means which tend to prevent the concretion from increasing, and to alleviate the patient's sufferings; the latter, by removing the calculus, affords effectual relief from all the uneasiness of the disease.

The means used with a palliative view are such as may be expected to correct derangement of the urinary secretion, and thus not only remove that excess of acid, or saline constituents, which is essential for the occurrence of concretion, but also diminish the severity of the symptoms resulting from the calculus actually existing, since these, as has been already observed, always correspond directly in their severity with the degree to which the secretion of urine is morbidly altered. In order to determine what remedies ought to be prescribed for this purpose, the urine of the patient must be examined. If it shews the characters which denote an

excess of acid, alkaline medicines will be indicated. Of these the carbonates of soda and potash are the best, and may be administered in the dose of a scruple or half a drachm, two or three times a-day, dissolved in a tumbler of water. Lime-water and soap-ley were formerly much used in various forms and combinations, in the expectation of their producing a solvent effect on the stone; and the relief experienced from them was often so great as to afford apparently good ground for believing that they possessed such a power. It is admitted now that they could act beneficially only by correcting morbid derangements of the urinary secretion; and they are, therefore, superseded by the less nauseous alkaline preparations above mentioned. If, on the contrary, the quantity of earthy and alkaline salts seems to be redundant, acids should be employed. The muriatic is usually preferred, and may be given in the dose of twenty or thirty drops, in a sufficient quantity of water, three times a-day. When, along with this state of the urine, there exists much irritation about the bladder and kidneys, as is generally the case, small doses of opium ought to be conjoined with the acid; and other means of a soothing kind, as the hip-bath and opiate injections, at the same time prescribed. Whatever be the nature of the derangement, it will always be proper to correct any errors in the patient's diet or mode of living that tend to injure the health in general, and the digestive functions in particular.

The means which are employed, with the view of effecting a radical cure, may be considered under three heads, accordingly as they act:—1. By promoting the escape of the stone entire through the natural passage; 2. By breaking down the stone into fragments small enough for being carried out with the stream of urine; and, 3. By cutting a free outlet for the stone.

Renal calculi of small size generally remain only a short time in the bladder, and pass out with the urine often almost immediately after descending from the ureter. When the history of a case leads to the suspicion of there being a concretion of this kind remaining in the bladder, or if it should be detected by sounding, its exit ought to be assisted by a very complete dilatation of the urethra by means of bougies, by drinking copiously of simple diluent fluids, and by the relaxing influence of warm bathing. Sir A. Cooper recommended the use of forceps, shaped like a sound, for seizing and extracting small calculi.* If there are many concretions, the instrument contrived for this purpose, at Sir Astley's suggestion,

* Med. Chir. Trans. vol. xi.

by Mr Weiss, may be used with safety and advantage ; but if there be only one, the groping that will generally be required for its seizure can hardly fail of being very injurious. Prosper Alpinus relates, that there was a practice in Egypt, of ancient origin and extensive employment, for the removal of stones from the bladder, which consisted in distending the urethra by blowing into it with a tube, and then urging the calculus to descend by pressing on it with the fingers introduced into the rectum. It is difficult to conceive the possibility of executing this procedure on an adult, and in children the urethra is too narrow for allowing much advantage to be derived from it. Cases sometimes occur in which the calculus has entered into the urethra, and after passing through more or less of its extent, has been arrested at a narrow part of the canal, either natural, or resulting from stricture. The membranous portion is the most common seat of this occurrence, which also happens sometimes at the orifice. A retention of urine occasionally results from the obstruction thus caused ; and if a full-sized catheter were passed without any precaution, it might push the concretion back into the bladder, which of course ought to be avoided. The instrument should be merely carried down so far as to disengage the calculus from the contracted place that it occupies, and which it closes like a spherical valve ; or, if of a very small size, it may be conveyed past the concretion into the bladder. The immediate bad effects being thus obviated, it is necessary to employ means for assisting the stone to pass forwards. Bougies of progressively increasing size, introduced down to the seat of obstruction, may prove sufficient for this purpose. Forceps are used with hardly any advantage, from the difficulty of expanding their blades. When it proves impossible to extract the calculus from the urethra, it ought to be cut out, which is readily effected, by making an incision upon it while held firmly, so as to prevent any displacement during the operation, or upon a grooved staff. The wound sometimes heals by the first intention, but it is prudent to keep a catheter in the urethra for a few days, to prevent any risk of the urine infiltrating into the cellular substance. Calculi are sometimes lodged in fistulas of the perineum, and, of course, so long as they are permitted to remain, render a cure by the ordinary means impracticable. If discovered in this situation, they should be removed without delay by incision.

The second mode of removing a stone from the bladder consists in grinding it down to powder, or pieces small enough for escaping

by the natural passage. Though there are very ancient traces of this practice, and though in modern times ingenious patients have occasionally, by persevering efforts, succeeded in bringing away part, if not the whole, of calculi from which they suffered, yet Lithotrity, as this method of operating has been named, may be regarded as of recent origin. The apparatus was necessarily very inefficient and unmanageable so long as the cannula through which it was introduced into the bladder had a curved form. Some anatomists of the last century suggested that a straight instrument might be passed along the urethra; but Dr Gruithuisen (1813) first used a straight catheter. The contrivance of this gentleman, followed by the successive improvements of Amussat, Leroy, Civiale, and Heurteloup, rendered the lithotritic apparatus wonderfully perfect. It consisted of a straight cannula, containing another of steel, the extremity of which was cleft into three branches, that expanded by their own elasticity when pushed beyond the external tube, and closed upon being drawn within it. This internal cannula in its turn enclosed a solid rod of steel, terminating in a head so figured as to act destructively on a stone submitted to its rotatory motion. At the other extremity of this apparatus there were additional parts for preventing the escape of the urine, without impeding the motion of the cannulas or perforator, and for attaching the string of a drill bow. When the stone was large, a compound perforator could be employed, having a moveable branch at its extremity, that might be separated to more or less distance from the central position by a regulating screw at the other end, and excavate the stone to an extent corresponding with the degree of its expansion. The thin shell thus formed was broken by another instrument, named *brise-coque*, which consisted of an instrument shaped like a slightly curved Sound, and having its extremity formed into strong jaws, which were made to separate and embrace the stone, which was then crushed by the blows of a hammer or the force of a screw. The latter apparatus has come to supersede the former one for the whole operation, which is, therefore, now named Lithotripsy or crushing, to distinguish it from the grinding process. It is needless to describe particularly the various instruments employed, since description alone could give no precise idea of their structure, and still less of their exercise. The general principle, as already mentioned, consists in the separation of two jaws by pushing one before the other, and then, after grasping the stone, approximating them by the force of a screw or simply manual pressure.

Great improvements have been made in the instruments employed for crushing stones in the bladder, attended with a corresponding degree of facility and success in their employment. The operation may now be conducted with propriety by any practitioner who is accustomed to manipulate the urethra and bladder; and when the stone is not so large as to require frequent repetition of the process, it may be removed in this way with wonderfully little disturbance to the patient. But if there is any prospect of a prolonged and laborious conflict with the fragments, it is much better to extract the concretion entire through incision, than to incur the danger of exciting chronic inflammation of the bladder.

Chronic inflammation of the prostate gland or mucous membrane, if excited by the pressure or laceration of the instrument, will probably lead to further derangement of the urinary secretion, and the consequent deposition of new calculi,—the irritation caused in extracting which will keep up the train of morbid action, and if not at length fatal to the patient, must at all events make him suffer much more than he would have done from excision of the stone.

When the operation is to be performed, the patient should be placed reclining, with his pelvis a little elevated. The crushing instruments must not be introduced when the bladder is empty, as its coats could then hardly escape injury; but it is not expedient to inject water for the purpose of distension, as it is apt to escape by exciting the contractile effort of expulsion. A better plan is to allow accumulation of the urine to the requisite extent, since there is then less tendency to evacuation, while the capacity of retention affords the best evidence of the organ being sufficiently free from irritability to warrant the operation. Chloroform should not be administered, since pain is a sure sign of some error in the procedure, and therefore if prevented from being manifested, can no longer act as a useful beacon to the operator. The patient should be placed on his back, with the pelvis raised by a firm pillow, so as to let the stone lie, not at the neck, but in the posterior fundus of the bladder. In searching for the concretion or its fragments, the instrument should not be moved about at random with expanded jaws, but be carefully conveyed to the side of the body which it is desired to seize, and then, having one blade elevated, while the other remains in its place, be fairly turned round and closed upon the stone. It is impossible to explain any more in this than other operations, all the minutiæ of manipulation which are requisite for its successful performance. Practical expe-

rience, and familiarity with the instruments employed, are essential for a perfect execution of the process, which is one of those that may be performed with advantage on the dead subject.

There is no operation of surgery which has excited so much attention, and been practised in so many different ways, as Lithotomy. A prejudice, that it was unsafe to cut the neck of the bladder, for many centuries paralysed all exertions in improving the operation, which, in accordance with this misleading principle, was performed by making an incision in the perineum, and then nominally dilating, but really tearing, the orifice of the bladder sufficiently to allow the stone to be extracted. Such a procedure being tedious, painful, and dangerous, was justly dreaded both by patients and surgeons, the latter of whom willingly resigned it to irregular practitioners of rupture curing, and cutting for the stone, who in those days travelled the country in search of employment. The mode of performing lithotomy was indeed taught in the schools, and ingenious men contrived various modifications of the apparatus; but no real improvement was effected until near the end of the seventeenth century, when Frère Jacques introduced an entirely different method, which was to cut freely into the bladder. He commenced his career as a lithotomist, unacquainted with anatomy, and provided with very imperfect instruments,—but nevertheless extracted the stone with such invariable facility and dispatch, that though many of his patients died, and comparatively very few made complete recoveries, he acquired great reputation, and the friendship of some of the most distinguished surgeons in Paris. Through their assistance he supplied the defects of his education, and afterwards operated in various countries with distinguished success. The important truth having thus been ascertained, that the bladder could be cut without any fatal or injurious consequences, the attention of surgeons took a different direction, and a variety of methods and instruments were contrived for cutting the same parts that had been previously torn. It is unnecessary to consider these particularly, as the operation practised and described by Cheselden (1720), though perhaps not differing materially from that of some other surgeons both in this country and abroad, has been generally regarded the standard for imitation.

The lateral operation of Cheselden consists in making a free incision of the perineum,—opening the urethra at its membranous part,—and continuing the cut through the prostate gland, obliquely outwards and downwards. The simplest mode of effecting

this is to use a scalpel, or other knife, that may be under the surgeon's command; but as it requires an accurate acquaintance with the relative situation of the parts concerned, and considerable manual dexterity, to divide the prostate safely with such an instrument, various apparatus have been contrived for cutting in the requisite direction, and to a sufficient extent, merely in consequence of their form and construction, and without the necessity of precise guidance on the part of the surgeon. But after a hundred years' experience of such substitutes for operative skill, it is now almost universally admitted that the simple knife is by far the safest means for the purpose, and it does not seem necessary to enter here into any description of the obsolete procedures which used to occupy so large a portion of systematic surgical writings. The instruments required are—1. A grooved staff to guide the knive in cutting into the bladder. It ought to be of the largest size that the urethra will readily admit, which is usually about No. 11 of the bougie scale, and the groove should be very wide and deep, neither on the side nor convex surface, but in the intermediate space, so as to correspond with the direction in which the incision is carried. Mr Aston Key recommended a straight staff,—which certainly has the advantage of conveying the knife more directly than a curved one, but is liable to the objections of occupying the operator's left hand while the section is made, instead of leaving it at liberty to press aside the rectum, and also of exposing the artery of the bulb to danger. 2. A knife, which, including both the handle and blade, should be between seven and eight inches in length. The edge of the blade should be blunt, to let the operator's finger rest upon it, except to the distance of an inch and quarter from the point. 3. Forceps for extracting the stone, of two or three different sizes, of which the blades should be broad, moderately hollowed, and destitute of projecting teeth, which are apt to break the calculus. 4. A scoop to remove fragments or gravel. And, 5. A flexible tube, about six inches long, and half-an-inch wide, to convey away the urine after the operation, and prevent its infiltration into the cellular substance.

The parts that require to be cut are—1. The integuments, which should be divided to the extent of about three inches in an adult, or more if the subcutaneous adipose tissue is unusually thick, and of course less in children. The incision should extend obliquely from the raphe of the perineum to the hip, passing nearly equidistant between the anus and tuberosity of the ischium. 2. The trans-

verse muscle of the perineum, and anterior part of the *levator ani*. 3. The transverse artery of the perineum. 4. The membranous part of the urethra. 5. The prostate gland through the whole extent of its left lateral lobe. And the parts which ought not to be cut are :—1. The rectum, which may be injured in laying open the perineum, in cutting into the groove of the staff, and in dividing the prostate, but chiefly in enlarging the wound, in case it proves too small subsequently to withdrawing the staff. 2. The artery of the bulb of the urethra, and the bulb itself, from cutting into the canal too far forwards, and at its lateral part. 3. The pudic artery, from cutting too much in a lateral direction in making the section of the prostate. 4. The internal fascia of the perineum, or vesical reflexion of the pelvic fascia, from cutting the prostate upwards, or carrying the incision beyond it in a lateral direction.

When the operation is to be performed, the patient should have his bowels freely evacuated by a laxative administered the day before. He should be placed reclining on a table about two feet and a half high, covered with a folded blanket, and under his head a pillow or two may be laid, but nothing to raise the shoulders. He is then to seize the soles of his feet, one in each hand, which should rest on the fibular or outer edge, and by means of a strong tape or bandage have the limbs secured in this position, after which they are to be confided to two assistants, one standing on each side of the table. The staff having been introduced is now to be committed to a third assistant, who holds it in one hand, and the scrotum in the other. The surgeon then seats himself on a chair, shaves off the hair from the perineum, feels the different parts that determine the place of his incision, and resting the fingers of his left hand on the skin so as to prevent any displacement of it, pushes his knife directly inwards at the anterior point of incision to the depth of the perineal muscles. He cuts in the direction above mentioned so as to divide the skin, fat, superficial fascia, and transverse muscle, gradually diminishing the depth of his incision until it reaches its posterior termination ; then introducing the fingers of the left hand into the wound, to serve as a guide for the knife and protection to the rectum, he cuts so as to divide the anterior part of the *levator ani*, and expose the membranous portion of the urethra, into which he makes an opening, and then, keeping the knife in the groove, while he satisfies himself, by taking the staff in his left hand, that it is held properly in the mesial plane close up against the pubis, he gives it again to the assistant, and pushes the knife steadily into the

bladder, and fairly through the prostate; at the same time, with his left hand, holding down the rectum, and feeling what way is made with the knife. He then introduces his finger into the bladder, desires the staff to be withdrawn, and conducts in the forceps. He searches for the stone with the blades closed, and, having found it, opens them very wide, depresses, and then closes them. By gently relaxing his hold, and renewing it, he shifts the position of the calculus, if unfavourable for extraction, and, with the assistance of his left fore-finger, proceeds to draw out the stone, not directly, but by a motion in alternate directions, so as to dilate the margin of the wound without tearing. Forcible efforts ought never to be used in doing this; and it is much better to introduce the knife again, if the opening proves too small. After one stone has been removed, the bladder ought to be searched for more, with a sound introduced through the wound; and if any are detected, they must be removed in the same way as the first. Should the calculus be broken, its fragments must be carefully extracted with the scoop if small, or the forceps if large. The tube is then to be introduced, either alone, or, if there is much tendency to hemorrhage, with some folds of lint wrapped round its middle; after which the patient may be placed in bed, on his right side, with the limbs moderately bent.

The after treatment in cases that proceed favourably is extremely simple. Means must be employed to prevent the urine which distils through the tube from wetting the bed, by interposing a piece of oiled cloth between it and a folded blanket laid under the breech. The diet, during the first three or four days, should be sparing, and of a farinaceous kind. Gentle laxatives, such as castor-oil, are to be administered as occasion may require. The tube may be withdrawn at the end of either two or three days. About the ninth day a little urine is generally observed to issue from the urethra; and when the natural passage thus begins to be resumed, the discharge by the wound very soon ceases, so that by the thirteenth or fifteenth day the whole is evacuated by the penis.

The bad consequences of the operation are:—1. Sinking; 2. Hemorrhage; 3. Infiltration of urine; 4. Inflammation at the neck of the bladder; 5. Peritonitis; 6. Recto-vesical fistula.

Unless the patient is extremely weak from the exhaustion of disease, or the feebleness of his age, as when it is below two, or beyond seventy years, there is no risk of his sinking directly under the effects of the irritation attending the operation, if properly

performed. But if, from the inadequate size of the wound in the bladder or *levator ani*, the stone, instead of being gently extracted, is dragged out by force, after long and painful ineffectual attempts to draw it through, the stoutest individual may suffer a shock too great for his strength, and die in the course of a few hours, as if suffering from profuse hemorrhage, an extensive burn, or any other injury destructive to the powers of life.

If the vessels are regularly distributed, and the surgeon cuts no more than he ought to do, there is hardly any fear of a fatal or even troublesome bleeding. Should the dorsal artery of the penis rise from the pudic high in the pelvis, and take the course which it has been observed to follow in some few cases along the neck of the bladder, and obliquely across the lateral lobe of the prostate, it can hardly escape division during the performance of the operation which has been described. The coincidence of such an irregularity with stone in the bladder must be extremely rare; and the danger of hemorrhage from this source so small as to afford little reason for apprehension, though instances of it have occurred. When the flow of blood appears alarming, the surgeon should introduce his finger into the wound, and press the pudic against the ramus of the ischium. He will then ascertain whether the hemorrhage proceeds from it or its branches given off below, in either of which cases a ligature may be applied by means of a tenaculum, the sides of the wound being held aside, and the source of the bleeding, if necessary, exposed to view more completely by further incisions. If the hemorrhage is found to proceed, not from the trunk of the pudic, the artery of the bulb, or that of the perineum, it must be referred to the neighbourhood of the prostate, and all that can be done is to introduce a tube wrapped in lint, raise the patient's breech, and apply cold.

Infiltration of urine takes place when, from the small size of the wound, from its being seated too far forward in the perineum, from an insufficient division of the *levator ani*, or from swelling of the cut surfaces, the urine has not a free outlet externally; and if the incision of the bladder is carried far back, more especially through the reflexion of the pelvic fascia on its neck, this untoward event will be more apt to happen. The patient feels first a painful sense of distension, and then an uneasiness in the hypogastric region behind the pubis, which leads to the belief that peritonitis is commencing, and blood is freely withdrawn both locally and generally without affording any relief. A fever, attended with the symptoms

that denote excessive irritation, commences, continues in despite of every means employed to check it, and proves fatal in a few days. Whenever the urine is not observed within five or six hours after the operation, the surgeon should examine the tube to discover whether or no it is obstructed by coagulated blood,—and if a tube has not been employed, he should introduce his finger into the bladder, so as to make sure of there being a free passage for the fluid, keeping in mind that infiltration of urine, though in general easily prevented, can seldom if ever be remedied.

Inflammation at the neck of the bladder is the bad consequence most to be dreaded. It is attended with pain at the point of the penis, nausea, with disgust at every sort of food, and occasional retching,—yellow furred tongue,—frequent pulse,—and great general restlessness. It proves fatal seldom sooner than one, or later than three weeks. On dissection, the cellular substance at the neck of the bladder is found infiltrated with pus, and the prostate gland also contains purulent collections. The circumstances that seem to have most effect in giving rise to this insidious and deadly process are laceration and contusion inflicted during the removal of the stone, especially if the sensitive and unyielding ring at the base of the prostate in the neck of the bladder be not divided by incision. This texture resists division, and cannot be torn with impunity ; so that the safety of the operation depends very much upon the point thus essential being duly accomplished. Little can be done to arrest the inflammation when once excited,—but the means that promise most assistance in doing so are frequent immersion of the pelvis in a hip-bath, and opiate injections.

Peritonitis very seldom follows the lateral operation of lithotomy ; but if it should occur, it will appear within twenty-four or forty-eight hours at furthest, and may be recognised by the tenderness of the abdomen to pressure, the small wiry pulse, and cadaverous appearance of the patient. Free depletion, both local and general, warm fomentations, and the warm bath, will be the proper remedies.

A communication between the rectum and wound occasions, in the first instance, little inconvenience ; but as the cure advances, and the orifice of the wound contracts, the contents of the gut, whether gaseous or liquid, instead of escaping through it, are forced into the urethra, and issue from the penis, while part of the urine descends into the rectum. The only chance of remedy for this disagreeable occurrence is to divide the septum that lies between

the external orifice of the wound and its communication with the gut; but this should not be done immediately after the operation, as it has happened that the wound of the intestine, when of small extent, occasioned no trouble, and healed by the first intention.

When the various obstacles to success that have been mentioned, together with the adverse influence of disease in the kidney, which is sometimes associated with stone in the bladder, and also the dangerous consequences common to all severe operations, are taken into account, it will appear obvious, that, however perfect the principles on which the operation is performed, and skilful its execution, the patient's recovery cannot be regarded as by any means certain. A succession of fortunate cases often leads an operator to flatter himself with a belief of his own infallibility, but sooner or later he meets with reverses; and it appears that the average of successful practice is one death in from seven to ten cases. The period of life at which the operation proves most successful is between the second and fifteenth years, and next to this from sixty to seventy. The most unfavourable age seems to be about forty or fifty; and it is always observed that when the health is vigorous, and the suffering from the disease slight, the risk is much greater than when the patient is reduced by continued and incessant pain, provided no organic disease has been excited in any part of the system.

Other methods of cutting for the stone have been proposed and followed more or less extensively; but as the success attending any of them has not nearly approached that of the operation which has been fully considered, it seems unnecessary to enter into a particular detail of them, and the three following may be noticed shortly as the most deserving of attention:—1. The bilateral operation; 2. The high operation, or above the pubis; and, 3. The recto-vesical operation.

The first of these was contrived by M. Dupuytren, in order to lessen the risk of injuring the rectum and pudic artery. The peculiarity of it consists in cutting the prostate on both sides equally, which is effected by an instrument constructed for the purpose, and composed of a sheath containing two blades, that can be made to project laterally more or less as may be required. This instrument, being conveyed into the bladder on the groove of the staff, after the preliminary incisions have been made in the perineum, in a transverse direction, is expanded and withdrawn in this state, cutting the gland to the requisite extent. Many objections might be urged against this method, but it is sufficient to mention that

the result of experience is not in its favour. The High operation is of older date, having been introduced about the close of the seventeenth century, when it was discovered that the bladder could be cut with safety, but the proper principles for operating in the lateral way had not yet been established. It was proposed considerably earlier than this, and had even been practised in some few cases, but did not engage much attention until the time mentioned. The mode of procedure was to make an incision in the *linea alba*, about three inches long, extending from the pubis upwards, separate the recti muscles, and open the anterior or pubic side of the bladder, beginning as near as possible to its neck, and continuing the wound upwards to a sufficient extent, with care to avoid cutting the peritoneum, where reflected on the fundus. The advantages contended for in recommendation of this operation were the facility of its performance, even where the stone was of the largest size, the safety of it in respect to hemorrhage, and the comparatively small degree of pain it occasioned the patient. The objection, however, of urinous infiltration, which was equally obvious in theory and serious in practice, more than counterbalanced these arguments; and the means contrived for preventing this dangerous consequence either proved insufficient, or, by their complexity and irritation, destroyed the great ground of superiority contended for. The high operation is now performed by very few surgeons, and will probably soon cease to be practised at all. The Recto-vesical method was introduced by Vacca and Sanson (1816), and through the influence of their recommendation, together with that of some other surgeons, attracted considerable attention for a few years. It consisted in dividing the *sphincter ani*, rectum, membranous part of the urethra, and prostate, so as to lay the two canals thus far into one, through which the stone could be easily extracted. This was effected by introducing into the bladder a staff grooved on its convex side, cutting through the sphincter and the integuments of the perineum, and then conveying in a sharp-pointed curved bistoury, which being entered into the groove beyond the prostate, and carried steadily forwards, completed the cutting part of the operation at once. It was contended that the stone could thus be got out very easily, and with hardly more pain than what attends the operation for *fistula in ano*,—that there could be no danger of bleeding incurred,—and that the risk of urinous infiltration, as well as inflammation, would be less than after the lateral operation. The great objection that obviously suggested itself was the probability

of a recto-vesical fistula; but the free division of the sphincter seemed likely to diminish the chance of this, and experience proved that it did not often happen. In the hands of an inexpert operator, this method is perhaps the least difficult; but it certainly must be regarded as decidedly inferior to the lateral operation when properly performed, as well in regard to the danger of its immediate effects, as in prospect of the patient's condition after recovery being accomplished.

When the stone is of no great size, it may be removed very easily and safely by opening the membranous part of the urethra, just as if for the division of a stricture, and thus passing forceps with narrow blades into the bladder, a tube being afterwards placed in the wound to prevent urinary extravasation.

Retention of Urine in Females.

From the shortness, straight direction, and width of the urethra, together with the absence of a prostate gland, females are much less liable to retention of urine than males. They suffer from it, however, occasionally, in consequence of the following circumstances:—1. Paralysis from distension; 2. The pressure of a gravid uterus; and, 3. Retroversion of the uterus.

The female bladder is more capacious than that of the male, and can suffer the accumulation of more fluid without being injured in its contractile power. When, however, the limit of healthy expansion is at length exceeded, the same effect is induced as when the male bladder is concerned, and the patient labours under a complete retention, and requires for her relief that the catheter should be introduced. The instrument employed for this purpose is made of silver, about six inches long, very slightly curved, and a quarter of an inch wide. The patient lies in bed on her back with the thighs drawn up; and the operation ought to be performed under the clothes. The fore-finger of the right or left hand, according to the position of the patient, is introduced between the *labia minora*, and carried upwards to their junction, a little below which the orifice of the urethra is situated, and where it is readily recognised by the feeling of a depression, with a little elevation behind or nearer the vagina. The finger being retained here, the point of the catheter is by its means directed into the bladder. The mouth of the tube may be closed by applying the thumb over it, until a receptacle is provided for the urine,—or a bladder may be tied to it so as to secure the fluid, without any risk of allowing its being

spilt upon the clothes. If the catheter has a stopcock upon it, this will be managed still more conveniently, but the instrument is thus rendered rather too complicated for its easy introduction.

When the uterus is distended, and more especially when its contents descend low in the pelvis during parturition, the urethra is liable to such compression and displacement as frequently induce retention of urine. In such circumstances, it is not always practicable to introduce the common female catheter, and one either flexible, or, if rigid, curved like that for the male urethra is required. The difficulty is still greater when the retention depends upon retroversion of the uterus. This displacement consists in a turning back of the fundus of the uterus, and its being bent down between the vagina and rectum. It very rarely occurs in the unimpregnated state, though it is said to have been met with in virgins, and is most apt to happen between the third and fourth months of pregnancy, in consequence of some sudden motion of the trunk, as in leaping or dancing. A consideration of the relative situation and connexion of the *os uteri* and urethra will render it obvious that the effect of such a retroversion on the latter must be a great extension of it upwards and forwards; withdrawing the orifice from its usual situation; impeding the discharge of the urine, and rendering the introduction of a catheter extremely difficult. The bladder becoming distended, reacts on the primary disease, and opposes the replacement of the uterus, whence the first object in the treatment is to draw off its contents. This may sometimes be done by means of a flexible or curved silver catheter; but it has happened repeatedly that such instruments could not be introduced, and the patient either died from extravasation of urine, or was saved by puncture of the bladder above the pubis. Should that operation be judged necessary, it is to be performed in the same way as in the male; but especial care must be taken in introducing the trocar not to transfix the elongated and narrowed neck of the bladder, which may happen by directing the instrument perpendicularly, instead of backwards towards the promontory of the sacrum. The uterus also has been punctured from the rectum; but this proceeding must be regarded as unwarrantable, unless the other more safe measures have been tried without success. When the resistance of the distended bladder has been removed, the surgeon should introduce the fore and middle fingers of one hand into the rectum, while the other co-operates in the vagina, and endeavour to replace the retroverted uterus.

It may be observed that females, who suffer from uterine excitement or hysterical affections, are apt to complain of inability to excrete the urine, and the catheter is often used in such cases; but warm fomentations applied to the hypogastrium, and cathartic injections thrown into the rectum, will almost always obviate any real necessity for its employment in such circumstances.

Urinary Calculi in the Female.

Females seem to be much less liable to the formation of renal calculi than the other sex, and get quit of them more readily when they do occur, owing to the shortness, width, and dilatability of their urethra. Sometimes, however, calculi are detained after descending from the kidney, and nuclei for concretion are also occasionally afforded by foreign bodies introduced from without, through the urethra into the bladder. The stones, which have their foundation laid in either of these ways, increase in magnitude in the manner already explained, and occasion symptoms analogous to those formerly described. Frequent micturition, the urine tinged with blood, and aggravation of these complaints by rough motion, excite the suspicion of calculus in the bladder, especially if the patient has previously suffered the symptoms which indicate the presence of one in the kidney or ureter, and the introduction of a catheter or sound ascertains its existence positively. Women between the ages of twenty and fifty are most frequently the subjects of the disease.

The female urethra being not only very short and wide in its natural state, but also very dilatable, allows small stones to be seized and extracted through it very readily. But when the calculus obtains a large size, it has generally been thought necessary, until of late, to enlarge the opening by incision. This may be readily effected by introducing a grooved director, and conveying in by its means a knife, with which the urethra and neck of the bladder are divided obliquely outwards and downwards on one or both sides, without injury to the vagina. The objection to this operation is the risk of subsequent incontinence of urine; and the fear of such a consequence has led some surgeons to cut above the pubis, or between the pubis and the orifice of the urethra (Lisfranc). Sir A. Cooper, and others, brought into notice a mode of extracting the calculus, which, though practised previously at different times, had been almost forgotten. This was to dilate the urethra by instruments contrived for the purpose, or by sponge tent; means

certainly preferable to those which seem to have been formerly in use, such as the root of gentian, or a piece of small intestine containing air or water, introduced into the urethra flaccid, and afterwards rendered tense by twisting (Bromfield). The process of dilatation must be carried on slowly to prevent an insufferable degree of pain, and other bad consequences. If the stone is large, it will greatly expedite and facilitate the operation to introduce the finger into the urethra, and divide with a straight bistoury any particularly tense part of the canal that may be felt. After this the dilatation goes on much more rapidly, so as to be completed in a few minutes, instead of requiring days.

Incontinence of Urine.

Incontinence, or involuntary discharge of urine, is rarely met with in females, but occurs very often in males. It happens at all ages, and depends on different circumstances. In children, who are frequently subject to it during their sleep, the cause seems to be irritability of the bladder, inducing its expulsive contraction before the fluid accumulates in sufficient quantity to occasion uneasiness enough for awakening the patient. The fear of punishment, or some other strong impression on the mind, may break this disagreeable habit, by inducing a more vigorous resistance on the part of the voluntary muscles situated at the neck of the bladder; since, as is well known, volition is not entirely suspended during sleep. A more powerful remedy, and one that seldom fails when the morbid disposition has no other source than that under consideration, is the application of a large blister over the sacrum and lower part of the loins. A very distressing incontinence is met with in persons of more advanced age, and often in the vigour of life, who have suffered derangement of the nervous system, either from spontaneous disease or the effects of external injury. The complaint is then usually associated with weakness of the inferior extremities, which betrays the nature of its origin, but it sometimes exists alone, and is of itself sufficient to render the patient miserable. Powerful counter-irritation, especially that effected by the actual cautery applied on each side of the spinous processes of the lower lumbar vertebræ, affords the best chance of relief; and internal stimulants, as cantharides, may be conjoined with this practice, though there is seldom decided evidence of their exerting any beneficial influence. Warm and cold bathing, frictions, and strict attention to the preservation of general health, should at the same time

be diligently employed; and improvement must not be despaired of though it should be a long while of appearing. Incontinence is common in old age; but in this case is generally confined to the period of sleep, and may be prevented from proving troublesome by introducing the catheter previous to the time of rest. In extreme cases of incontinence, when there is a constant dribbling from the urethra, the patient may be rendered comparatively comfortable by attaching to the penis a bag of India rubber, provided with a plug or stop-cock, for allowing the urine to escape when a convenient opportunity occurs.

Irritability or Chronic Inflammation of the Bladder.

This complaint is almost confined to males. It is characterised by frequent desire to make water, and inability to resist these calls, however incessant or inconvenient. The feeling before micturition is generally more or less painful, and sometimes extremely so, whence stone or stricture is often supposed to be present, and this supposition leads to the introduction of instruments that greatly aggravate the patient's sufferings. The disease usually occurs in young and middle-aged men. It is occasioned by various circumstances, such as over-distension, which in the first instance causes paralysis of the muscular fibres, the irritation of stimulating food, or chronic inflammation, spreading back from the urethra, or originating in the mucous coat of the bladder, in consequence of exposure to cold, or other exciting causes of inflammatory derangement. The treatment consists in using measures of a soothing nature, of which rest, both of mind and body, is an essential one. This, together with a milk diet, copious diluent drinks, and the hip-bath, sometimes proves sufficient. In more severe cases, injections, of two or three ounces of warm water, with a few drops of laudanum, or the sedative solution of opium, may be thrown into the rectum once a day or oftener. Benefit is also derived on some occasions from hyoscyamus and camphor, administered in the form of pill, also from ten or twelve drops of balsam of copaiva, with five or six of the sedative solution, taken two or three times a-day, and from small doses of Dover's powder, with colchicum. Blisters applied to the sacrum or perineum, contrary to what might be expected, sometimes afford relief, and a seton in the latter situation has succeeded after the trial of other means in vain. The operation of *vesicæ lotura*, or injecting the bladder, has often been used with temporary, but seldom with any permanent advantage. A

solution of the nitrate of silver is introduced by means of a catheter and syringe, or elastic bag, in such quantity as the irritable bladder is capable of receiving, and allowed to remain until the desire of expulsion leads to its discharge. In cases which derive benefit from this practice, it is observed that the quantity of fluid injected, and the time it is permitted to remain, gradually increase. The disease generally proves extremely obstinate, and is not unfrequently found incurable.

Catarrh of the Bladder.

This title is applied to an inordinate secretion of mucus from the bladder, and discharge of it in the urine, at the bottom of which, when voided, it forms a glairy sediment, sometimes nearly equal in quantity to the fluid. The disease usually occurs associated with the one last mentioned, and, though not necessarily accompanying, hardly exists independently of it. What has been said in regard to the causes and treatment of that affection will therefore apply equally to this.

Hæmaturia.

This, as the name implies, is a discharge of blood, which may occur as a symptom of other diseases, or exist as an independent affection. In the latter case, the hemorrhage is sometimes very profuse, and the blood coagulating in the bladder gives rise to very unpleasant consequences, to remedy which it may be necessary to introduce a very wide catheter, having a syringe adapted to it for sucking out the clots. The discharge of blood may take place either from the surface of the mucous membrane, or from a morbid structure into which it has degenerated. In the latter case, remedial means can be of no use, but in the former it is generally possible to moderate and even subdue the morbid flow, by correcting any derangement of the system that has indirectly occasioned it, by soothing the parts concerned if they indicate excitement, and by administering the tincture of muriate of iron, the *uva ursi*, or other astringent medicines. This disease is most common in advanced age, and may occur to an alarming extent without proving either permanent or seriously injurious. Confinement to bed in the horizontal posture, a mild diet, and palliation of the symptoms, constitute all the treatment requisite for recovery.

CHAPTER XIX.

DISEASES OF THE GENITAL ORGANS.

Gonorrhœa.

By Gonorrhœa is understood an inflammatory affection of the urethra, attended with a discharge of thick yellow fluid. As the inflammatory symptoms subside, the discharge becomes thinner, paler, and at last almost watery, when it constitutes what is called a Gleet. This disease is certainly the result of impure intercourse; but whether it requires for its production that the person infecting should have been infected, in other words, whether it is to be ascribed to the influence of a peculiar poison transmitted from one person to another, or whether it may arise merely from excessive and promiscuous intercourse, and then excite similar affections in others, is not yet fully ascertained. There is great variety in the susceptibility of different individuals, and the matter seems active in proportion to its thickness and yellowness. The watery discharge of a gleet, in persons of ordinary sensibility to irritation, is innocuous, but in others it may occasion the most violent gonorrhœa.

The first symptoms of the disease generally appear from one to four days after the poison has been applied. They consist in itching, redness, and swelling of the orifice of the urethra, and are soon succeeded by a painful burning sensation in the same part, particularly severe during micturition, the calls to which are much more frequent than usual. A thin serous exudation then takes place, at first merely gluing together the edges of the orifice, but quickly becoming more copious, and at the same time acquiring a purulent appearance. While these local changes are occurring, the system suffers general derangement in proportion to its irritability, and the acuteness of the inflammation. This symptomatic fever is often attended with local disturbance of different parts. The absorbent vessels of the penis, the glands of the groin, and the testicle, are apt to inflame;

abscesses form exterior to the urethra; the prostate and bladder participate in the diseased action; and various important consequences thus ensue, which will be particularly considered hereafter. The primary and essential morbid action is confined to the extremity of the urethra, from its orifice to the distance of an inch backwards.

The treatment requires, in the first place, purgation, and the antiphlogistic regimen, to moderate the inflammation, and allay the fever. The patient at the same time should drink freely of diluent mucilaginous fluids, such as rice-water, or linseed tea, and foment the penis frequently with warm water. When the intensity of the disease has been subdued, internal and external means may be employed to stop the discharge. Of the former, the balsam of copaiva and cubeb pepper are the most powerful; and they act much more certainly when administered in substance, than when their virtues are attempted to be concentrated by decomposition into extracts or essences. As the copaiva is not only extremely nauseous, but apt to excite sickness, vomiting, and great general uneasiness, it must be given cautiously, in small doses, combined with camphorated mixture, spirit of nitrous ether, or some such vehicle, and a little laudanum or muriate of morphia. The cubebs may be given more freely, either along with the mixture just mentioned or alone. One or two drachms may be prescribed two, three, or four times a-day, either alone or together with the balsam. The local remedies are injections of astringent fluids into the urethra. For this purpose the solutions of alum and several metallic salts, as the sulphates of zinc and copper, the acetates of lead and zinc, and the nitrate of silver, are chiefly employed. No injections should ever be employed until the symptoms of acute inflammation have been subdued; and even then, if the patient has an irritable constitution, they ought to be prescribed with extreme caution. Not more than a quarter of an ounce should be thrown in at once, and the penis should be compressed between the finger and thumb at the neck of the glans, to prevent the fluid from passing further back than this. The injection may be repeated three or four times a-day, unless it occasions a renewal of the inflammatory symptoms, when it must be immediately abandoned. If, notwithstanding these means, the running continues several weeks, a full-sized bougie may be passed two or three times, as the irritation thus caused, though its first effect is to render the matter discharged more thick and copious, often puts a sudden stop to it. The tincture of cantharides in the dose of twenty or thirty drops three times a-day, sulphate of zinc,

given internally in the form of pill, and sea-bathing, are the remaining remedies usually had recourse to when the gleet proves obstinate. The first gonorrhœa is generally more severe than those that happen subsequently. In these the inflammatory symptoms are often from the commencement so mild that the means proper for arresting the discharge may be used without delay. It is in such cases that the cubeb pepper proves of the most conspicuous service, a dessert spoonful of it given two or three times a-day frequently cutting short the disease.

Of the bad consequences or attendants of gonorrhœa, one of the most constant is chordee or painful erection of the penis. The only effectual remedy of it is to cure the disease; but before this is accomplished, the patient's sufferings may be alleviated by opiate injections into the rectum,—the introduction of opiate suppositeries within the *sphincter ani*,—or pills of camphor with hyoscyamus taken occasionally. If the spongy or cavernous substance of the penis remains hard after the inflammation has subsided, and causes pain, together with distortion of the member when it is erected, the part affected may be rubbed with camphorated mercurial ointment, to promote absorption of the condensing lymph that is effused. Inflamed absorbents are met with chiefly on the dorsal surface of the penis, and in persons of a very irritable constitution. They form hard painful cords, over which the skin is red. The best application that can be made to them is a warm solution of acetate of lead and opium. Inflammation of the inguinal glands, or Bubo, does not occur nearly so frequently in consequence of the irritation of gonorrhœa, as of that proceeding from sores of the penis, and, therefore, may be more properly considered in connection with them. Abscesses sometimes form in the cellular substance exterior to the urethra, at all parts of its extent, from the orifice back to the anus. So soon as they are recognised, an incision ought to be made for the evacuation of the matter, which, if permitted to make a way for itself, may cause ulcerative absorption of the mucous membrane. When the inflammation spreads back along the urethra to the bladder, it induces the painful symptoms which have been described under the head of Retention of urine from spasm, and irritable bladder, and requires the treatment that has been already explained in regard to them. Inflammation of the testicle is a common attendant of gonorrhœa, but will be more conveniently arranged along with the other morbid affections of that organ.

Gonorrhœa Preputialis.

A purulent discharge is occasionally induced from the surface of the glans and prepuce in persons who have this covering long, and the lining integument of its inner surface approximating the nature of a mucous membrane. From the tightness of the prepuce in such cases, it is generally difficult to bring the orifice of the urethra into view, and the source of the running is, in consequence, often referred erroneously to the usual seat of gonorrhœa. As this mistake leads to improper practice, the preputial disease requiring merely local applications, it ought to be avoided by carefully drawing back the fore-skin until the opening of the urethra comes into view, and then squeezing the penis so as to force out the matter, which will shew, by the direction whence it comes, where it has been secreted. The absence of pain in making water affords another good ground of distinction between this form of the disease and the other. The treatment consists in injecting the black wash four or five times a-day between the glans and prepuce.

Warts.

A very common consequence of gonorrhœa, particularly of the preputial kind, is the growth of warty excrescences, chiefly round the neck of the glans, and by the side of the frœnum; but they may be seated on any or every part of the surface of the glans and prepuce. These growths vary extremely, both in size and number, being sometimes hardly perceptible, and at others constituting large tumours. They have generally narrow necks, and irregular, rough bodies. They are painful and unseemly, apt to bleed when injured, and, if large, attended with a very fœtid discharge. If small, their absorption may be readily induced by a slight application of aromatic vinegar once every two or three days. Various other fluids, powders, and ointments have been employed for this purpose; but the one that has been mentioned seems to be, on the whole, the best. When the warts are large, they should be cut away with scissors close to the sound skin, and even when but of small size, they are removed in this way more quickly as well as effectually.

Sores on the Penis.

The penis, like every other part of the body, is liable to become the seat of ulceration; and its pendulous position, mobility, and

proneness to erection, much oppose the healing process. With few exceptions, the sores which are the seat of this morbid action result from venereal intercourse, being either simply abrasions or lacerations, or the consequence of the irritation of poisonous matter applied to the organ. The former are usually called excoriations, and the latter chancres. The poison gives rise to the ulcer by forming, in the first instance, a small abscess or pustule, which, opening in a few days, leaves a breach in the surface. If an excoriation, at the time of its production, is exposed to the influence of irritating matter, it then exhibits the same characters as if of poisonous origin. The sores of both kinds are generally seated on the lining membrane of the prepuce, near its reflexion on the glans, at its orifice, and at the sides of the frœnum; being more rarely found on the glans itself, or the body of the penis. When resulting from poison, they are generally small, round, or oval, and excavated, having the base as well as the margin condensed by an interstitial effusion of lymph, and affording a viscid discharge. When caused by violence, they are usually of an irregular figure, and surrounded with more or less hardness, according to the irritation which they have suffered from the matter applied to them. The surface of both kinds is generally grey, yellowish, or ash-coloured, and shews no appearance of granulations. The pain is very variable. When the sore is in a highly irritable state, it usually presents either a phagedenic or sloughing character. In the former case the ulcer, which is generally seated on the body of the penis, is round, shallow, and very abrupt at the margin, which is red, while the surrounding integuments are not altered from their ordinary state. It is very painful, and increases progressively, preserving the characters that have been described, and enlarging in superficial extent without becoming deeper. In the sloughing state the sore is surrounded with much tense swelling, and diffused redness. The pain is intense; and the margin of the sore, which is very irregular, at one or more parts exhibits sphacelated spots.

Owing to the peculiarities of their situation, and also of the circumstances which attend their production, sores on the penis are generally very slow in healing, unless properly treated, and even then often require more time for the purpose than might be expected from their size. It was very generally believed until lately, and the opinion is still maintained by many, that the poison which gave rise to chancres was of a peculiar kind, which had not existed in Europe until the latter part of the fifteenth century, when it

suddenly appeared at the siege of Naples, having either originated there, or been brought by Spanish soldiers who had imported it from the newly discovered Western World. This poison of Syphilis, as it has been called, was supposed to produce various other effects besides the primary sore, when absorbed from it into the system: first causing bubo, and then a succession of constitutional disorders that were termed secondary symptoms. Of these the most important were scaly eruptions of the skin, ulceration of the fauces, exfoliation of the bones of the nose, chronic inflammation of the periosteum and bones, ulcers on the surface of the body, cachectic emaciation, and death. It was further believed that mercury, administered so as to produce its constitutional effect, or feverish excitement with salivation, acted as a certain antidote to this poison, whether operating locally or generally; but that unless it encountered the poison previously to being absorbed from the sores, it merely arrested the morbid derangement in progress, without preventing the occurrence of the other secondary symptoms, which required successive courses of salivation for their remedy. It is now fully ascertained that the poison of the present day, though producing local effects in all respects similar to those described as resulting from syphilis, does not give rise to the dreadful consequences which have just been mentioned, when treated without mercury. The cure may be tedious, and the skin, throat, or periosteum may be slightly affected, but none of the serious effects that used to be so much dreaded ever appear; and even the trivial ones just noticed comparatively seldom present themselves. We must therefore conclude, either that the violence of the poison is worn out, or that the effects formerly attributed to it depended on the treatment. The latter of these opinions is supported by the fact, that secondary symptoms of the utmost severity, embittering the patient's existence, and ultimately destroying it, are still met with in the practice of those who employ mercury profusely and indiscriminately; and it is a curious circumstance, which cannot be either explained or denied, that this medicine produces these effects, more especially those on the bones, only in persons who are suffering from venereal ulceration of the genital organs. The quantity of mercury requisite for thus injuriously affecting the system is very variable,—depending upon peculiarities of the patient's constitution, either natural or acquired. Of the former, a scrofulous disposition may be particularly mentioned; and of the latter, one of the most important is that occasioned by mercury itself, since a person who

has taken it to such an extent as to have been disordered by its operation, is ever after very susceptible of its effect. It is generally noticed that those persons suffer most from mercury who are least readily salivated by it.

A fearful system of scientific quackery has in recent times been founded upon the ruins of the old mercurial delusion, and although the so-called "modified use of mercury," which is at present so much the fashion in Paris and elsewhere, may not be so speedy in its effect, I can testify, from what has frequently fallen under my observation, that it empties the pocket and injures the health no less effectually than the process of poisoning which it professes to have so advantageously superseded. In cases where mischief has been done by the administration of mercury, it is sometimes necessary to employ an antidote, and for this purpose the iodide of potassium, in small doses, has rendered the most valuable service. The preparations of sarsaparilla are also much employed to counteract the effect of mercury, as well as syphilis; and the faith in their efficacy is so firmly established, that any expression of my belief that they are utterly inert could hardly excite doubt except in the minds of those who have witnessed my hospital practice, throughout the whole course of which not a grain of sarsaparilla has ever been prescribed.

The local treatment must be varied according to the circumstances of the case. In the first instance, as soon as possible after the appearance of the disease, it is proper to destroy the morbid action of the part by touching it with the nitrate of silver; and then the black-wash, or a solution of sulphate of copper, containing two grains in an ounce, may be applied on a piece of lint. If the orifice of the prepuce is contracted so as to prevent it from being drawn back, the black-wash should be injected four or five times a-day, which is better than laying open the fore-skin, as the cut surface is sure to take on a similar action with that of the ulcers, and thus prolong the cure. When the sore has a phagedenic character, a bread and milk poultice is generally the most useful application in the first instance, for a few days, and then a strong solution of sulphate of copper, containing a scruple to the ounce, used merely to moisten the surface once a-day, with some milder lotion in the intervals, proves most efficient in arresting the progress of the ulceration, as well as promoting granulation. The disposition to slough depends on excessive irritability, which in general is owing to too great a power of action, and requires measures of

depletion, together with those of a soothing kind. Leeching, scarifying, fomenting, and poulticing, acetate of lead, and watery solutions of opium, are the means found most useful for this purpose, and all of them, except the two first, may be used with advantage also when the irritability is associated with weakness of the part. In mercurial sloughing of a chronic character, the best counteragent is caustic potass gently applied.

If secondary symptoms appear, they ought to be treated merely on the ordinary principles which guide the practice in regard to them when proceeding from other causes. In affections of the skin and throat, it is much better to abstain from mercury altogether, and either trust entirely to local means, together with a suitable regimen, or employ iodine in some of the forms in which it is usually prescribed. In affections of the periosteum or bones, which, as already mentioned, never occur in a severe form except when the patient has suffered from the mercurial influence, iodine is also found eminently useful, the appropriate local treatment, and especially the regulated application of blisters, being at the same time employed. Should it fail in affording relief, corrosive sublimate may be administered, in very small doses, such as the eighth or sixteenth of a grain two or three times a-day, given either solid or in solution, and combined with some anodyne or diaphoretic vehicle. If mercury were never used improperly, the treatment of venereal diseases, both primary and secondary, would be very easy; and as its abuse is every day becoming less common, there is reason to hope that the formidable class of mercurial diseases, on which volumes have been written, and particularly ulcers of this origin on the genitals, skin, mouth, and throat, will soon cease to be met with in practice. In regard to them, it will be sufficient to state at present, that time, careful attention to the general health, and for local applications, the nitrate of silver, sulphate of copper, and the black-wash, are in general the best remedies. When the obstinacy of the sore is excessive, it may be necessary to destroy the surface by caustic potass.

Bubo.

The irritation of a sore on the genitals, of whatever kind, or wherever situated, especially if aggravated by exercise or intemperance, is very apt to occasion swelling and inflammation of the inguinal glands. The buboes thus produced differ in no respect, so far as regards their treatment, from those which owe their origin

to other sources ; and an erroneous opinion, that formerly led to the most mischievous consequences, namely, that, when caused by chancres, they were tainted with the syphilitic poison, and required a course of mercury for their removal, is now happily exploded. The mercury which, under this idea, used to be constantly prescribed in their treatment, by exciting fever and increasing the irritability of the system, often occasioned the most destructive phagedenic or sloughing effects, and, when less obviously injurious, rendered the ulcers that resulted from the buboes extremely obstinate, and sometimes almost incurable.

Instead of thus encouraging the irritation, the object should be to soothe and allay it as much as possible. Whenever the patient begins to feel pain in his groin, he should desist from walking, assume the horizontal posture, and foment the parts, two or three times a-day, with warm water. When swelling is perceived, leeches are usually applied ; and certainly almost always with the effect, in the first instance, of lessening the tumour and diminishing the redness. But there seems to be good reason for thinking that the local abstraction of blood is apt to render the morbid process more slow and obstinate, so that the patient suffers much more than if the disease had not been thus retarded. Warm fomentations, cathartics, and, above all, healing of the sores, are the most effectual means for resolving the inflammation ; while, if suppuration does take place, these means are conducive to its speedy and perfect accomplishment. If the swelling proves very indolent, blisters and tartrate of antimony ointment are often very useful in effecting its discussion, or hastening suppuration, if it is in progress ; and it not unfrequently happens that these means excite absorption of the pus even after it is distinctly perceptible by fluctuation, which is always very desirable, as a breach of the integuments ought, if possible, to be avoided in persons in whom the sluggishness of local action indicates a bad constitution. When the matter is fully formed, it should be evacuated by free incision, after which the cavity may be poulticed for a few days, and then dressed with a metallic wash. Should the surface present an unsound appearance, caustic potass ought to be employed for its destruction. If the glandular structure protrudes through the aperture, or rises above the bottom of the cavity in spongy-looking, ash-coloured masses, it may either be subjected to the action of caustic, or first be removed in part by the knife or scissors. Should sinuses exist, owing to the aperture being too small or unfavourably situated, they are to be laid fairly open. In

patients of feeble constitution, starvation and confinement are often the sources of obstinacy in the resulting ulcer, and must be obviated by an alteration of regimen. If the system has been injured by mercury, the cure is sometimes rendered extremely tedious. In such cases, the gradual restoration of healthy action, which takes place through time, and the use of iodine with cod-liver oil, together with the external application of caustic, black-wash, or sulphate of zinc lotion, may be confided in as the best means of promoting recovery. When buboes present a phagedenic or sloughing character, they must be treated on the same principles as sores of the penis in similar circumstances.

Phymosis.

By Phymosis is understood a condition of the prepuce in which it cannot be drawn back so as to expose the glans. This condition may be either permanent or temporary; in the former case depending on the small size of the orifice, and in the latter resulting from swelling of the prepuce or parts contained within it. Permanent narrowness of the opening may be either congenital, or caused by the contraction that occurs during the cicatrisation of ulcers. It is inconvenient on many accounts; and, in particular, exposes the individual to an aggravated form of all the diseases which affect the parts concerned. The temporary phymosis is a very common consequence of gonorrhœa, sores on the inner surface of the prepuce, and warts. The swelling is attended with redness and pain, and is not only distressing in this way, but reacts on the disease which occasioned it, and renders the symptoms more severe, as well as the treatment more difficult.

The treatment of permanent phymosis requires dilatation of the orifice by incision, and this may be effected in various ways. Circumcision, or the removal of the extremity of the prepuce with a knife or scissors, is easily performed, but allows an extensive separation of the skin or mucous lining of the prepuce, unless a number of stitches are introduced all the way round, in which case erections of the penis are apt to excite great irritation. It sometimes happens, particularly in advanced age, that the prepuce becomes greatly elongated, thickened, and hardened, and then this mode of proceeding is the best, indeed the only one practicable. The ordinary plan is to slit open the prepuce, simply inserting one stitch at the termination of the incision, which should be nearly at the neck of the glans, to prevent separation of the cut edges. The

unseemly flaps that are thus formed in the first instance soon suffer a diminution from interstitial absorption, which renders them hardly perceptible. The operation is most easily performed by means of scissors; and the best situation for cutting is in the mesial plane on the lower surface. Cold applications should be used for forty-eight hours, during which, and for a day or two longer, if necessary, the patient must be subjected to the antiphlogistic regimen. Dr Dieffenbach of Berlin proposed a method of curing phymosis without depriving the glands of a preputial covering. This proposal is grounded on the fact that the skin of the prepuce is always sufficiently wide, and that the contraction depends entirely upon the internal membrane. If, therefore, a circular ring be removed from the orifice, the skin may be drawn back so as to expose the glands covered by the mucous membrane, and this investment may then be cut away with the scissors as far back as seems necessary, after which nothing remains to be done but to connect, by means of sutures, the two cut edges of the external and internal membranes. The great objection to this ingenious operation is the risk of irritation, and tearing asunder of the edges of the wound by erection of the organ, as in this case the contraction, consequent upon cicatrisation of the extensive ulcerated surface that remains, must inevitably lead to reproduction of the phymosis. The best operation, on the whole, seems to consist in cutting off a circular ring-like portion from the extremity of the prepuce, drawing back the loose external skin, then slitting the internal membrane, on one or both sides, nearly as far back as the neck of the glans, and, lastly, stitching its cut edge to that of the skin. In cases of slight contraction, instead of removing any part of the prepuce, it is sufficient to divide the internal membrane so far as may be necessary by repeated snips of the scissors while it is exposed by drawing back the skin, and then stitching together the cut edges.

The temporary form of this disease requires soothing measures, to allay the inflammation on which it immediately depends. Rest, warm fomentations, and, if the symptoms are very acute, general depletion, together with leeches or scarifications, are the most effectual means for this purpose. If sores exist, they must be treated according to the principles already explained; and the operation for phymosis ought not to be performed to bring them into view, even though the contraction may have existed in a permanent form previous to their production. In this case the prepuce ought to be restored to its ordinary state before being laid open, as the cure

will thus be completed in a few days instead of weeks, which would probably be required if the incision were made during the diseased condition of the parts. Nevertheless, if the sores prove very obstinate or irritable, this inconvenience must be encountered; but a careful and patient trial should always in the first instance be given to those means that are calculated to supersede the necessity of an operation. When the phymosis depends upon or is connected with warts, the prepuce should without delay be slit open, as these excrescences cannot be removed so long as it remains contracted. It sometimes happens, in consequence of phymosis being associated with an ulcerated state of the respective surfaces of the glans and prepuce, that adhesion takes place between them. Attempts have been made to remedy this preternatural connexion by dissection and careful interposition of dressings; but this procedure, which is extremely painful, hardly does any good, as the strong tendency to contract during cicatrisation reduces the parts nearly to the same state in which they were previously to the operation. In such cases, however, it is found advantageous to slit open the prepuce as far as it is not adherent to the glans.

Paraphymosis.

In Paraphymosis the orifice of the prepuce is drawn back behind the glans, and causes compression or strangulation of its neck. This can happen only where the opening is narrow, without being so much so as to occasion complete phymosis. The narrowest part of the prepuce is just at the orifice, where the skin and mucous membrane meet; and when it is drawn back so as to denude the glans, the internal lining is apt to protrude more or less beyond the ring thus formed, so that the seat of the stricture is not exactly behind the neck of the glans, but separated from it by a circular swelling caused by distension of the protruded internal membrane. A penis suffering from paraphymosis thus presents anteriorly the point of the glans in a tumid state,—then a circular swelling of mucous membrane,—next a deep sulcus, at the bottom of which is seated the stricture, formed by the narrow orifice of the prepuce, —and, lastly, the integuments of the penis more or less swollen, constituting a third enlargement nearer the pubis. Paraphymosis occurs at all ages, but most frequently in boys. It is readily recognised by the appearances which have been described, and the symptoms it occasions by impeding the circulation. These are, in addition to the swelling, pain, and the other indications of inflam-

mation, which, in circumstances favourable to intensity of action, may terminate in sloughing, but more frequently proves its own cure, by inducing ulceration at the seat of stricture.

The treatment obviously requires the use of means proper for effecting reduction of the strictured glans, and the manipulation for this purpose should be conducted on the same principles as those of the taxis for hernia. The surgeon having anointed the glans with oil, embraces it between the points of the thumb and fingers of his right hand, while with those of the left he makes counter-pressure on the constricting ring. He gently but steadily compresses it for some minutes, and then, by a combination of pushing and rotation, endeavours to press its neck within the stricture. If this proceeding fails, which it very seldom does when properly executed, he separates the swellings on each side of the stricture by bending down the extremity of the penis, so as to bring the tense cord-like portion of the skin which constitutes it into view; and then, with a sharp-pointed curved knife, makes a small incision at the part, about a line in length and depth. The reduction is now readily effected, unless the parts should have become consolidated by adhesive effusion, in consequence of the disease having been permitted to exist a number of days or weeks, in which case, just as in hernial protrusions that prove irreducible after the stricture has been divided, the completion of the operation must be trusted to the gradual effects of that tendency to reparation which is exerted by the system. The penis should be enveloped in lint moistened with acetate of lead lotion, and the patient ought to maintain the horizontal posture, until the parts resume their natural condition.

Cancer of the Penis.

The penis is sometimes the seat of cancer. Ulcers on it often assume the most alarming appearance, and exhibit extreme indisposition to heal, in consequence of constitutional peculiarities, especially that induced by the prejudicial use of mercury; but such sores must be carefully distinguished from those of a truly carcinomatous nature. The latter are met with in persons of advanced age. They are characterised by the inequality of their surface, the cartilaginous hardness of their base, their fetid discharge, and lancinating pain. The inguinal and iliac glands become affected in the progress of the disease, and the patient dies hectic from continued irritation.

The only remedy that affords any prospect of a radical cure is removal of the morbid part, and this, of course, only when the glands are untainted. The operation, therefore, ought to be performed without delay, so soon as the disease is distinctly recognised to be of this malignant kind. The penis may be amputated without any ceremony,—care only being taken that the whole of the disease is taken away, together with a portion of the neighbouring sound tissues. The integuments are more apt to prove redundant than defective, and therefore need not be saved by drawing them back previous to division. The arteries that require ligatures are to be tied, and the oozing of blood may be restrained by the application of cold water, or by effecting pressure on the stump after a flexible catheter has been introduced into the bladder. Lest the orifice of the urethra should contract during the cure, a bougie must be introduced occasionally to preserve its proper width.

Diseases of the Testicle.

Inflammation, or Hernia Humoralis.

The Testicle is excited to inflame by a variety of circumstances, of which the most important, in respect to their effect or frequency, are bruises, wounds, gonorrhœal inflammation, either spreading back along the continuous surface between the urethra and testicle, or suddenly suffering a metastasis to the latter situation, and the irritation proceeding from strictures, or the means employed to cure them. The symptoms are pain, hardness, and swelling, with more or less redness; and in acute cases, there is not only feverish disturbance of the system, but also sickness, vomiting, and constipation, similar to those attending strangulated hernia, in consequence of the testicle being connected, in its sympathies, with the viscera of the abdomen. When the inflammation is intense, it may prove fatal; but, in general, it is merely productive of temporary distress, and exposes the patient to the risk of serous effusion, chronic enlargement, and alteration of structure, which are frequently its consequences. The most violent cases met with are those caused by wounds of the gland; and such injuries are, therefore, regarded as dangerous, particularly in irritable constitutions.

The treatment of inflamed testicle must be regulated by the circumstances of the case. If there is redness of the skin, and other indications of acute action, blood should be abstracted locally, either

by applying leeches, or by opening some of the veins of the scrotum with a lancet. If the latter mode is chosen, the patient should stand erect while the veins are punctured, and as long as it is desired that the blood should flow. Warm fomentations applied to the scrotum, emollient injections thrown into the rectum, occasional doses of castor-oil, and a strict antiphlogistic regimen are the other means of most use, and, when the symptoms are very severe, should all be administered, together with tartrate of antimony and opiates, to allay the tendency to excessive action. Injections of tobacco infusion into the rectum have also been found beneficial. In mild cases it is generally sufficient to evacuate the bowels freely, enjoin rest in the horizontal posture, and apply a lotion of acetate of lead with opium to the scrotum. After the pain and tenderness have subsided, a degree of swelling frequently remains, for which gentle frictions, with camphorated mercurial ointment, or other discutient applications, should be employed, but with due caution, so as not to occasion a relapse, by producing too much irritation.

Hydrocele.

By Hydrocele is understood an accumulation of serous fluid in the cavity of the *tunica vaginalis*, either occupying its whole extent, or confined to the part covering the spermatic cord. In the former case, which is by far the most common, the swelling has generally a pyramidal figure, the large extremity being downwards,—is devoid of pain and sensibility, except at the lower and back part where the testicle lies,—appears translucent when placed between the eye and a candle in a dark chamber,—and is felt to fluctuate when pressed between the fingers alternately. In hydroceles of old standing and large size, the *tunica vaginalis* often becomes distended to an equal size quite up to the external ring, and so thickened that no translucency can be perceived. The fluctuation, insensibility to pressure except in the region of the testicle, and the history of the case, are then the only diagnostics from a swelling of the gland; and, if they should leave any doubt, it may be removed by a puncture. From hernia, hydrocele may always be distinguished by compressing the neck of the tumour between the fingers. In hydrocele of the cord, as collections of fluid in this situation are named, the swelling is usually round or oval, fluctuating, and translucent, leaving the testicle quite distinct, so that it may be felt on all sides. It is sometimes associated with the other form of the disease, and can then hardly be recognised except by evacuating

one or other of the sacs. The title of Spermatocele has been applied to hydrocele of the cord when its contents are colourless, slightly opulescent, and presents numerous spermatozoa under the microscope. It was thought that this character denoted a form of the disease not amenable to the ordinary treatment, but I have ascertained that there is no good ground for such a distinction, though it is true that as the swelling is generally of a small size, and little disposed to increase, there is seldom much occasion for interference.

The origin of hydrocele may sometimes be referred to blows or other sources of irritation, but is in general very obscure. The existence of a predisposition to the disease is rendered probable by the fact, that the fluid sometimes collects first on one side, and then, perhaps after an interval of many years, appears on the other. The complaint generally commences about middle age, but is met with at all periods of life. Infants sometimes labour under it, either in consequence of the *tunica vaginalis* continuing to communicate with the cavity of the abdomen, and allowing fluid effused there to descend into it,—a condition that has also, though very rarely, been observed in the adult,—or simply effusion from some source of irritation often not observable.

The treatment of the disease is either palliative or radical. The former consists in merely drawing off the fluid ; the latter in doing so, and at the same time preventing its re-accumulation. The tapping of a hydrocele is best performed with a small trocar, which should be introduced at the anterior surface, about a third of the length of the tumour from the bottom, and at an equal distance from both sides. There is here least risk of wounding any large vessels, and the greatest separation of the *tunica vaginalis* from the testicle, to avoid which more effectually the instrument ought to be pushed gently and steadily through the parietes of the swelling, while they are held tight with the left hand embracing it, and directed not perpendicularly to the surface, but obliquely upwards. As the testicle is not by any means constant in its position relatively to the swelling, and as the *tunica vaginalis* is liable to partial thickenings, which would very much oppose the free introduction of the trocar, the operator should never proceed to puncture until he has examined the parts, and satisfied himself that there is no obstacle in the way of the instrument. This simple operation is proper in cases where it is not certain that the water will be again collected, and when the state of the patient's constitution, from age

or other circumstances, renders it imprudent to excite any more than the most gentle irritation. It ought always to be performed, before the radical cure is attempted, when the swelling is very large, or when it is necessary to ascertain, by examining more accurately than can be done while the water still remains, that the condition of the testicle is not opposed to the success of the operation required for this purpose.

Various methods have been employed for effecting the permanent cure of hydrocele. Of these the following may be mentioned:—Incision, Excision, Caustic, Seton, and Injection. The last of these is now almost universally preferred, and it will, therefore, be sufficient to notice the others very shortly. Incision, which is the most ancient practice, consisted in laying the cavity of the distended *tunica vaginalis* freely open, and inducing its obliteration by the granulating process. Inflammation and constitutional disturbance were the necessary consequences of this operation, and not unfrequently proved so violent as to occasion gangrene and death. The plan of Excision, though of very old origin, was chiefly practised in the latter part of the last century. It consisted in cutting away an elliptical portion of the integuments, together with the whole of the *tunica vaginalis*, where not adherent to the testicle and cord. This operation, though more tedious and painful in its execution than the former, occasioned less severe consequences and was followed by a more speedy cure, owing to the serous tissue being in great part removed. The Caustic was applied in the same way as for making an issue. The aperture caused by it could not of course heal by the first intention, and necessarily excited suppuration of the whole surface, which then gradually contracted like that of an ordinary abscess. This practice was employed during the last century, though not unfrequently attended with serious accidents in irritable constitutions. The Seton was applied to this purpose by Guy de Chauliac, in the fourteenth century, and is mentioned by Fallopius, Paré, and others, but was never very extensively used, either then or in more recent times. Pott strongly recommended it, and has given a very particular description of the mode of performing the operation. The essential part of it is the introduction of a skein of silk, or cotton, through the parietes of the swelling in its long direction. Inflammation and suppuration follow, and at the end of a fortnight the seton being withdrawn, the cure is soon completed. Notwithstanding all the precautions that can be used, the irritation thus

excited sometimes occasions an alarming degree of inflammation, and even in the most successful cases a long and irksome confinement is required. The treatment by Injection was first employed by the surgeon of a Scotch regiment, named Monro, in the early part of last century. Various trials of it were made in this and other countries, particularly by Sabatier of Paris;* but Sir J. Earle had the merit of introducing it into British practice. The object of the operation is to excite a degree of inflammation, sufficient to occasion such a change in the state of the parts concerned as may prevent the water from returning. An endless variety of fluids have been employed for this purpose, but port wine, solution of sulphate of zinc, and cold water, have been chiefly used until lately, when the tincture of iodine has come to supersede all the others. There is some difference of opinion as to the mode in which irritating fluids, injected into the *tunica vaginalis*, act in radically curing the disease. Some have alleged that the respective serous surfaces become firmly united, in consequence of an effusion of lymph from them; and others maintain that there is merely a change produced in the secreting action of the vessels, which prevents the fluid from re-accumulating, though the cavity remains as perfect as ever. It is probable that the truth lies between these two opinions, and that, though union of the adjacent surfaces is not essential to the cure, adhesions generally do take place.

The apparatus required for the operation is a small trocar, and a syringe capable of containing a quarter of an ounce. The trocar having been introduced as for the palliative cure, the cannula should be pressed in a little further, to insure its conveying the injection fairly into the cavity of the *tunica vaginalis*. The fluid is then thrown in and allowed to remain. Pain stretching up along the groin, towards the loins, and occasionally slight nausea, are in general experienced during the operation. After it is concluded the patient goes to bed, and seldom feels much inconvenience from what has been done until the following day, when the testicle swells, and more or less fluid is effused into the vaginal cavity. A slight degree of constitutional disturbance keeps pace with these local changes, and both are usually at their height on the third or fourth day. The swelling then begins to lessen, the feverish state subsides, and the patient is able in a few days to resume his ordinary occupation, though several weeks generally elapse before the

* Mém. Acad. Chirug., tom. v.

swelling is completely dispersed. It is observed that the more solid the swelling consequent upon the operation is, the more speedy and complete is the cure.

The hydrocele of children does not require the radical operation, as the fluid is readily absorbed under the influence of a discutient lotion, such as a solution of muriate of ammonia with spirits and vinegar, or, at all events, seldom returns if such a lotion be applied after evacuation by a trocar or lancet.

Hæmatocele.

The *tunica vaginalis* is sometimes distended with fluid, not clear and serous-looking, but of a dark-brown colour, and when allowed to remain at rest after being drawn off, depositing a layer of florid blood; while the cavity, if laid open, is generally found to contain more or less fibrinous coagulum, partly detached, partly adherent to the sides of the sac. The disease is then named Hæmatocele. It is recognised by the characters of hydrocele, with the exception of translucency, which is altogether absent; but, as this feature may depend on unusual thickness of the sac, the only certain diagnostic is obtained by puncturing the tumour. Hæmatocele is sometimes associated with diseases of the testicle. The origin of the blood which constitutes it is involved in great obscurity; but, on the whole, seems to be ascribed with most probability to hemorrhage from the vessels of the *tunica vaginalis.* The disease is almost always a hydrocele in the first instance, and the history usually given of it is, that after the ordinary serous fluid had been drawn off, the swelling returned very rapidly, and upon being tapped again, was found to be filled with the dark-coloured contents above described. In cases of old standing, numerous small scales are observed floating in the fluid, and these when collected are ascertained * to consist of cholesterine. Dr Bostock has suggested, with apparent probability, that they are not the direct result of secretion, but the product of a chemical change taking place in the effused fluid, similar to that by which adipocire is formed from flesh when subjected to long maceration in water. The same sort of scales are found in old collections of albuminous fluid in other parts of the body, and no doubt proceeded from the same source. The *tunica vaginalis* is always very much thickened, sometimes of almost cartilaginous hardness throughout, and occasionally soft and pulpy on its inner surface. I minutely injected the vessels of a hæmatocele

* Dr Christison.

which had been ascertained, by a puncture previously, to be still capable of reproducing the bloody contents, but did not find the slightest extravasation or appearance of rupture, either from disease or injury.

The treatment of hæmatocele does not afford so much room for choice as that of hydrocele, since the only method of safely and effectually relieving the patient consists in cutting away a portion of the thick and diseased *tunica vaginalis*. The best way of performing the operation is to make, in the first place, a free incision into the cavity, and then, feeling the extent of the sac, cut away as much as possible of it where not adherent to the testicle. The wound should be dressed with dry lint after the vessels have been tied. Considerable constitutional disturbance may be expected; but, under proper treatment, it seldom proves excessive. Suppuration being induced, the granulating process soon brings the sides of the wound together, and completes the cure.

Cirsocele.

The veins of the testicle, which enter into the formation of the spermatic cord, are subject to varicose enlargement, particularly on the left side. The vessels become greatly dilated, thickened in their coats, and extremely tortuous. There is thus caused a swelling, which alarms the patient, occasions a dragging uneasy feeling in the groin and back, aggravated by standing or walking, and is itself also sometimes the seat of disagreeable sensations. When the dilatation occurs high in the cord, near the external ring, it sometimes bears a great resemblance to inguinal hernia. In order to distinguish between the two diseases, the patient is generally laid in the horizontal posture, when the swelling disappears, whether of the one kind or the other. Pressure is then made at the ring, and the patient rises, when the swelling will reappear if depending upon vascular enlargement, as the blood cannot thus be prevented from finding its way through the arteries, but the tumour will not return if of a hernial nature. This test, though often decisive, is frequently ambiguous; and it seems a more certain means of ascertaining the truth to compress the neck of the swelling, while the patient stands erect, when, if composed of dilated veins, *it will become more tense.* The same diagnosis is applicable for the recognition of swellings in this situation dependent upon serous effusion between the vessels composing the spermatic cord, which is not unfrequently met with in children, and is apt to be mistaken

for hernia. Cirsocele is met with chiefly in young men between twenty and thirty, but frequently occurs soon after puberty. It exists in very various degrees of size, and occasions more or less inconvenience accordingly. It does not seem to interfere with the functions of the testicle.

The circumstances which determine the commencement of the disease have not been ascertained. It is certainly more common in persons who have indulged in venereal excesses, but often exists quite unconnected with any such habits. It tends to increase to a certain extent, and then either remains stationary or diminishes. The patient is generally rendered very anxious by the complaint; but the small inconvenience which attends it does not warrant any very severe measures for its relief. Washing with cold water completely removes the swelling for a time, by corrugating the scrotum, and bracing up the testicle to the pubis. A suspensory bandage effects this more permanently, though not so efficiently; and an open state of the bowels, with rest in the horizontal posture, contributes to keep the disease within bounds. The means of radical cure consist in extirpation of the testicle, which can hardly, if ever, be warrantable;—ligature or transfixion of the veins, which is dangerous and useless;—the pressure of a spring truss, which is absurd in theory and hurtful in practice;—and excision of the redundant scrotum.

Chronic Enlargement of the Testicle.

The testicle is very liable to simple enlargement, with hardening, which produces uneasiness from the bulk and weight attending it, and no doubt impairs the action of the gland; but is seldom painful or very sensible of external impressions. It is generally irregular on the surface, and dense in its structure. The circumstances which most frequently give rise to this condition are attacks of inflammation, especially when repeated or badly treated, and chronic irritation of the urethra from stricture or other causes. In commencing the treatment, the first step should always be to examine the state of the urethra by passing a moderate-sized bougie, and if it either meets with obstruction or causes more than usual pain, thus indicating a morbid sensibility of the lining membrane, the operation must be repeated with instruments varied according to the nature and peculiarities of the case, until there is no longer any trace of disease. Even when the urethra seems to be sound, advantage is occasionally derived from the use of

bougies, and in a week or two, or sometimes in a few days, very formidable-looking tumours may thus be discussed. Should the swelling exist along with a sound state of the urethra, or resist this treatment, means of promoting absorption must be employed. With this view, the patient should maintain the horizontal posture, use a very spare diet, and be subjected to a gentle course of mercury; at the same time having the absorbent actions of the part excited by leeching, and discutient lotions, which answer better than blisters or ointments. If there is water in the *tunica vaginalis*, a complication named Hydro-Sarcocele, the fluid ought to be evacuated by puncture before these local measures are instituted. When the swelling attains a large size, and resists a patient trial of the means that have been mentioned, it may be removed by the knife as a last resource, and of course with a favourable prognosis in regard to the prospect of permanent recovery. A section of the tumour removed in such cases generally exhibits a compact fibrous structure, which is usually of a yellow or yellowish-gray colour, and contains irregularly-sized cells interspersed through its substance.

Cystic Sarcoma of the Testicle.

The testicle is liable to the formation of cysts in its texture, and these sometimes occupy so much of it as to constitute a mass in which the cystic character predominates. When this disease is associated with hydrocele or hæmatocele, its diagnosis cannot be made out with accuracy, until the fluid in the *tunica vaginalis* has been drawn off. The only remedy for this affection is removal, and the operation may be performed with less regret, as the glandular structure of the testicle always suffers such atrophy, or changes in its texture, that it cannot be expected to perform its function.

Medullary Sarcoma of the Testicle.

Excepting the bones and the mamma, the testicle is perhaps more subject to the derangement of nutrition, which leads to this morbid growth, than any structure in the body. It is generally met with at and before the middle period of life; sometimes commencing without any assignable cause, but not unfrequently being referred to blows, or bruises, or to inflammation excited by other means. The patient's appearance is generally healthy, and the diseased action shews less tendency to spread than when it occurs

in other parts. The tumour merely enlarges, becoming very irregular and tuberous on the surface, and exhausts the patient by the irritation which the pain attending it occasions ; but the integuments and glands are extremely slow in acquiring the morbid disposition, so that the operation of removal, which, of course, affords the only means of relief, is performed even in very advanced cases with a favourable prognosis. In the earlier stage of the growth, it is often found very difficult to determine positively, by external examination, whether the swelling is solid, or depends on the presence of fluid. The globular shape, tendency to tuberous projections of the surface, pain, and equality of consistence at all parts of the tumour, observed when it is solid, may generally render the discrimination precise ; but in cases of doubt, the truth can readily be discovered by making a puncture, which can do no harm, if the patient is prepared to submit to extirpation of the testicle in the event of its proving necessary. The tumour, when divided, displays the characters peculiar to such degenerations, namely, a soft brain-like pulpy substance, irregularly partitioned by thin septa of cellular texture, and varying in colour from white to dark-red, according to the proportion of blood which enters into the composition of the mass.

Suppuration, and Fungus of the Testicle.

Young men of scrofulous constitutions are liable to abscesses and sinuses of the testicle, which are apt to prove very obstinate, even when they are freely dilated by incision. It might seem in such cases that extirpation would be a simpler, much speedier, and hardly more injurious mode of relief, than thus laying open the structure of the gland by dividing it in various directions ; but if the cure is completed, very little trace of these incisions remains, and the organ may perhaps be still capable of performing its office. It occasionally happens after suppuration has taken place in the testicle, particularly when induced by the cachetic state caused by mercury and preceded by hardness, and the resulting matter has been discharged, that a fungous excrescence protrudes from the opening, presenting a very formidable appearance, which formerly led to removal of the organ as affected with malignant disease. Mr Lawrence* pointed out the true nature of these productions, and explained that they depended not upon the peculiarity of action, but on the peculiarity of structure, which, being soft and

* Ed. Med. and Surg. Journal, 1806.

enclosed in a firm capsule, tended to expand, when the coverings were perforated so as to permit its doing so. He ascertained that if the excrescence were cut off or destroyed by caustic, the remaining surface granulated; and, though it might repeatedly protrude again to a smaller extent, that ultimately, through a repetition of the same means, followed by pressure, it became completely cicatrised.

As the fungus, from its constitution, admitted of being considered similar to an extreme degree of exuberant granulation, it occurred to me that the disease might be induced by pressure to retrace its steps, and thus permit recovery without any loss of substance. For this purpose, nothing seemed so convenient as covering the growth with the scrotal integuments, which being freely separated by dissection from their subjacent connexions, could be readily brought over the tumour, so as to have their edges united by sutures. This experiment proved eminently successful, and has been followed by results in the practice of others, as well as myself, which warrant me to recommend the operation as in every respect deserving of confidence. It may now, through the agency of chloroform, be performed without pain. It is much more speedy in effecting recovery than any other method, and it preserves instead of destroying the organ concerned.

Extirpation of the Testicle.

The mode of removing the testicle, whatever be the circumstances requiring the operation, is to be conducted on the same principles, which may now be explained. The points of most importance in determining these are—1. The quantity of integument to be left; 2. The suppression of the bleeding; and, 3. The dressing of the wound.

When the tumour is large and of rapid growth, the skin covering it is not only put very much upon the stretch, but also borrowed from that of the penis and the other testicle; consequently, if the whole of it were taken away, a very large exposed surface would remain. If, on the other hand, none of the integuments, or only a small portion of them, were removed, more especially in a case of slow and long-continued swelling, though the corrugating effects of the contractility of the scrotum, excited by the irritation of the operation, might, in the first instance, make it appear that no inconvenience was likely to result, the redundant integument would certainly, so soon as it became relaxed, afford an ample

receptacle for the accumulation of blood or pus, and present a very extensive granulating surface, that must greatly prolong the cure. Keeping these different considerations in view, the surgeon should endeavour to preserve merely enough of the integuments to allow the edges of the wound to be brought together, without either straining or laxity. In regard to the hemorrhage, great apprehension has been entertained lest the cord should be retracted by the cremaster muscle, and the artery withdrawn beyond reach of the ligature. This has led to many coarse and dangerous expedients, such as tying the whole cord previous to its division, or including all its vessels together except the *vas deferens*. Violent pain, fever, inflammation, convulsions, and even death, were the consequences of this practice, which is now abandoned, the artery being tied alone; but the fear of retraction still excites uneasiness during the operation. It, therefore, seems necessary to remark, that, as the cremaster muscle is attached very near the external ring, it cannot withdraw the cord except to a very small extent, and that, if the artery retires at all, it must do so in consequence of its own elasticity. Retraction on this account may be expected in proportion to the size of the tumour, the rapidity of its growth, and the nearness to the external ring, of the point at which the cord is divided. In no case, however, will it be necessary to use any force in retaining the vessel, and the assistant may readily secure it either between the nails of his thumb and fore-finger, or with forceps. Besides the spermatic artery, there are always several, and sometimes so many as seven or eight vessels coming from the groin and perineum, that require to be tied.

Such being the principles to be followed in performing the operation, it may now be right to explain succinctly the mode of proceeding. The patient should be laid reclining on a table or bed, with the thighs separated, and the hair of the pubis shaved off. The surgeon then grasping the testicle in his left hand, makes two incisions, commencing at the external ring, and uniting at the bottom of the tumour. He next cuts down to the cord, where these incisions meet above, passes his finger under the vessels, and then desires the assistant to lay hold of them. He now divides the cord as low as is consistent with entire removal of the disease, and pulling the lower end of it towards him, turns out the testicle, which may be detached with a few strokes of the knife, while the penis and sound testicle are drawn aside. The spermatic artery, and any branches of the perineal or inguinal vessels that threaten

to bleed are then tied, and lint is applied, to afford the requisite support.

Sarcomatous Enlargement of the Scrotum.

The scrotum is liable to an enlargement, which seems to consist merely in a morbid growth of the cellular substance, with interstitial deposition of albuminous matter, so as to give it a very firm consistence. When exposed by a section, the structure appears white, compact, and homogeneous, except where small cells containing glairy fluid are interspersed through it. The growth begins in the lower part of the scrotum, but, as it proceeds, engages the whole of it, together with the skin of the penis, which becomes completely concealed from view. The prepuce is greatly elongated, and presents at its orifice a tuberculated cauliflower-looking excrescence, that does not bear the slightest resemblance to the part in its natural state. There are no limits to the size which such humours may attain. Twenty, forty, or even sixty pounds weight is by no means uncommon; and there is one case on record in which the mass when removed weighed 170 pounds.* The disease generally commences in adults, and increases slowly during the remainder of life. It is common in tropical countries, particularly in the West Indies, but occurs comparatively seldom in the temperate climates of Europe.

The only remedy for this oppressive growth, which impedes progressive motion, and occasions other serious inconveniences, consists in its removal. This object has sometimes been attained without taking away the penis and testicles; but the former of these organs is so deeply imbedded in the substance of the tumour, and its texture is usually so vascular, that such a procedure can seldom be practicable. If an attempt is made to preserve the sexual parts, flaps of the integuments must be preserved of sufficient size to cover them. Should, on the contrary, the removal of the entire tumour be determined on, the incisions may be executed with great rapidity, which mode of conducting the operation is much safer than cutting slowly, with the view of securing the arteries as they are divided; for both the pain and hemorrhage are thus greatly increased, and the patient, instead of being relieved from his load in a few seconds, may be detained under the knife for hours.

The labium of the female is occasionally the seat of a similar

* Titley on the Diseases of the Genito-Urinary Organs, 1831.

growth. It possesses the same structure, gives rise to similar inconvenience, and admits of no other remedy.

Cancer of the Scrotum.

Mr Pott (1775) described a cancerous ulceration of the scrotum, which he had frequently remarked in adult chimney-sweepers. Succeeding surgeons have confirmed the accuracy of his observations, so far as London is concerned; but in Edinburgh, and other parts of Scotland, this chimney-sweeper's cancer is never met with, except in persons who have begun to suffer from it elsewhere. The following is the description of Mr Pott:—"It is a disease which always makes its first attack on, and its first appearance in, the inferior part of the scrotum, where it produces a superficial, painful, ragged, ill-looking sore, with hard and rising edges. The trade call it the *soot wart*. In no great length of time it pervades the skin, dartos, and membranes of the scrotum, and seizes the testicle, which it enlarges, hardens, and renders truly and thoroughly distempered, from whence it makes its way up the spermatic process into the abdomen, most frequently indurating and spoiling the inguinal glands. When arrived within the abdomen, it affects some of the viscera, and then very soon becomes painfully destructive." *

The only remedy for this disease is removal of the cancerous part; and, unless the operation be performed before the morbid process has advanced far, it does not afford any chance of a permanent cure.

Diseases of the Female Organs of Generation.

The vagina is sometimes more or less completely obstructed by a membrane at its orifice, which opposes the exit of the menstrual discharge. The non-appearance of the menses at the usual period of life, or the symptoms connected with their retention, should always lead to an inquiry respecting the conformation of the parts, and if such a congenital imperfection as the one just mentioned is discovered, the patient may be completely relieved by a very simple operation; all that is necessary being to divide the membrane with a knife or scissors, and interpose a piece of lint between its cut edges. The vagina, in some rare cases, has been found altogether wanting for part of its extent, in which cases, of course, nothing can be done in the way of remedy.

* Pott's Surgical Works, vol. iii. p. 177.

The Uterus is subject to the development in its substance of simple sarcomatous tumours of a very firm fibrous structure, which often grow from different parts of the organ at the same time, and, though generally not exceeding the size of an egg, are sometimes so large as to distend the abdomen far beyond the limits of an ordinary pregnancy. Iodine and other medicines are prescribed, both locally and internally, with the view of promoting the discussion of such growths; but it is probable that nothing can have any beneficial effect upon their progress except attention to the mode of life, which should be of a kind calculated to excite as little as possible the system in general, and the uterus in particular. Any operation is quite out of the question.

Cancer of the uterus occurs occasionally, but is fortunately not frequent, since the situation and connexions of the parts affected prevent the only effectual remedy for carcinomatous disease from being put in practice, without inflicting a mortal injury. A few cases are recorded in which the uterus is said to have been extirpated when previously prolapsed beyond the orifice of the vagina, and permanently retained in this situation by the adhesions resulting from inflammation. It is only in such circumstances that the operation ought ever to be contemplated, and even here it must be regarded as affording a very small chance of success, so that, unless the patient's sufferings are very great, and threaten to terminate fatally soon, it could hardly be recommended with propriety.

The uterus may be extirpated more safely, when it is in the state named Inversion by accoucheurs. It is in this case turned inside out, so as to form a round or pyriform tumour, either confined to the vagina, or protruded beyond the vulva. When this eversion, which generally takes place at the time of delivery, is not immediately remedied, it is apt to become irreducible; and the patient suffers many disagreeable symptoms from the unnatural condition of the organ, especially frequent hemorrhage, downbearing pains, and general weakness. In cases that resist more gentle means, the tumour may be removed by ligature, which should be of strong twine or silk; and either applied simply round its neck, or carried through the middle of it double by means of a needle, one of the threads being then tied on each side. If disagreeable effects ensue, opiate injections into the rectum, and the hip-bath, will be the most efficient measures for affording relief.

Polypous excrescences frequently grow from the inner surface of the uterus, and either remain confined to its cavity, or descend

into the vagina, sometimes even protruding externally. These tumours have a pyriform shape, and a firm consistence. They possess little sensibility, but much vascularity, and occasion many unpleasant symptoms, such as bloody and mucous discharges, pain in the back, weakness, emaciation, and general bad health. They cannot be either positively recognised, or removed, unless they extend below the *os uteri*, or have access afforded to them by dilatation of the orifice. If they cannot be brought into view, the best mode of removing them is to tie a strong ligature as close as possible to their root. This is executed much more easily by means of the fingers, than any of the apparatus contrived for the purpose. They may also be removed by evulsion. When the neck of the excrescence can be pulled beyond the orifice of the vagina, the simplest and speediest mode of proceeding is to transfix it with a needle, and carry through two threads, which are then tightly tied, one on each side, after which the tumour may be removed by the knife. There is often considerable difficulty in distinguishing growths of this kind from eversion of the uterus. Their history, deficient sensibility, and their having round their root a ring formed by the *os uteri*, in general afford sufficient diagnostics on a careful examination.

Excrescences frequently grow from one or both lips of the *os uteri ;* and by bleeding, or exciting the usual symptoms of uterine irritation, occasion great distress. It has been found by Lisfranc, and other French surgeons,* that their excision may be performed without any bad consequences, and with the best effects, even when they have attained a very large size. The instruments employed for the purpose consist of hooked forceps to draw the morbid growth into view, and curved scissors or a bistoury to cut it away. The hemorrhage may generally be restrained by cold applications, and plugging the vagina with lint or sponge ; but if it should prove excessive, the cut surface must be again drawn out and compressed, by transfixing it with a couple of threads, and tying one on each side.

The Ovaries are liable to various morbid conditions, but particularly two, which often become the subject of surgical consideration. Of these, the first that may be mentioned consists in the development of cysts in their substance, which is thus converted into a cystic tumour. The swelling is at first felt round, firm, and moveable in the inguinal region. It gradually increases, not owing to

* Archives Generales de Medecine.

an equal enlargement of all the cysts, but an extension of one or more of them. The cavity of the abdomen is distended, and at length appears as if the peritoneum were the seat of dropsical effusion. The progress of the disease is very variable; sometimes proceeding rapidly to the extinction of life, by pressing to a fatal degree on the vital organs of the abdomen or chest, but more frequently allowing years to elapse before coming to this termination. The disease commences most frequently in young females, but is met with at all periods of life. It is distinguished in its advanced stage from ascites, chiefly by the history of the case.

The treatment of Ovarian Dropsy, as this affection is called, proves still less satisfactory than that of dropsy of the peritoneum, which will not excite surprise, when it is recollected that the diseased action in the latter case is simply an increased secretion, while in the former it is a new and peculiar formation. Purgatives, diuretics, and all other means employed to promote absorption of the accumulated fluid, almost invariably prove quite unavailing; and paracentesis, though it affords some temporary relief, seems in general to hasten the progress of the disease. The operation, therefore, ought not to be performed, except when the patient is suffering great distress, and threatened with speedy dissolution. Various methods of effecting a radical cure have been proposed, and in a few cases subjected to trial. Of these the chief are, throwing injections into the sac, introducing a seton through it, and drawing it out of the abdomen by a small aperture in the parietes. The extent, situation, and connexion of the cysts, must render such proceedings dangerous and uncertain; and even if, by some rare chance, any of them should prove successful in removing or obliterating the sac, the disease, though retarded for a time, would, in all probability, soon recur,—for the sac does not exist alone, but in association with many others of a smaller size, which possess the same nature, and may consequently serve as the germ of a future swelling. If the method of extraction should ever be attempted, it must be confined to those cases in which the tumour has not attained a very large size, and is still not adherent to the peritoneum. Injections and setons, again, are applicable only where the sac has adhered to the parietes of the abdomen, so as to prevent effusion on the surface of the peritoneum, and diminish the risk of inflammation.

The Ovaries are subject to enlargements of a solid kind, which not only occasion inconvenience by their size and weight, but are

generally the seat of painful sensations. The structure of these tumours is generally of a complicated kind, displaying, when exposed by a section, the characters of vascular, fibrous, cystic, and medullary sarcoma, in variable proportion and distinctness. The disease is sometimes rapid in its progress, but usually slow, and often exists for years before giving much trouble. After attaining a certain extent, it sometimes remains stationary, and the patient becoming habituated to its presence, suffers comparatively little inconvenience. Iodine, leeches, and other means calculated to promote absorption or allay irritation, are employed in such cases, but with hardly any perceptible advantage; and all that can be done by external measures, whether local or general, seems to be to retard the morbid process through the effect of diet and regimen. Excitement of every kind ought to be avoided; the secretions ought to be carefully maintained; and if any local means are used, they ought to be of a soothing kind, such as warm fomentations.

The inefficacy of medicine in remedying tumours of the ovaries has led to the trial of surgical operations for their removal. The obvious objections to such a proposal are—1. The uncertainty that must always attend the diagnosis of the disease, which is often very closely simulated by distension of the bowels, thickening of the omentum, enlargement of the liver, and growths from the uterus; 2. The impossibility of ascertaining, before the abdomen is laid open, whether or no the connexions of the tumour allow of its removal without the infliction of a mortal wound; 3. The danger of the operation even in the most favourable circumstances; and, 4. The difficulty of knowing how long the patient may live if the disease is not interfered with. These theoretical objections have been amply confirmed by experience; and though some fortunate patients may have escaped after being freed from part or even the whole of the disease, it would be very unjustifiable to repeat such hazardous experiments.

CHAPTER XX.

BRAIN, SPINAL MARROW, AND NERVES.

Injuries of the Brain and its Coverings.

CONCUSSION, or a violent shock, may act injuriously both on the brain and the parts which enclose it, either separately or together. It occasions at one time rupture or laceration, and at another merely disturbance in the vital action. In both cases it is apt to excite inflammation, and then, beside its primary effects, produces very important secondary ones.

Concussion of the brain is caused by blows on the head, or by falling in such a position as prevents the force of the shock from being diffused over a number of intermediate articulations, before reaching the head. The effect of blows on the head in producing concussion is proportioned to their force, the flatness of the surface applied to the skull, and the resistance it makes. The symptoms of the injury vary with the degree of it. If there is no laceration of the cerebral substance or membranes, the patient merely suffers a temporary diminution or suspension of the functions of the organ. In very slight cases, there is confusion of ideas, and weakness of the voluntary muscles, which last only a few minutes. When the shock has been more severe, the patient is quite insensible; his pulse is small and irregular; his breathing is slow and feeble; his pupils are fixed, generally in a contracted, but sometimes dilated state, and there is occasional vomiting. This condition seldom lasts beyond ten, or at the most twenty minutes, and is succeeded by a return to health, which either continues, or terminates in inflammation. When the concussion has caused laceration of the cerebral substance, the insensibility is of longer duration; and when at the end of some hours, or it may be a day or more, the patient begins to give signs of returning consciousness, he recovers very imperfectly, and only for a short interval before inflammation commences. In such cases, death often occurs within a few hours,

or even a shorter period, after the accident, and before any signs of recovery from the insensible state can be perceived.

The treatment of concussion may be conveniently considered, in reference to the three stages of the consequences of the injury which have been mentioned, namely, that of the concussion properly—that of recovery—and that of inflammation. During the first of these, little or nothing ought to be done, except putting the patient to bed, and applying some source of artificial heat to his feet if necessary. Bleeding would be decidedly improper; and the exhibition of internal stimulants, though it might hasten the recovery of sensibility, might also increase the violence of subsequent reaction. Unless, therefore, the signs of debility in the vital actions should be alarming, the patient may be trusted entirely to the powers of his constitution.

The second stage, or return of sensibility, requires more attention, since the treatment during this stage greatly influences the succeeding one. The patient is apt to suppose himself quite well, and to have fortunately made a very easy escape from the effects of his accident; but were he, in accordance with this belief, to expose himself to cold, or subject himself to the excitement of exercise or stimulating food and drink, he would render inflammation almost certain, and aggravate its intensity beyond that which would otherwise have resulted from the injury. He ought, therefore, to be confined to the house, or to bed if the case is severe, and restricted to the most scrupulous antiphlogistic regimen for a few days. So far as the brain is directly concerned, he might safely resume his usual habits after this period of probation, but its coverings being apt to suffer, or perhaps, more correctly, to shew signs of the suffering at a more distant date, in consequence of the injury they have suffered, as will be explained hereafter, he should for several weeks at least be very abstinent, if the blow has been at all severe. The restoration of the sensorial faculties is sometimes only partial, and the patient then remains permanently defective in respect to some of them, particularly memory. Sometimes also the character or disposition of the individual is observed to be changed.

The symptoms of inflammation of the brain generally appear within from twelve to twenty-four hours after the injury has been sustained. The pulse becomes quickened and sharp in its stroke; the skin feels hot and dry; the patient is restless, complains of headache, and is unusually sensible to light and noise. If the dis-

ease proceeds, the indications of it just mentioned become more strongly marked. Delirium and spasmodic contractions of the muscles come on, and are soon succeeded by insensibility and palsy of the limbs, and death closes the scene in the course of a few days at farthest. On dissection, the brain or membranes are found very vascular, with purulent effusion on the surface of the latter, and softening of the substance of the former. In cases where the texture of the brain has been lacerated in the first instance, the state of insensibility and collapse which immediately follows the accident, after a period of variable length, from a few hours to twenty-four, gradually passes into that of inflammation, generally with the intervention of an imperfect return of sense and voluntary motion, which is apt to suggest delusive hopes of improvement. The patient expresses pain by restlessness and moaning, his limbs are rigid or convulsed, and in a short time he passes into the same condition as if the inflammation had originated from mere derangement of action, and not alteration of structure. On dissection, the cerebral substance at the injured part is found softened, and seeming as if mixed with blood and pus.

In treating all inflammatory attacks, it is of the utmost consequence to employ the remedial measures as early as possible, and in none is it more necessary to do so than in this. Free general depletion, followed up by cupping on the neck, powerful cathartics and injections, shaving the head, and applying cold to it, with the liberal administration of tartrate of antimony, are the means to be chiefly trusted for breaking the strength of the disorder. By leeching the temples, and keeping up a copious secreting action of the bowels, the remaining symptoms are in general removed, if the other more efficient measures prove successful in subduing the force of the disease. Sometimes the inflammation assumes a chronic form, which, though not attended with much immediate danger, is very distressing, and may lead to permanent affections of a very unpleasant kind. In this case the patient's pulse does not descend to the natural standard, but continues small and frequent; his tongue displays a yellowish-white fur, his skin is hot and dry, he has no appetite, his sleep is disturbed, he complains of headache, his complexion is sallow, and the expression of his countenance indicative of anxiety. Free purgation, and blistering of the head, are the best means of counteracting the morbid condition which gives rise to these symptoms, and which, if permitted to go on, may occasion thickening of the membranes, or disorganisation

of the brain, attended with epilepsy, fatuity, and ultimately with death.

It appears that the *dura* and *pia mater* may also suffer from concussion, since they sometimes inflame, and produce peculiar symptoms in cases where the head has been subjected to violence, that can act only in this way. Blows which expose the bone are the most common sources of such effects, and frequently give rise to them, though of inconsiderable violence. The patient, after a little confusion or stupor, may feel quite well, and follow his ordinary pursuits for several days, at the end of which, generally from the seventh to the eleventh, he begins to shew some indication of the disease that is going on within his head. The pulse becomes frequent and wiry; his tongue is furred; his countenance anxious; his sleep broken; and he feels a general uneasiness, with indisposition for all active exertion, whether of body or mind. Headache, with intolerance of light and noise, then succeeds, with occasional rigors; but delirium and convulsions are more slow of appearing than when the cerebral substance is the seat of inflammation. At length these symptoms present themselves, and are speedily followed by insensibility, involuntary discharges from the bowels, and death. On dissection, an effusion of pus is generally found occupying a more or less extensive portion of the surface of the *dura mater*, which is separated from the bone, and altered both in colour and consistence, or of the subjacent *pia mater* and substance of the brain. As the approach of this disorder is slow and insidious, while the means of checking it can be used with effect only in the commencement of its progress, all injuries of the head that can possibly give rise to it ought to be treated with care.

The patient should for weeks abstain from every kind of excitement, and endeavour to preserve his secretions in the most healthy state. Quickness of the pulse, and headache, suggest free venesection, with the internal administration of tartrate of antimony, either alone or combined with the saline cathartics. If repeated rigors succeed signs of inflammation, and especially if the patient becomes insensible, it may be presumed that pus has been effused; and the only chance of his recovery is afforded by perforating the cranium, so as to give the matter free vent, if it is lodged between the bone and the *dura mater*. If not found there it may exist deeper, but incisions in search of it would be quite unwarrantable. Puffiness of the scalp, and a glassy dry appearance

of the wound, if there be one, have been insisted upon as important indications of suppuration of the *dura mater;* but they often exist in cases where there is nothing of the kind, and, therefore, ought not to be confided in.

The operation of perforating the skull is performed in this country with a Trephine or circular saw, to which the necessary rotatory motion is given by the hand. On the continent, an older instrument named the Trepan, which works like a carpenter's brace, is still in use; and it is difficult to understand how the latter should ever have given place to the former, the use of which renders the process much more tedious and laborious. The only objection that can be alleged against the trepan is, the risk of its injuring the *dura mater* or brain; but the apprehension of this rests entirely on theoretical grounds, as with moderate care any chance of such an occurrence may be prevented. The patient should be laid on a support, low enough to render it unnecessary for the operator to elevate his arms in working the saw. If the bone is not sufficiently exposed by the original injury, a crucial or triangular incision must be made through the scalp, the flaps of which are then to be dissected back. The pericranium is next scraped off sufficiently to prevent it from impeding the teeth of the saw, which is applied at first with its centre pin protruded to keep it steady, and afterwards, when a groove has been formed, this obstacle to its progress is removed. The sawing must be conducted cautiously, as the skull is not always equally thick, and is often throughout very thin, with hardly any perceptible diploe. A tooth-pick, or probe, should be introduced from time to time, to ascertain whether or no the bone is perforated at any part of the circle, and when the whole seems to be nearly cut through, a levator or forceps may be employed to raise the detached piece. If circumstances appear to require the removal of more bone, the same means are to be repeated,—or the process may be accelerated, if the portion is extensive, by Hey's saw, as it is usually called, which proves convenient for connecting the circular apertures together so as to separate at once a large portion of the cranium. After the operation the wound is to be lightly dressed, and the general treatment conducted with the view of checking any tendency to inflammatory action. Cases admitting of this operation with any prospect of success are extremely rare, as the suppuration generally extends over a large surface of the membranes, or engages the substance of the brain.

Compression of the brain, when a consequence of external vio-

lence, is directly caused either by effusion of blood or by depression of the skull. In both cases the symptoms are the same, and denote suspension of the cerebral functions, more or less complete. The patient lies as if in a profound sleep ; his breathing is stertorous ; his pulse slow and labouring ; his pupils immoveable, and in general dilated. He groans occasionally, winces under pressure applied to the injured part of his head, and frequently raises his hand to it. This state may continue, without suffering any material change, for a period of indefinite length, from hours to weeks, or even months ; but generally terminates in the course of a few days at farthest, either in a return to health, or in inflammation. Effusion of blood may take place between the skull and *dura mater*, on the surface of the brain, and into its substance. In all of these situations it depends on rupture of the vessels from concussion ; and, therefore, the symptoms of that kind of injury are at first generally associated with those of compression. As the symptoms of concussion, however, always go off soon, unless the brain has been lacerated, it may be concluded, if the patient remains insensible beyond an hour or two, that there is either an effusion of blood, or rupture of the cerebral substance. The latter case may be, in general, distinguished by the more complete insensibility, and other indications of suspended function which attend it, and by the early appearance of inflammatory symptoms. It seems that the effusion does not always occur immediately after the injury is sustained, but sometimes takes place gradually, so that there may be either no insensibility observable for a short period after the blow is inflicted, or an interval between the insensibility caused by concussion and that resulting from compression. In this case there can be no doubt as to compression being the cause of the symptoms. The quantity of blood effused is seldom great, but may amount to several ounces. Between the skull and *dura mater* it usually takes the form of a cake, of limited extent ; on the surface of the brain it constitutes a thin crust or lining, widely spread over it ; and in the substance of the organ it is generally coagulated at the centre of the injured part, and diffused, in the form of ecchymosed spots, into the neighbourhood. The largest accumulations of blood are met with between the *dura mater* and the anterior inferior angle of the parietal bone, where it seems to be effused from the meningeal artery. The extravasation, in general, takes place either immediately under the part subjected to violence, or on the side of the head opposite to it.

Depression of the cranium happens more readily in young than in old subjects; but produces less inconvenience in the former than the latter, owing to the yielding condition of the bones at their time of life, which allows the cavity, when diminished at one part, to expand in another. Where a perceptible depression exists, the symptoms may be fairly referred to the compression thus caused; since, when the case is broken, it is not likely that the contents should be so much shaken as when it remains entire.

It was formerly thought that the symptoms of compression peremptorily required the immediate performance of an operation for raising the depressed portion of the skull, or affording vent to effused blood. The ample experience of a different practice, followed in modern surgery, has proved that in most cases, unless the substance of the brain has suffered serious injury from concussion, the condition of the patient labouring under compression will not be altered for the worse, and in many will amend, if some days are allowed to elapse after the injury has been sustained, before proceeding to trepan the skull. The salutary change depends, no doubt, partly upon the effects of absorption,—partly upon the brain becoming accommodated to the diminished size of its containing case; and it will be promoted by bleeding, active cathartics, and powerful injections thrown into the rectum. If the symptoms do not diminish, or if they increase, the operation must be performed; and the proper time for determining on it is regulated by the particular features of the case. Should depression of the skull be associated with a wound of the scalp, penetrating to the bone, a very short trial of the means calculated to supersede the necessity of an operation will be sufficient, as the fracture is already a compound one, and consequently not liable to be aggravated in this important respect by trepaning. On other occasions, two or three days may generally be allowed to pass without any bad consequences. In operating for depression of the cranium, the saw should be applied on the sound part, so as to remove the overlapping edge that prevents the broken portion from being raised into its place by a levator, or taken away altogether. If the blood effused is found under the *dura mater*, which then appears unusually tense, and presents a bluish appearance, an opening ought not to be made through the membrane, since there is great danger in cutting into the cavity of the arachnoid, and little advantage is to be expected from doing so, as the blood in such a case is spread over an extensive surface, and the brain is in some

measure relieved from pressure by the aperture that has been formed in the bone.

Fractures of the cranium would be of very little consequence, were it not on account of their connexion with injury of the organs which it contains. In reference to this, they may be conveniently divided into Fissures, Depressions, and Punctures.

A Fissure, as the name implies, is merely a solution of continuity in the bone, without any material displacement of the edges of the fracture. It is caused by diffused force acting directly, or transmitted to a distant part of the cranium by the intermediate portion remaining entire, and conducting it where the strength is less able to resist. The base of the cranium is generally the part broken in the latter way, or by *contre-coup*, as it is called; and the fissure usually extends through the cuneiform process of the occipital bone, transversely or obliquely backwards. Bleeding from the ear often accompanies, though it does not necessarily proceed from, a fissure of this kind. Fissures, as might be expected from the mode of their production, are in general followed either by speedy death, or by violent inflammation of the cerebral substance and membranes. These bad consequences were attributed by the old surgeons to the split of the bone allowing noxious transudations from without inwards, and their practice consisted in sawing away with the trepan, as far as they possibly could, all traces of the injured bone. In the more sound pathology of the present day, fissures are regarded as quite innocent as far as regards their own effects,—but as affording ground of unfavourable prognosis, by shewing that the skull has been subjected to a great degree of concussion. They are, however, seldom known to exist until after death, since no one now thinks of searching for them, as was the custom formerly.

Fractures with depression result from the operation of forces acting on a somewhat extensive surface which gives way before them. The contents of the cranium are consequently not much shaken; and as the depressed portion presents its smooth side to the membranes, there is comparatively little risk of inflammation being excited in them. It has been already explained, in regard to compression, that it is not considered right in modern surgery to interfere by operation with such fractures, unless the symptoms denoting compression of the brain should be well marked, and persist after a moderate period, during which proper measures are employed for promoting the accommodation of the organ to the

alteration that has taken place in the shape and size of its containing case.

Punctured fractures are inflicted by sharp-pointed bodies, which apply their force with concentrated effect. They perforate, or beat in, a small portion of the external table of the skull, which, acting on the more brittle, internal, or vitreous part, generally depresses it to a considerably greater extent, in the form of a flattened cone, the apex of which corresponds with the centre of the injury. The sharp edges and points of bone thus driven inwards are apt to lacerate the membranes, or at all events irritate them, so as to excite inflammation. Sometimes the bad effects thus produced are of a chronic kind, and the patient, months or years after the injury has been sustained, may suffer from pain, discharge, or epilepsy, caused by the irritation of a scale of bone pressing on the *dura mater* or brain. In the first instance, this injury is attended with little inconvenience, since the skull being broken, there is little concussion, and no internal effusion of blood, while the extent of bone depressed, though it may be considerable when compared with the size of the external wound, is not so great as to occasion any sensible degree of compression. But no fracture is really so dangerous, or so much entitled to attention on its own account, and it ought always to be regarded as requiring an immediate operation. In performing this, it is rarely necessary to convert a simple fracture into a compound one, as the bone is in almost every case exposed by the blow that caused the injury. In general the aperture is large enough to allow the broken pieces to be picked out; but sometimes it is necessary for this purpose to remove a circular portion by means of the trephine. In this case the centre pin of the instrument should be fixed at the margin of the opening, as near as possible to the middle of the injured part. After the operation, the patient must be protected from all sources of excitement, and freely depleted, if threatenings of inflammation appear.

Wounds of the brain, unless very deep or extensive, are not immediately attended with any remarkable indications of the injury, except what may be presented to view by the part itself. The patient often walks, speaks, and conducts himself in other respects as if not materially hurt. Inflammation almost inevitably, however, soon comes on, and proving no less intense than uncontrollable, usually terminates fatally in the course of a day or two. The treatment ought to be directed with the view of preventing and

checking these bad consequences, but will seldom be productive of much benefit, and therefore the prognosis in such cases is very unfavourable.

Hernia cerebri is a protrusion that frequently occurs, when the *dura mater* has been exposed or injured in consequence of external violence. The membrane becomes prominent, discoloured, soft, and at length perforated by a small aperture, which enlarging, allows a fungous excrescence to expand itself. This growth is found on dissection to consist of a bloody mass, in which some traces of the cerebral substance can be discerned, and seems to resemble in constitution the fungus of the testicle that has been described above. It probably depends upon the brain having been injured by the concussion proceeding from the blow which caused the injury, and suffering in succession ecchymosis, inflammation, and suppuration, which, extending to the *dura mater*, effects its perforation, and permits the soft substance of the brain to escape from the pressure that it sustains within the cranium, mixed with coagulated blood effused into its interstices, so as to present the appearance of a solid tumour. The treatment of *hernia cerebri* which proves most beneficial consists in the free excision of the protruded mass on a level with the surface of the *dura mater*, and the subsequent application of pressure by means of lint, together with a plate of lead suited to the size of the aperture in the bone. With the assistance of such means the patient sometimes recovers, but more frequently sinks under the irritation attending the disease.

The scalp is liable to various injuries, of which the first that may be mentioned are Bruises. The most common effect of these is the appearance of a firm round flat tumour, owing to effusion into the cellular substance, which takes place almost immediately after the blow is inflicted, and then gradually diminishes without any remedial measures, so as to leave, in the course of a few days, no trace of its existence. When the contusion is more severe, blood is effused under the integuments, so as to constitute a fluctuating swelling, the extent of which is very variable, from that of the point of a finger to a half or more of the surface of the cranium. The edges of the scalp surrounding it are very firm, and somewhat thickened, whence there is some risk of erroneously supposing, from a careless examination, that the skull is depressed. The blood is usually absorbed either spontaneously, or under the influence of a discutient lotion, assisted by pressure, but occasionally excites

sufficient irritation by its presence to cause the formation of an abscess. Should this change occur, a free opening must be made for the escape of the matter; and, if the quantity of fluid effused in the first instance is very large, or does not soon shew signs of being absorbed, it may be well, in order to hasten the cure and prevent suppuration, to evacuate the cavity of its contents, and then carefully press its sides together. In some rare cases, one or more of the larger arterial branches are ruptured, and the tumour then not only fluctuates, but pulsates. External pressure is found quite ineffectual in checking the accumulation when proceeding from this source, and the only method of remedying it consists in laying open the cavity, sponging out the blood, and securing the injured vessels by ligature, or the application of compresses on their orifices. Bruises of the scalp, though perhaps apparently very trivial, are sometimes followed, at a distant date after the accident, by very disagreeable symptoms, denoting chronic inflammation of the pericranium, or *dura mater*. In such cases there are usually indications of constitutional derangement previous to the accident, and means proper for correcting this general disorder may be sufficient to remove the local complaint. But if the patient, after being subjected to an alterative course of diet and medicines, still suffers from painful sensations of the scalp, aggravated by pressure on the injured part, from headache and sickness, or from perversion of any function connected with the cerebral organs, a crucial incision ought to be made down to the bone, and be prevented from healing until it is closed by the contraction of the granulating process.

Wounds of the scalp are to be treated in accordance with the general principles that have been explained. The neighbouring hairs should be always shaven clean away, and those more distant cut short to prevent them from insinuating themselves between the edges of the sore, collecting blood or other matters discharged from it, or impeding the application of dressings. If the scalp is detached from the bone in the form of a flap, it ought not to be cut away, as was done previously to the time of Mr Pott, who shewed the advantage of allowing nature to determine how far the part was rendered incapable of recovery. No inconvenience arises from replacing the flap in the first instance; and if even a portion only of it should be saved, the cure will be greatly accelerated. When sand or other impurities are lodged in the wound, it must be carefully washed; and if this proves insufficient, a poultice may

be applied until the surface is freed from all foreign matters. All wounds of the scalp, but especially those of a punctured form, are apt to occasion extensive inflammation of the neighbouring integuments. It would not be proper, by way of preventing this, to make any incisions in the first instance; but if the bad consequences in question should ensue, free dilatation, together with warm fomentations and poultices, ought to be employed without delay, while the general treatment of the patient is conducted so as to conduce to the soothing effect desired.

Diseases of the Coverings and Contents of the Cranium.

Encysted tumours occur very frequently under the integuments of the scalp. They generally consist of a very thick and firm cyst, which contains a mixture of fluid and pultaceous matter. They vary in size from that of a walnut downwards, and unless subjected to pressure or ulcerated, are very loosely connected, so that when a knife is thrust through the integuments and cyst in its long direction, the latter may be readily pulled away with the forceps, or turned out with the handle of the knife. Tumours of this sort are not unfrequently observed to be hereditary. More rarely, cysts of a thinner texture, and containing lardy-looking matter, generally intermixed with hairs, are met with in the scalp, chiefly at its lower and back part, near the neck. These adhere more firmly, and require to be dissected out. They often attain a very considerable size.

The only disease of the contents of the cranium, not depending on external injury, that has ever been subjected to surgical treatment, is Hydrocephalus, or a morbid accumulation of fluid. The fluid is generally enclosed in the ventricles, but sometimes lies exterior to the surface of the brain, which is then usually more or less malformed. The disease is either acute or chronic: in the former case occurring suddenly as a consequence of inflammatory action; and in the latter commencing insidiously without any such antecedent symptoms. Acute Hydrocephalus may take place at any period of life, but is most common in children. The quantity of fluid seldom exceeds an ounce or two, and death is caused probably not more by the pressure of the water than by the destruction of the cerebral substance occasioned by the inflammation which attends the effusion. The chronic form of the disease always commences in childhood, and is not unfrequently congenital. The accumulation of fluid slowly increases, and the bones of the

cranium not being united, are separated by stretching of their connecting membranes, so as to allow the quantity at length to weigh several pounds, without much interfering with the functions of the brain, which becomes expanded into a bag-like form, and loses all trace of convolutions except on its inferior surface. The patient in such cases has the power of locomotion diminished, and his body becomes excessively attenuated; but existence is often prolonged for many years, and may at length terminate in a way not connected with the disease of the brain.

The great object in treating acute hydrocephalus is to subdue the primary inflammation, since the case is nearly hopeless when effusion takes place. It is evident that the mere removal of the effused fluid by operation, though it might for a little diminish the symptoms of pressure on the brain, could not afford any permanent advantage, and the operation for this purpose would necessarily be attended with the danger that attends all wounds of the cerebral substance. Few attempts have accordingly been made to cure the disease by puncture, and the results of these confirm the unfavourable opinion of the practice that was previously entertained on theoretical grounds.

In Chronic Hydrocephalus, the accumulation of fluid constitutes the whole of the morbid condition, and consequently evacuation of it may not appear an unreasonable mode of affording relief. The operation has, accordingly, been frequently performed, but not with such success as affords any encouragement to repeat it. This will not appear surprising, if it is recollected that, in all other dropsical swellings, paracentesis hardly ever affords more than temporary relief, and that, in the particular case under consideration, there are circumstances peculiarly opposed to a more permanent recovery. The unyielding nature of the parietes of the cranium, even though at some parts remaining in a membranous state, must equally prevent the complete removal of the fluid, and the employment of effectual compression afterwards to oppose its reproduction. No great risk seems to be incurred, in the first instance, since the wounds made by introducing the trocar have generally healed without producing any bad consequences, which may perhaps be accounted for by the thin expanded state of the cerebral substance, but the progress of the case is usually accelerated rather than checked.

Injuries and Diseases of the Spinal Canal and its Contents.

The spinal cord is liable to concussion from blows and falls, particularly the latter, the symptoms of which are similar to those of concussion of the brain, inasmuch as they denote suspension of the functions usually exercised by this part of the nervous system. As these consist chiefly in conduction of the impressions producing sensation and voluntary motion, the patient loses more or less completely the feeling and power of moving in all the portion of the body which is supplied with nerves originating from the spinal cord, below the part where it has suffered from the external violence. The organ does not recover from this state of inaction so soon as the brain,—a day or two at least almost always elapsing before any well-marked sign of improvement is perceptible. It is probable that the cause of this may be a complication with effusion of serum, or blood, occurring in consequence of the injury, which, subsequently undergoing absorption, allows the usual actions to be restored.

In cases of this kind, the treatment, in the first instance, should consist merely of rest, and, if necessary, introducing the catheter to draw off the urine. The patient, though insensible to external stimuli, generally complains of uneasy feelings, sometimes amounting to intense pain, in the paralysed part of his body; and if the state of his pulse, or other symptoms, such as flushing of the face, tenderness of the back to pressure, &c., should indicate the commencement of inflammation, general and local bleeding, warm fomentations, and purgative injections, must be assiduously employed to arrest the morbid process. After the acute symptoms have been subdued, and also in cases where the injury has not been primarily followed by them, the patient sometimes makes very slow progress in regaining the powers he has lost. Counter-irritation by blistering, tartrate of antimony ointment, or the actual cautery, then often proves extremely useful; while warm bathing, with friction, and attempts at exercise, are diligently used to excite the languid energies of the limbs.

The vertebræ are liable to dislocation and fracture, but never suffer in either of these ways without the operation of extreme violence, except in the cervical region, where the parts concerned are least firmly constructed, and sometimes suffer displacement from a degree of force not so very great. Dislocation seldom occurs unaccompanied by fracture; and the medullary cord is almost

always much injured at the time, independently of the pressure apt to be permanently caused on it by the disjointed or broken vertebræ. The symptoms resulting from such injuries are nearly the same as those of simple concussion or compression, and the distinction between them depends on the former being generally more severe, as well as obstinate, but chiefly in the alteration of shape which is discovered in the spinal column. It has been stated* that dislocation of the spine always terminates fatally, either in the first instance, or in the course of a few months, owing to the chronic inflammation, and alteration of structure occasioned by the injury; but this is not altogether correct, since recoveries in such circumstances do take place, though certainly very rarely. The prognosis, therefore, must be unfavourable.

The treatment does not admit of replacement of the dislocated surfaces through the agency of external means, and the removal of portions of bone by operation to facilitate reduction, though it has been attempted, offers no reasonable prospect of benefiting the patient, while it must increase the danger of bad consequences by adding to the irritation. The vertebral canal is so much wider than the nervous cord which it contains, that a mere alteration of its direction, even though pretty acute, could hardly produce any very important effect on the functions of the organ; and if the displacement were so great as to make the bones press injuriously upon it, there is every reason to suppose, that taking away the portions of vertebræ concerned, even granting it could be done without mischief, would be of no use in remedying the derangement of the structure of the cord. The patient, therefore, should be treated as if he had merely suffered concussion or compression. Symptoms of inflammation should be checked—the discharges from the rectum and bladder duly maintained—and if the immediate danger is surmounted, the means proper for subduing chronic disease at the injured part, should it be required, or for rousing the energies of the limbs, in case they remain defective in their power, must be carefully employed.

The only disease of the spinal marrow, that affords subject of surgical practice, is that sort of *Spina Bifida* in which the nervous parts are perfectly formed, but the membranes are distended with fluid so as to protrude through the aperture of the spine, and constitute an external tumour. The integuments at the part, which is usually the lumbar or sacral region, are generally thin, livid, and

* Sir A. Cooper on Dislocations and Fractures. 1826.

adherent. This disease is often associated with other congenital malformations, adverse to the duration of life, but when existing by itself, is not necessarily fatal. The thin parietes of the tumour sometimes ulcerate, so as to form a minute orifice, which, opening from time to time, allows the fluid to escape, and thus at length completes the cure. In imitation of this natural process, small punctures have been made with a needle (Sir A. Cooper), pressure being afterwards carefully exercised, and the practice has occasionally proved successful. It is evident that the circumstances are here much more favourable for recovery after puncture than in the case of dropsy within the cranium, since the membranous nature of the sac which contains the water permits it to be readily compressed. The operation is still far from certain in its result, and ought not to be undertaken except when the child seems otherwise in a thriving state.

Injuries and Diseases of the Nerves.

When a nerve is divided, the part to which it is distributed is immediately deprived of sensation and voluntary motion, and also suffers a diminution in the energy of its vital action, the consequences of which are coldness, emaciation, and proneness to ulceration and sloughing. If the respective extremities are not separated to any great distance, they generally become united by a new-formed substance, and in some rare cases, nervous fibrils have been traced from one extremity to the other. If a nerve is only partially divided, the wound is generally slow in healing—uneasy sensations are felt by the patient, who refers them to the part where the injured nerve is distributed—and the edges of the external sore are red, tumid, and extremely sensitive to external impressions. In such cases, warm fomentations, and other soothing means, afford some relief; but the most effectual measure for rendering it complete, is to cut the wounded nerve entirely across. When a foreign body is lodged in the substance of a nerve, the same symptoms that have just been mentioned are produced in an aggravated degree. Agonising pain, and spasmodic contraction of the muscles are then induced, so as to make the patient willingly accept the severest terms for obtaining a release from his sufferings. Excision of the irritating body ought of course to be performed if practicable, and, if this cannot be done, amputation must be resorted to as the only remedy.

Symptoms very similar to those resulting from injury of a nerve

sometimes occur without any local circumstances to account for them. The part affected is generally the face. The pain and spasmodic action of the muscles are not constant, but occur in paroxysms, which either come on spontaneously, or are induced by movement of the jaws, the operation of cold, heat, or stimulating food, and often mere mental emotion. This *Tic-Douloureux*, as it is called, was formerly treated by simply dividing the nerve affected; but with so little permanent benefit, that the operation fell into great discredit, and was replaced by the use of constitutional remedies, such as a succession of smart purgatives, especially croton oil, and the carbonate of iron, administered in large doses. But it has lately been found that permanent relief may be obtained by removing a portion of the nerve, so as to insure its complete division and effectually prevent its reunion.

The nerves sometimes become the seat of tumours, which are generally of a firm fibrous structure and yellowish colour, but have been met with of a soft pulpy consistence. They seem to be formed between the nervous fasciculi, which can be traced over one or more sides of the swelling. They are generally smooth, round, or oval; and of a size intermediate between that of a pigeon and hen egg. They occur most frequently in the large nervous cords of the superior extremity, between the elbow and shoulder, for the most part commence about the middle period of life, and are observed more rarely in females than males. They are usually the seat of more or less constant uneasiness; and when squeezed or otherwise irritated, occasion pain, with spasmodic twitching of the part to which the nerve affected is distributed. They are recognised by their symptoms, by their situation, and by their greater mobility in the transverse than longitudinal direction of the limb. The proper treatment of these tumours, as all external remedies are of no use, is to cut them out. The immediate effect of this operation is insensibility and paralysis of the part concerned; but through time the patient generally recovers, in some degree, the powers thus lost; and, at all events, is freed from the annoyance of the disease, which is often so great as to render his life miserable.

Tumours of a similar kind are not unfrequently met with at or near the extremities of nerves divided by amputation. The enlargement seldom attains a considerable size, being generally that of a pea or marble. It is extremely sensitive to external pressure, which excites intense pain, referred to the limb removed,

with spasmodic contraction of the muscles of the stump, while the tumour, even though not mechanically irritated, is hardly ever free from uneasiness. The only remedy is removal, which may be effected either by simply excising the affected part, or performing a secondary amputation, which is the more eligible course, when the stump has been in other respects imperfectly formed.

The Subcutaneous Nervous Tubercle, as it is called, though not distinctly connected with the nerves, so far as can be traced by dissection, yet agrees so much in its symptoms with the tumours just described, that it certainly ought to be considered along with them. It is almost always about the size of a pea, smooth, round, or oval, and of a firm yellowish structure. It is seldom, if ever, observed to increase, being as large when first discovered, as it is found to be at any time afterwards. It is seated immediately under the skin, which it slightly elevates; occurs on the inferior extremities much more frequently than on the superior; and is more rare in males than females, who are usually affected with it before middle age. In one case, the subject of which was a middle-aged lady, I found a tumour of this kind lying under the nail of the little finger. It is the seat of uneasy sensations, which suffer occasional paroxysms of exacerbation, sometimes periodically, but chiefly in consequence of excitement, either local or general. Emotions of the mind often produce this effect; and it is frequently observed, that the same circumstances which induce the attacks, when repeated, cause their sudden cessation. The only remedy for the disease is excision, which no less easily than quickly and safely relieves the patient from it.*

* W. Wood, Med-Chirurg. Trans. of Edinburgh.

CHAPTER XXI.

SKIN.

Erythema, Erysipelas, and Anthrax.

THE skin is liable to inflammation in consequence of very numerous and various irritations direct as well as indirect. When proceeding from the former, it is either attended with merely local inconvenience, or, if sufficiently severe to disturb the system, occasions symptomatic fever, which presents the usual characters of that accompanying inflammatory affections. The morbid action of the part concerned does not tend to diffuse itself more extensively, and, according to the particular circumstances of the case, terminates in resolution, mortification, suppuration, effusion, ulceration, or diseased nutrition. Inflammation of the skin, resulting from indirect irritation through constitutional disturbance, is distinguished by some important differences, of which the most deserving of attention are its tendency to spread, and the peculiar nature of the disorder in other parts of the system that is connected with it. The terms Erythema, Erysipelas, and Anthrax, the last of which may include Carbuncle and Boil, are used to denote the principal modifications which it presents. The first is applied to a very superficial redness, attended with hardly any perceptible swelling, evanescent on pressure being applied, having an extreme tendency to spread over the body, occasioning a hot burning sensation, and terminating in resolution or death. It is preceded and accompanied by great constitutional disturbance, being ushered in with prolonged and repeated rigors, sickness, and retching, which is sometimes almost incessant for several days together. The pulse is extremely quick, but not strong; the tongue is coated with a yellowish-white fur, inclining to be dry; the skin is very hot, often raising the thermometer to 104°; the patient complains of an insufferable burning sensation all over the body; his countenance has a yellow hue and anxious expression; his mind is weak, and apt to wander. The

mucous membranes of the lungs and intestines are often in an excited state, giving rise, by their increased secretion, to crepitation in breathing, and diarrhœa. The disease is extremely distressing and in general very obstinate, recurring again and again after the principal attack appears to have been subdued; but it does not often prove fatal. When death does ensue, it happens either from derangement of some internal organ, especially the brain and lungs, or from exhaustion caused by the continuance of the fever. Erythema is sometimes associated with an inflammatory state of the subjacent cellular substance, which is distended so as to cause a puffy sort of swelling, and generally soon afterwards becomes the seat of purulent effusion, or not unfrequently of sloughing.

The disease generally appears in persons on the surface of whose bodies there is a solution of continuity. This may be either recent or of old standing, but the latter condition seems on the whole most favourable to attacks of the disease. The patient is rendered more liable to be attacked by having a bad constitution, or one disordered by an unhealthy mode of life. The grand exciting cause seems to be some peculiarity of the atmosphere, such as that existing in crowded, ill-ventilated hospitals, or even in open situations during particular seasons. In such circumstances, the wound, if recent, is often nearly healed before the erythema appears. The erythema commences in the neighbourhood of the sore, and then leaving the skin there in its natural state, travels over the trunk or limbs, or nearly every part of the body in succession. There is hardly any treatment of a local kind that can be used with advantage. Leeching or cupping the inflamed part affords relief for the time, but seems to have no effect in arresting the progress of the disease. Of internal remedies, the most useful in the first instance are emetics, which sometimes appear to cut short the morbid process. The mercurial and saline purgatives, with gentle diaphoretics, should be frequently administered,—blisters applied to the epigastrium seem very serviceable,—and opiates have often a remarkably good effect in soothing the sensation of heat on the surface of the body, procuring sleep, and otherwise diminishing the uneasy symptons of the disease. General bleeding can rarely be used with propriety, and stimulants are hardly more admissible except in the advanced stage.

By Erysipelas is understood an inflammation of the skin, more deeply seated and less disposed to shift its place than erythema, and which tends to terminate in effusion of serum under the cuticle,

elevating it into vesicles. The skin may be affected either alone or together with the subjacent cellular texture. In the former case the swelling, though distinctly perceptible, is slight, the surface is red, tense, and glistening, and vesicles of variable size soon make their appearance. In the latter, which is styled phlegmonous erysipelas, the swelling is more considerable, but the other symptoms are the same; and the most important difference is established by the result, which is apt to be suppuration or sloughing. The constitutional disturbance, that precedes the appearance of erysipelas, is of the same kind as that which goes before erythema, but seldom proves so severe. The patient complains of headache, bad taste in his mouth, and coldness; and when the skin inflames, his general uneasiness, so far from increasing, generally diminishes very much, or entirely subsides.

The head is the part of the body most frequently affected by erysipelas, and, along with the external inflammation, there are usually symptoms denoting an excited condition of the internal organs. The causes of erysipelas resemble those of erythema, but differ in so far that they depend more upon peculiarities of the individual. It occurs as often when there is no wound, as when there is one; and it is almost confined to those persons whose general health is previously deranged, particularly in regard to their biliary secretions, and by intemperance. In the treatment more benefit is derived from local remedies, and antiphlogistic measures of a general kind are more frequently required than those of a stimulating nature. When the head is concerned, blood should, if necessary, be abstracted by venesection; and it is only when the patient's system is extremely weak that an opposite method ought to be pursued. A dilute solution of the tartrate of antimony, with the supertartrate of potass, or the saline purgatives, if given so as to maintain a degree of nausea, with copious discharge from the bowels, exerts a powerful influence in subduing the disease. Of local means, those of a repellent kind, such as cold lotions, are considered unsafe, at least if they are used before the constitutional disorder has been removed. Bleeding from the inflamed surface sometimes affords benefit, and may be obtained by leeching, puncturing, or scarifying. It has been objected to the use of leeches, that it may excite irritation by the bites, but this inconvenience has not been experienced in practice. Punctures to the number of from ten to fifty, repeated once or twice a-day (Sir

R. Dobson,* 1828), have been preferred by some as free from this objection, besides being more economical and convenient. Incisions of an inch or two in length, and made fairly down to the cellular texture (Copland Hutchison, 1814),† are of great use in the phlegmonous form of the disease; both, in the first instance, by cutting short the inflammatory process, and also in the more advanced stage by facilitating the discharge of pus or sloughs. Longer incisions, equal in extent to the inflamed surface, and sometimes exceeding one or two feet, have been recommended (Lawrence, 1828),‡ but seem to have no advantage to compensate for their severity, and cannot be regarded as exempt from danger in systems not particularly strong. There are few cases that require incisions of any kind; and great mischief has resulted from their too indiscriminate employment. In persons who are very weak, and suffer intense pain, the best application is a warm solution of acetate of lead with opium. When there is much swelling of the part affected (Œdematous Erysipelas), pressure is found very beneficial, both before suppuration, and while sinuses exist after the matter is discharged. If sloughing takes place (Gangrenous Erysipelas), poultices are proper, until the dead parts are thrown off, after which a nutritive diet is all that the patient requires. The last mentioned form of the disease sometimes occurs with very acute symptoms, and runs its course in despite of every sort of treatment, so as to terminate fatally within a few days from its commencement. It generally originates from some slight local injury, such as a prick or scratch, but occasionally commences without any breach of the surface having been sustained. It is always preceded by, and accompanied with, extreme constitutional disturbance, of which the most remarkable features are excessive rapidity of the pulse, great frequency of respiration, want of sleep, anxiety, dusky complexion, and dark colour of the tongue, lips, &c. Free incisions, hot fomentations, calomel with opium, administered internally, and a liberal allowance of wine or other stimulants, are the means best calculated to afford relief in this most alarming state, which may be regarded from the first as all but incurable.

By Anthrax or Carbuncle, and Furunculus or Boil, are implied different degrees of a similar affection of the skin, consisting in an inflammation fixed to the part where it occurs, but tending to spread

* Med.-Chirurg. Trans. vol. xiv. p. 206. † Ibid. vol. v. ‡ Ibid. vol. xiv.

in its extent, attended with intense pain, and terminating in suppuration, with more or less sloughing. The disease is met with of all sizes, from that of a pea to that of a plate. It occurs, when large, generally on the posterior surface of the trunk between the occiput and sacrum, and, if small, chiefly on the face and limbs. In other parts of the body it usually attains an intermediate size. There is usually little swelling, but great induration. Small apertures take place spontaneously in the progress of the disease, but as these depend on detached suppurations in the substance of the thickened cutis, they afford no relief. The irritation consequently continues,—the disease enlarges its area,—and if of large size, or seated in a weakly subject, may at length prove fatal. In general, the disease is more distressing than dangerous. It is always preceded by derangement of the system, though it frequently happens that no marked symptom of this attracts attention, until the local appearances present themselves. A state of too full health, or assimilation of food disproportioned to the patient's exercise, and also an irritable state induced by intemperance, and derangement of the biliary secretion, are the conditions most favourable for producing the disease. In the form of boil it often exists in various parts of the body at the same time, or occurs in them successively. It is always accompanied with feverish disturbance, proportioned to the extent and accuteness of the local symptoms.

The treatment of all the degrees of this affection should be conducted on the same principles. The first of these is to relieve tension, bleed from the part, and afford free vent to the confined matter, by making a free crucial incision completely through the integuments to the full extent of the disease;—the next is, to promote the cleaning of the cavity, by applying soft poultices;—and the third is, to correct the predisposing state of the system, which appears to have induced the morbid action, by bleeding, purging, soothing, or stimulating, according to the circumstances of the case. When the boils are numerous and small, the local treatment that has been recommended would be more severe than the disease warrants, and may therefore be omitted, while the constitutional means are diligently employed. In the opposite extreme, where the carbuncle is of great extent, it is of the utmost consequence to proceed in the most efficient manner for subduing the local disease, and not only make free incisions in the first instance, but repeat them from time to time, if the inflammation should still at any part threaten to extend.

Chronic Cutaneous Diseases.

Under the title of Cutaneous Diseases may be comprehended a great number of affections, apparently very dissimilar from each other, but which are found to differ chiefly in appearance, and in general to agree very closely in regard to the cause of their production, as well as the mode of their remedy. They all consist in the existence of some chronic preternatural condition of the skin, and have been arranged into divisions, according to the nature of it. Of these the most important are the Papular, in which the surface is elevated into little pimples,—the Pustular, which consist in small collections of matter,—the Vesicular, in which the cuticle is elevated by small quantities of fluid effused under it,—and the Squamous, in which the cuticle is rendered thick and scaly. The species and varieties of these different kinds, and others that have been noticed, are so numerous, that the most concise description of their distinctive characters would require far more space than can be afforded for the purpose in this work, to which, it may be observed, they do not strictly belong, since, though external in their situation, they are remedied chiefly by internal means.

They originate, in the first instance, with few exceptions, from constitutional disturbance, but frequently become so naturalised to the system, as to continue after the derangement that gave rise to them has ceased to exist. Disorder of the digestive organs is the grand source of their production, and they may be regarded as bearing the same relation to chronic conditions of this kind, that erysipelas or erythema does to those of an acute form. The circumstances that occasion this disturbance of the abdominal viscera are very various, and many of them were wont to be regarded as the immediate causes of cutaneous disease ; but it will be found that they are not truly so, having always interposed, between their operation and the affection of the skin, some derangement of the digestive functions, which ought more properly to be considered the cause of the disease. In the treatment it is often sufficient to restore the general health, but more frequently it is necessary to conjoin local means with those employed for this purpose, since, as has been already observed, the morbid action of the skin is apt to become habitual, and to continue after the derangement in other parts of the system that gave rise to it has ceased to operate. For correcting the depraved condition of body, all errors of diet must be carefully ascertained and interdicted. The food should be easily

digestible, but small in quantity. Bleeding and purging may be used if there seems to be a tendency to plethora. Regular exercise, and an alterative course of mercury, with the saline cathartics, or some mineral water of this kind, are then to be prescribed. In the treatment of scaly eruptions great benefit is derived from the use of corrosive sublimate and Fowler's solution of arsenic; and from the combinations of iodine with mercury and arsenic. Of local means, the one most generally useful is frequent ablution with warm water and soap. Water impregnated with sulphur, such as that existing naturally at Harrowgate and elsewhere, or prepared artificially by dissolving a small proportion of sulphate of potass with sulphur, usually proves more beneficial. If there are any hairs at the part, they ought to be removed, as their presence is not only a constant source of irritation, but prevents the measures for cleansing it from being employed efficiently.

Of medicinal applications, the best are citrine ointment diluted with axunge or *linimentum aquae calcis*, in the proportion of one part to four or six; an ointment containing sulphur and axunge in the proportion of one to eight; the ointment of the acetate of lead; a mixture of the two last mentioned; a solution of the sulphuret of potass, or hydro-sulphuret of ammonia; and other ointments or solutions of a stimulating kind.

Warty excrescences of the skin are of very frequent occurrence, particularly on the face and hands. In the latter situation, they are simple extensions of the natural texture, and prove inconvenient merely from the deformity and awkwardness in using the fingers, occasioned by their presence; but in the former, they consist of formations altogether foreign to that of the skin, and besides being unseemly, are apt, in the more advanced period of life, to take on malignant action, either in consequence of being irritated, or spontaneously. They generally appear on the hands during the period that intervenes between childhood and puberty, and are seldom met with in adults. They may, if it is desired, be removed at once by the knife, caustic, or ligature, of which means the one first-mentioned is the best; but are in general readily dispersed by the more gentle method of exciting their absorption, by applying some stimulating ointment or lotion. Strong acetic acid answers very well for this purpose, if applied every second or third day. When they are seated on the face, caustic, and all other applications likely to excite irritation, should be carefully withheld from them; and if itching, pain, or increasing size at any time indicates

activity, and probable perversion of their nutritive action, excision ought to be immediately performed.

Corns consist of a thickening or induration of the cuticle, induced by pressure, which excites the secreting action of the cutis. The toes, particularly on their lateral aspect, are most liable to this occurrence; and it appears that there is great variety in the predisposition to the disease, which is possessed by different individuals. The symptoms of a corn are precisely what a foreign body of similar size and consistence would produce, if placed in the same situation. They may be palliated by slicing off the most projecting part of the induration, by wearing wide shoes, or avoiding walking. The radical cure is often attempted by detaching the corn from its matrix by means of a pointed and flat, but not sharp-edged instrument,—which may be done very completely without bleeding, is always followed by great relief, and sometimes proves permanently effectual. A better method is to soften the corn by touching it with acetic acid again and again until the whole is scraped out, and then apply the nitrate of silver to the exposed surface of the cutis, to destroy its morbid secreting tendency.

Corns are occasionally not hard, but soft, the cuticle constituting them being white and moist. These *soft corns*, as they are generally, though not very correctly, termed, usually prove more troublesome than the others. They cannot be detached entirely,—and are apt to inflame, suppurate, and form obstinate sores, if subjected to irritation. Astringent applications, such as that formed by mixing together equal parts of alum and the white of eggs, often afford great relief.

Diseases of the Fingers and Toes.

The nail of the great toe often occasions much distress, by becoming embedded at one or both of its edges in the soft parts, instead of lying over and protecting them. This *growing in* of the nail, as it is termed, depends originally in most cases on the pressure of a tight shoe, or on the projecting corners of the nail having been broken off accidentally, or cut away intentionally, with the erroneous view of preventing them from entering the flesh, since they are much more apt to do so when thus rounded off, than when left in their natural shape. After the edge of the nail has effected an ulcerated breach, it prevents any step towards reparation, by causing irritation, which inflames and thickens the soft parts con-

cerned, so as to make them overlap more and more. Various methods were formerly employed in the treatment of this complaint, which seldom did more than afford temporary palliation; of these may be mentioned, cutting away the overhanging edge of skin, touching the ulcerated surface with caustic to destroy its morbid sensibility, interposing a plate of some sort between the edge of the nail and the ulcer, and scraping away the morbid part of the nail so as to make it very thin, in order to diminish the force with which it pressed upon the raw surface. M. Dupuytren devised an easy and effectual mode of treatment, which has superseded all the others.* This is to remove all that part of the nail which is connected with the ulcer,—an operation that may be effected more readily than might be expected, by thrusting one blade of a pair of strong scissors close under the nail, and dividing it quite up to the root, after which the portion that is to be removed being firmly seized with forceps, is twisted out with great ease. Should the nail be exciting irritation at both edges, it will be best to take away the whole of it, for which purpose the preliminary division ought to be made exactly in the middle. The wound should be dressed simply, and heals in a few days, in so far as to acquire a cuticular covering. The nail then gradually extends over the surface it formerly occupied, and, unless subjected to improper pressure, occasions no further inconvenience.

Small Exostoses occasionally grow from the distal phalanx of the great toe, and also, but very seldom, from those of the other toes. They generally form a tumour under the edge or extremity of the nail, and sooner or later seriously impede the use of the foot. The nail, if necessary, having been removed, an incision should be made, first on one side, and then on the other, so as to embrace the root of the growth, and divide the soft parts covering it, after which it may be readily detached by strong scissors or cutting forceps.

Onychia is an obstinate ulcer seated in the vascular structure that lies under the nail, and envelopes its root. It is of small size at first, but gradually spreads so as to engage the whole extent usually covered by the nail. The surface is brown and glossy, the discharge excessively fetid, and the pain intense. The nail is formed very imperfectly, and either remains dry, black, and loosely adherent, or presents merely a small vestige of its root, which is thick, white, soft, and connected by a broad base with its secreting

* Repertoire d'Anatomie et de Physiologie, t. i.

matrix. The surrounding skin is tense and inflamed, and, in cases of long standing, the texture of the subjacent bone is sometimes greatly expanded.

This disease occurs most frequently in children, but is met with at all periods of life, and in the fingers much more frequently than in the toes. It is occasionally referred to local injury, but perhaps always in some measure depends on derangement of the general health. After being established, however, it exists as an independent disease, and can hardly be remedied by means that operate on the system. The treatment requires, in the first instance, that the nail should be completely removed, and then that the ulcer should be touched with caustic potass, poultices being afterwards applied until the slough separates, while means are at the same time employed to improve the general health.

Paronychia, or Whitlow, denotes an acute inflammation of the finger, generally resulting from local irritation operating on an irritable constitution. The disease is sometimes confined to the soft parts, sometimes engages the tendons or their sheaths, and sometimes affects the bones. In all cases the best practice is to make a free incision as soon as possible through the seat of the disease, which is almost invariably on the palmar aspect. When the fibrous tissues slough, the dead parts ought to be carefully withdrawn so soon as they are loose, since their presence acts powerfully in keeping up irritation. Leeches, warm fomentations, and poultices, are often productive of great harm in the treatment of paronychia, by divesting attention from the only effectual mode of affording relief—namely, incision. After the parts are freely divided, a poultice may be applied for a few days, but not longer, as its relaxing effect, if continued, proves injurious. When the tendons or bones are destroyed, amputation must be performed, as the finger, even though it might be healed, could not be of any service to the patient. Exfoliation of the distal phalanx, which frequently occurs, does not require the same proceeding, as the finger, though somewhat shortened by it, is not materially impaired either in appearance or utility.

The Palmar Fascia, on the ulnar side of the hand, is liable to contraction, attended with thickening, which produces more or less complete and permanent flexion of the little and ring fingers. This affection occurs in young and middle-aged persons of both sexes, but in males more frequently than females. It seems to be

induced by violent exertion and pressure of the hand. All kinds of external applications have been found quite unavailing in its treatment, and the only effectual mode of affording relief is to rupture the contracted fibres by forcible extension of the contracted finger, either simply or after a preliminary subcutaneous incision through part of the band, when it is very strong.

CHAPTER XXII.

THE EYE AND ITS APPENDAGES.

Inflammation of the Conjunctiva.

THE conjunctival covering of the eye and eyelids is very liable to inflammation, in consequence of a great variety of irritations, both direct and indirect. Bright light, intense heat, cold wind, acrid fumes, dust, and foreign bodies of all kinds introduced under the eyelids, produce inflammatory symptoms more or less severe, according to the irritability of the individual, and the degree of irritation. The suppression of accustomed secretions through the operation of cold or any other cause, is also a fruitful source of such attacks. The proneness to this inflammation is remarkably increased by habit.

In considering the symptoms of the disease, it is necessary to divide them into acute and chronic. The former are—1. Redness and turgescence of the conjunctiva, the surface of which is everywhere covered with arborescent vessels; 2. Swelling of the eyelids, and watering of the eye; 3. Intolerance of light; 4. Pain of the eyeball and forehead; 5. Symptomatic fever. The characters of the chronic form are moderate redness without tumefaction, weakness of the eye when employed for vision, and a disagreeable sensation, as if from the presence of some granular body under the eyelids. Between these extremes there are innumerable shades of difference in the severity of the symptoms, according to the peculiarities of particular cases. When the inflammation is very intense, the turgescence of the conjunctiva is sometimes so great, as to cause an obvious swelling of the membrane, which is named Chemosis. It depends on effusion into the loose subjacent cellular texture, partially conceals the cornea, and may even evert the eyelids. The chronic condition almost always remains as a consequence of the acute one, and when it exists independently of this origin, generally proceeds from some chronic source of irritation, either direct

or indirect, as inversion of the eye-lashes, or derangement of the digestive organs.

The treatment requires, in the first place, that the eye should be relieved and protected from all sources of irritation. Foreign bodies, if suspected, must be searched for and removed, the eyelids, if necessary, being everted, so as to bring the whole extent of their mucous surface into view. Workmen employed in forging or grinding iron are exposed to the entrance of small sparks from the metal into the eye, where they generally fix themselves in the conjunctival lining of the cornea, and, unless speedily wiped off, are apt to become imbedded in its substance, where, being extremely small, they may remain a long while producing irritation without being discovered. The light of the patient's room should be obscured, and he ought to abstain from all attempts to use the organ. Free evacuation of the bowels by mercurial or saline purgatives, leeches applied to the neighbourhood of the eye, and warm fomentations frequently repeated, are the means of most use. If fever exists, general bleeding, in sufficient quantity to produce a decided effect on the system, should be employed. The blood may be taken either from the arm or temporal artery, but seems to be abstracted most beneficially in the former mode. When the chemosis is so great as to impede the closing of the eyelids, some portions of the distended membrane may be cut off with scissors, which relieves the distension, and tends also to subdue the inflammatory action. After the intensity of the symptoms has been subdued, and they assume the chronic character, or if they appear in this form from the commencement of the attack, decided benefit is usually derived from introducing into the eye once a-day, a dilute solution of the nitrate of silver. The vinous solution and tincture of opium, with various other stimulating and astringent applications, have been employed at this stage of the disease, but the solution just mentioned is far more beneficial than any of these. Its most convenient strength seems to be obtained by dissolving two grains in an ounce of rose-water, but many use it in a much larger proportion than this. Scarification of the inner surface of the eyelids was formerly much practised in the chronic state of inflammation, but is now seldom resorted to, as the relief it affords is generally of short duration. It is executed by everting the eyelid to be operated on, scratching it longitudinally in several places with a lancet, and wiping away the blood as long as it flows with a sponge or piece of lint. Leeches produce most effect when

applied to the corners or angles of the eyes, particularly the inner one. In obstinate cases of chronic inflammation, when no permanent source of irritation can be discovered to exist, advantage is frequently derived from effecting counter-irritation by blistering the back of the neck, or introducing a seton into it.

Consequences of Inflammation of the Conjunctiva.

A purulent discharge from the surface of the inflamed membrane occasionally occurs, and constitutes what has been named Purulent Ophthalmy. The inflammation, though probably commencing in the conjunctiva, and chiefly observable in it, generally affects the other tissues of the eye, and is apt to prove very destructive, when allowed to pursue its course, by causing morbid adhesions, opacities, and ulcerations of the organ. It most frequently occurs in infants soon after birth, and in young children. Many explanations have been offered to account for its origin in the former of these, such as the existence of gonorrhœal or leucorrhœal disease in the mother at the time of birth; but careful observation of all the circumstances concerned leaves little doubt that the exciting causes are merely those which conduce to common inflammation, operating on a weakly or bad constitution. It is of great consequence to watch the eyes of children, and especially those of very tender age, lest inflammation should commence and proceed without being discovered until too late. The eyelids are apt to be glued together in the first instance, and though they afterwards become tumid, with distended veins, and of a livid hue, attention may still not be directed to the seat of the disease; and when at length the pent up matter gushes out, the organ is too frequently found irremediably injured.

If the patient is seen during the inflammatory stage that precedes the purulent discharge, which usually does not extend beyond a day or two, a leech ought to be applied at one or both of the angles of the eyes, according to the age and strength of the child. Warm fomentations, and a frequent separation of the edges of the eyelids are proper at the same time, due attention being bestowed on the secretions of the digestive organs. So long as symptoms of acute irritation continue, the same soothing system should be pursued; but when the disease begins to assume a chronic form, the solution of nitrate of silver ought to be employed; and in the still more advanced stage, if it prove obstinate, a succession of

blisters applied to the back of the neck greatly contributes to arrest the morbid action.

A very violent purulent ophthalmy is occasionally met with in adults who are affected with gonorrhœa. There are two opinions in regard to its production: one being that it depends on a metastasis of the disease from the urethra to the eye; the other, that it proceeds from the irritation of matter casually introduced into the latter part. The former of these explanations seems very improbable; but whatever be the causes of the inflammation, there can be no doubt that it is extremely violent and destructive, in general resisting the most active treatment, and terminating in the serious imperfection or total destruction of the eye as an organ of vision. Free and repeated general bleeding, leeching, and warm fomentations should be used as early as possible; together with powerful cathartics and antimonial diaphoretics. If the disease assumes a chronic form, the treatment that has been already explained will be proper.

Ulceration of the cornea, or its conjunctival covering, is a very common consequence of inflammation. The ulcers are sometimes preceded by small superficial pustules, but more frequently appear without any such antecedent. They are usually small, round, and of a brownish colour. They possess a very irritable surface, and consequently maintain the inflammatory symptoms. If large and deep, they leave, on cicatrizing, a permanent white spot named Leucoma. In treating them, the measures employed must be varied according to the acuteness of the inflammatory symptoms; but when these are of a chronic kind, as is usually the case, the solution of nitrate of silver always produces the best effects, and has now completely superseded a practice, formerly much in use, of touching the ulcers with a pointed stick of the lunar caustic. When the ulcers frequently recur, they will be found to depend on some indirect irritation, such as that caused by an unhealthy state of the digestive organs; and of course any such source of disturbance ought to be removed as soon as possible.

Opacity of the cornea varies in extent and depth. It always proceeds from organizable effusion into the natural texture of the part; but this may be induced in three ways:—1. Inflammation, leading to effusion in the superficial conjunctival covering of the cornea; 2. Effusion of lymph into the substance of the cornea with or without purulent matter; 3. Cicatrization of an ulcer. The first of these is named Nebula, the second Albugo, and the third

Leucoma. Nebula is a very common consequence of conjunctival inflammation, especially in children. It occasions various degrees of opacity, according to which, and also its situation in regard to the pupil, it interferes more or less with vision. The remedy consists in the introduction of stimulating applications, which promote absorption. Of these the solution of nitrate of silver is the most efficient. Albugo and leucoma hardly admit of removal. The treatment just mentioned sometimes produces diminution of the opacity, and is certainly preferable to the more severe measures which have been proposed, such as excision or puncturing, since they not only do no good, but generally increase the evil.

Pterygium is a fleshy-looking growth of firm consistence, and flat triangular form. It is seated in the conjunctival covering of the sclerotic or cornea, always beginning in the former, and in its progress tending to encroach over the latter. It generally grows at the internal angle, the apex is always directed towards the pupil; and the transverse diameter of the eye passes through the centre of its base. It occasions uneasiness, by obstructing the movement of the eyelids; and, if allowed to pursue its course on the cornea, may ultimately impede vision, by covering the pupil. The local means which are proper for subduing chronic inflammation, sometimes check the progress of pterygium; but the radical remedy of it consists in removal. This is readily effected by seizing the growth with a hook or forceps, pulling it outwards, and cutting it entirely away with scissors curved to one side. If it be so large as to lead to an apprehension of inconvenience from the contraction caused by the resulting cicatrix,—a portion merely of the disease, about a line or two broad, and running transversely across it, may be removed. The vessels are thus completely interrupted, and the remainder of the excrescence gradually shrinks away.

A granular state of the conjunctiva lining the eyelids, is occasionally a consequence of chronic inflammation, particularly when it is associated with purulent discharge. The surface, instead of being soft and smooth, becomes covered with small elevated points or tubercles; and the irritation which is necessarily occasioned by the roughness thus produced, maintains the inflammatory symptoms, so that a reaction is instituted, which renders the ordinary treatment ineffectual. Sometimes, instead of this slight elevation and irregularity of the surface, the conjunctiva is extended into large fleshy-looking excrescences, which roll out upon the cheek

when the eyelids are separated, and occasionally cannot be reduced without considerable difficulty. In the latter case, excision is the preferable practice; but, in the former condition, which is more frequently met with, though the knife and scissors have been employed, there can be no doubt that the best treatment consists in touching the granular surface from time to time, at the distance of a day or two, with lunar caustic.

Staphyloma is a projection of the cornea, of a round or conical form, and protruding more or less beyond the eyelids. It depends on expansion, together with thickening of the tissue concerned, which sometimes partially retains its translucency, but more frequently loses it entirely. The surface displays arborescent vessels, conveying red blood, and, in cases where the tumour is large, acquires a cuticular covering. The eye is rendered totally useless as an organ of vision; and the patient is apt to suffer occasionally from attacks of inflammation, which are induced by the exposed state of the organ to external irritation. The disease generally occurs as a consequence of inflammation of the purulent kind, but is sometimes brought on by violence. It almost always commences during infancy or childhood; and after attaining a certain extent, does not tend to increase. The treatment is either palliative or radical; the former consisting in the use of means calculated to allay the symptoms of temporary irritation; the latter in cutting away the whole of the projection from within a line of the sclerotic, which is easily done by pushing a sharp-pointed knife through it, and then cutting transversely so as to complete the division, first of one half, and then of the other, while the flap is held so as to steady the part under the knife. After this operation, the humours of the eyeball are more or less completely discharged, and the collapsed coats occasion no further trouble, or may even be made the support of an artificial eye to conceal the defect. The best application during this process is a poultice, and if the inflammation runs too high, it must, of course, be controlled by appropriate measures.

Inflammation of the Sclerotic.

The fibrous tissue of the eye is apt to inflame in persons who are subject to rheumatism, or who have had their constitutions impaired by the prejudicial influence of mercury, administered for the cure of venereal diseases. The attack is induced by the ordinary exciting causes of ophthalmy, especially exposure to cold. It

is characterised by redness of the eyeball, attended with less swelling, and apparently more deeply seated than when the conjunctiva is the part affected. The distended vessels form a zone round the anterior part of the sclerotic about a line in breadth, and to the same extent distant from the cornea. Beyond this, the vessels in proceeding backwards observe a radiating direction, and do not branch out as in the conjunctiva. In chronic cases, the eyeball, along with more or less of the redness that has been described, assumes a sickly yellow hue. The pain is of a dull aching kind, extending into the forehead, and generally suffering occasional exacerbations, with alternate remissions. The constitutional disturbance varies with the acuteness of the local symptoms. This inflammation may extend to other tissues of the eye, and produce destructive effects on them; but when confined to the sclerotic coat, it terminates always in resolution, or in a chronic state approaching to it. When acute, it requires bleeding, leeching, warm fomentations, and purgatives; and when chronic, cupping, followed by blistering on the back of the neck, with small doses of oxymuriate of mercury, Dover's powder, and colchicum, administered internally.

Iritis, and its consequences.

The Iris is liable to inflammation in consequence of local irritation, and also of indirect causes operating on an unsound constitution. The derangement of the system which seems most favourable to this effect, is that resulting from the abuse of mercury in the treatment of venereal diseases; but bad health from original constitutional defect, or from an improper mode of life, may occasion a predisposition sufficient for its production, when the exciting circumstances are brought into action. It may also result from the extension of inflammation originating in some other texture, as the conjunctiva or sclerotic coat.

The symptoms are severe deep-seated pain of the eye, extending into the forehead, with more or less fever, according to the intensity of the local affection; the iris changes its colour, usually acquiring a dull brick-red hue in part of its extent; the pupil is generally small, fixed, and irregular; the aqueous humour appears turbid; and there is a distinct red zone formed by the enlarged vessels of the sclerotic, at the distance of about a line from its connexion with the cornea. The consequences of this inflammation, are effusion of lymph on either surface of the iris, which, becoming

organised, may cause permanent obliteration of the pupil and adhesion of the iris to the capsule of the lens, or to the cornea. The lymph sometimes exudes in the form of distinct drops, which, when descending to the lower part of the anterior chamber, constitute what is called Hypopion.

In the treatment of iritis, the ordinary means of depletion, &c., are found to be insufficient for arresting the morbid process. The pain and fever may be thus diminished, but they are not removed; and the effusion of lymph proceeds as if no attempt had been made to control the disease. The grand remedy for it is mercury, given so as to affect the system; and if this be done early, while the usual measures for subduing inflammatory action are at the same time employed, and there is no local irritation present, there is almost a certainty of affording speedy and effectual relief. It is well ascertained that the constitutional action of mercury is the most powerful obstacle to the effusion taking place, and exerts the strongest influence in promoting the absorption of lymph which has been thrown out.* In the first instance, blood should be abstracted generally and locally, according to the violence of the symptoms; the bowels should be freely evacuated, and then two or three grains of calomel, with a quarter of a grain of opium, are to be given three times a-day, until the mouth is affected, when the quantity of the medicine may be diminished so as merely to keep up a moderate degree of ptyalism. In the second stage of the disease, much benefit is often derived from rubbing the forehead and neighbourhood of the eye with a mixture of equal parts of mercurial ointment, opium, and the extract of belladonna. The disease sometimes occurs from the commencement in a chronic form, in which case, leeching and counter-irritation, by blistering on the back of the neck, ought to be conjoined with the mercury.

The permanent effects of iritis improperly treated or neglected, which consist in obliteration of the pupil, sometimes admit of remedy by an operation. The object of it is to make a new aperture in the iris sufficient for allowing the light required in vision to enter; and various methods have been contrived for its performance. The most important of these are—1. Making a simple incision in the closed iris by means of a needle with cutting edges, or a small knife introduced through the sclerotic at the distance of somewhat more than a line from the cornea, and carried forwards through the membrane so as to effect its division to the extent

* Dr Farre and Mr Travers, Cooper and Travers, Surg. Essays, Part I. p. 97.

required (Cheselden, Sir W. Adams); 2. Tearing away the iris from its ciliary attachment sufficiently for establishing an adequate opening, by means of a curved needle introduced through the sclerotic or cornea (Scarpa); 3. Dividing the iris from its centre to the circumference in the direction of two radii meeting together at an angle of 45°, so as to form a triangular flap, the apex of which corresponds to the pupil, and its base to the ciliary attachment of the iris,—a process that may be effected more easily than might be expected, by puncturing the cornea, and introducing the blades of very small curved scissors,—one of which is sharp to penetrate the iris, and the other blunt to prevent injury of the cornea (Maunoir); 4. Cutting out a piece of the iris, which is done by puncturing the cornea and allowing the iris to protrude, or, if necessary, pulling it out with forceps, and then removing the portion thus presented by means of scissors curved on the side (Gibson). These methods have been variously modified and combined, and have led to the contrivance of an endless variety of instruments, the particular description of which will be found in the works devoted to ophthalmic surgery. The one last mentioned is easily performed; is not attended with much risk of the new aperture closing, and is little injurious to the other structures of the eye. The opening of the iris must be made opposite a clear part of the cornea, and the incision of the latter part should not, if possible, be directly over the new pupil, lest the opacity of its cicatrix should throw another obstacle in the way of vision.

Protrusion of the Iris.

When an opening is formed in the cornea, either by mechanical violence or ulceration, the Iris is apt to protrude through it in the form of a round dark-coloured tumour of variable size, which is extremely sensitive to external impressions, and consequently causes great irritation. If the protruded part be cut away, it is replaced by another portion; it should therefore be removed by caustic, which may be applied every other day. The nitrate of silver answers best for this purpose; and, by taking off the sensibility of the protruded surface, relieves the patient from pain before the tumour is destroyed.

Dropsy of the Choroid Coat.

The Choroid membrane is liable to distension from the accumulation of a dark-coloured fluid, which sometimes contains scales of

cholesterine. The sclerotic and conjunctiva are protruded, and becoming thin in consequence of the pressure from within, allow the colour of the fluid to appear through them. The use of the eye is sometimes retained, but frequently lost. If the swelling is small, it need not be interfered with,—if large, it may be remedied by repeated punctures.

Inflammation of the Retina.

In some cases of inflammation of the eye, the Retina seems to be principally, if not solely, affected. The patient complains of intense deep-seated pain, accompanied with the false perception of sparks or flashes of fire, while the power of vision is greatly impaired, or altogether suspended. In some cases this defect proves permanent, but in others it disappears, together with the inflammatory symptoms. The most efficient treatment consists in copious depletion, both general and local, with active measures for promoting the intestinal secretions.

Cataract.

The lens and its capsule are liable, together or separately, to opacity, which more or less impedes vision, and constitutes the disease named Cataract. The substance of the lens, when thus affected, is sometimes firmer than usual, at other times softer, or even fluid, according to which varieties cataract is divided into hard, soft, and milky. Opacity of the capsule is seated in the anterior layer; when it exists alone, there is usually no lens, in consequence either of congenital defect, or removal by operation. Lenticular cataract, when solid, is generally of most firm consistence at the centre. Its colour is very various, from dark-brown to white when examined through the cornea, but does not exhibit so much difference when removed from the eye, being for the most part grayish-yellow in the firm kind, and bluish-white in the soft or milky cataract. The last mentioned appears larger, and as if occupying the posterior chamber more fully than usual. Capsular cataract has a grayish mottled appearance, and seems as if flattened.

The causes of cataract are involved in great obscurity. It is sometimes congenital, and then consists either in opacity of the anterior part of the capsule, with atrophy of the lens, or in a soft curdy state of the latter. It frequently occurs at an advanced period of life, after the age of fifty, particularly in persons having light-coloured eyes, where it is generally of dense structure.

External violence, as that of a smart blow on the eye, or the penetration of a sharp-pointed instrument into the lens, frequently induces almost immediately the formation of cataract, which in such cases is usually of a white colour and soft consistence. It appears that the substance of a lenticular cataract suffers no change in its firmness during the continuance of the opacity, and that it is either hard or soft from the commencement of the disease.

The symptoms of cataract are,—1. A brown, yellow, gray, or white colour of the pupil, instead of its usual blackness; 2. Defective vision, from mere dimness to complete blindness, except that the power remains of discerning the outlines of objects held between the eye and the light; 3. Mobility of the iris, and the absence of symptoms denoting affection of the nervous system.

As the opacity usually takes place slowly and gradually, the indications of it are at first very slight, and increase almost imperceptibly until it is completed. During the progress of the disease the patient sees best in an obscure light, as the pupil then dilates most, and exposes the lens towards its circumference, where the opacity is less, partly from its thinness at this part, and also from the morbid change beginning at the centre. Belladonna or other applications that dilate the pupil, improve the power of vision, on the same principle, so long as they continue in operation.

A great variety of means have been tried for arresting the progress of cataract, and inducing removal of the opacity by absorption, so as to restore the lens to its natural state. None of these have had the desired effect; and it is now admitted, that the only mode of relieving the patient is to remove the opaque body from the situation in which it impedes the entrance of light. The operations performed with this view may be divided into three kinds:—1. Those which merely alter the position of the lens, so as to prevent it from obstructing vision; 2. Those which extract the lens altogether from the eye; and, 3. Those which disintegrate the structure of the lens, and expose it to a process, whether of solution or absorption, is not well ascertained, but which gradually diminishes its fragments, and finally removes all trace of them.

The first of these methods, or Couching, as it is called, may be effected either by depression or reclination. In the former of these the lens is made to descend into the lower part of the eyeball, still preserving its original situation in regard to the parietes of the cavity. In the latter its upper edge is turned backwards, so that the

anterior surface is directed upwards and the posterior one downwards. Various instruments, named couching-needles, have been contrived for performing depression; but the most convenient is the one distinguished as Scarpa's. It is an inch and a quarter long, and slightly curved towards the point, which is sharp. The pupil should be dilated, by the extract of belladonna rubbed over the forehead, or dropped in watery solution into the eye. The patient should be seated, or reclining in a posture perfectly horizontal. The upper eyelid must be elevated by an assistant, who, pressing on its edge with the points of his fore and middle fingers, or a levator, if the patient is a child, raises without everting it. The surgeon depresses the lower eyelid with his fore or middle finger, according to the eye operated on, and places the other at the internal angle, so as to press on the white part of the ball, which powerfully counteracts the tendency it has to roll. He then enters the point of the needle, the convex side of which is turned forwards about a line and a-half distant from the cornea, a little below the transverse diameter of the eye, pushing it suddenly through the coats. Pressing the handle towards the temple, he directs the instrument forwards and inwards, between the dilated iris and edge of the lens; moves it freely in the anterior chamber, so as to satisfy himself that it has penetrated the capsule; next places it across, so as to make its concavity correspond with a line a little above the transverse diameter of the lens, into the substance of which he fixes its point; and then, by a steady decided sweep of the hand, depresses the opaque body into the lower part of the eyeball, so as to leave the pupil clear and black. He now disengages the needle from the lens by a slight rotatory motion, and, waiting a second or two to see that all is right, withdraws it. If the lens rise after being depressed, before the needle is removed, it must be again carried down, and, if it rise subsequently, the operation must be repeated, with an interval sufficiently long to prevent undue irritation. After the operation a piece of lint wet with cold water should be applied, so as to cover the eye,—the patient should be confined for three or four days to a dark room and to the antiphlogistic regimen,—and the signs of inflammation should be carefully watched for, so that no time may be lost in using active depletion, and the other means that may be required.

The bad consequences of the operation are acute inflammation, caused by the derangement of structure which it occasions, and a chronic form of inflammatory action, which is not only extremely

distressing to the patient, but apt to terminate in blindness, by rendering the retina unable to perform its functions, or leading to effusion of lymph in the interior of the eye. The two last of these effects are usually ascribed to continued irritation proceeding from the displaced lens pressing on the ciliary processes and retina. The treatment that has been explained, in reference to acute and chronic inflammation, must be employed according to the circumstances of the case.

Reclination is performed in all respects as depression, except that the needle, after being applied to the anterior surface of the lens, is moved directly backwards instead of downwards. The advantage contended for in favour of this modification of couching, is the smaller risk of inducing chronic inflammation by the pressure of the dislocated lens, which, however, is more apt to rise again than when depressed.

Extraction of the cataract is an operation which was not practised previous to the last century. It is effected by making an adequate opening in the cornea, puncturing the capsule, and thus allowing the lens to escape. The advantages of this proceeding are—1. That the lens does not remain to excite irritation; and, 2. That no part of the eye is necessarily injured except the cornea, which is not an irritable texture. The objections to it are—1. The risk of wounding the iris, and of allowing the vitreous humour to escape along with the lens; 2. The difficulty of the operation; and, 3. The danger of the wound of the cornea not uniting by the first intention, and suppurating, in which case, collapse, with opacity of the eye, are the necessary consequences.

The instruments required for the operation are a knife for cutting the cornea, and a small hook for rupturing the capsule. Richter's and Beer's knives are the best for the purpose. They should increase from the point backwards in thickness as well as breadth, so as to prevent the aqueous humour from escaping until the incision is completed, or at all events carried so far that the cornea is transfixed, since the danger of injuring the iris is not so great after this has been done. The hook should be exceedingly small and rectangular, or instead of it, a curved needle may be employed. The pupil ought not to be dilated, lest the vitreous humour escape. The patient should be seated or reclining, with his other eye covered. The upper eyelid is to be carefully raised, without making any pressure on the ball; and the operator then depresses the lower one, at the same time fixing the eye with his fore and middle

fingers, as in couching. The point of the knife is entered about the distance of a line from the margin of the cornea, a little above its transverse diameter on the temporal side, and pushed steadily through until it issues at the opposite corresponding part. If the iris comes in the way of the blade, gentle pressure is made upon the cornea; and when the membrane has thus been induced to withdraw itself, the incision of the cornea is completed downwards, at an equal distance throughout from the margin. The eyelids are then allowed to close, in order to dilate the pupil. The hook is cautiously introduced under the flap, and directed into the capsule, which should be freely ruptured. The eyelids are again closed, and when they are opened a few seconds afterwards, the lens may probably be found lying in the wound, or exterior to it. If it does not soon appear, very gentle pressure may be made on the ball, with the intervention of the upper eyelid. But if any doubts are entertained as to the capsule being ruptured, or the aperture of the cornea being sufficiently large, it is much safer to remedy these defects of the operation by re-introducing the hook in the former case, and a knife or scissors in the latter, than to endeavour to compensate for them by forcibly compressing the eyeball. The after-treatment consists in confining the patient for several days to a dark room, enforcing the strictest antiphlogistic regimen, and employing, without loss of time, the most active means of subduing inflammation, if signs of it should appear.

The operation of breaking up the texture of the lens may be performed either through the cornea (Keratonyxis), or through the sclerotic (Scleroticonyxis). In the former way, a small straight needle is the best instrument, and in the latter, if the cataract is soft or fluid, the curved one used for couching, but if it is firm, the edge should be straight and sharp. The pupil ought always to be fully dilated, and the eye, as well as the patient, prepared for the operation in the manner already explained in regard to couching. The needle should be introduced at the distance of a line from the sclerotic or cornea, according as it is wished to operate anteriorly or posteriorly. It should be directed to the centre of the cataract, and made to lacerate its texture as extensively as possible. It has been found that the fragments disappear sooner in the anterior than in the posterior chambers, and therefore they ought to be urged forwards into it. The process of amendment goes on a long while, extending to weeks and months after this operation, but one or more repetitions of it are frequently required before the cure is

completed. As the irritation produced is generally very inconsiderable, this is of little consequence. If a large fragment of the lens, or the whole of it, escapes into the anterior chamber, though solution may take place, there is great risk of such severe or continued irritation as may require its extraction through an opening cut into the cornea.

In relation to the choice of these different methods of operating, it may be observed—1. That extraction and couching are confined to cases in which the cataract is of firm consistence; 2. That breaking up, though it has been applied to hard cataracts, is most advantageous in those that are soft or fluid; 3. That extraction is ill suited to cases in which the cornea is small or flat, or very prominent—the eye has a tendency to roll, and the patient is unsteady, as in infants or children—or the cornea is very tough, and little disposed to unite by the first intention, as in old people; 4. That keratonyxis, as being the easiest mode, is best calculated for infants and children; and, 5. That the best procedure for general practice is, to introduce a curved needle through the sclerotic, depress the lens, if it is found to be firm, and break it up if the consistence proves too soft for this.

Malignant Diseases of the Eyeball.

Cancer rarely originates in the eye, though it occasionally extends to it from the neighbouring parts. But medullary sarcoma occurs in it more frequently than in any other part of the body, except the bones, mamma, and testicle. Children are chiefly subject to its attack, but adults occasionally suffer from it. The retina is generally the part first affected, but in the progress of the disease all the textures entering into the formation of the eyeball become involved. The first symptoms are blindness, and a greenish or dusky-red colour of the pupil. Then the eye protrudes, sometimes remaining entire, at other times ulcerating, and allowing a fungus to issue. The patient becomes weak and emaciated, loses appetite, and acquires the greenish-yellow complexion characteristic of malignant action. The disease varies in the time required for its course from months to years, being usually most rapid in young, and slow in adult persons, but always terminates fatally.

The only remedy that affords any chance of relief, is excision of the eye before the morbid process has advanced so far as to render the removal of the whole tumour impracticable, and even then the prospect of a permanent cure is extremely unfavourable, since

there is hardly any well-authenticated case of its being accomplished. Various methods have been contrived for performing the operation, but the best one seems to be, after dividing the commissure of the eyelids at the outer angle, in order to gain more room, to dissect out the tumour with a common scalpel, guiding it with the fore-finger of the left hand, which being interposed between the morbid surface and the edge of the instrument, insures the complete excision of the diseased mass. The orbit should be filled, but not stuffed, with lint; and, if the blood continues to flow, cloths wet with cold water may be applied over the face. When suppuration commences, the lint ought to be withdrawn, and replaced by a little simple dressing. The cavity granulates and contracts, but the cure is tedious, and too frequently, before cicatrization is far advanced, the morbid growth reappears.

Tumours of the Orbit.

Medullary or cartilaginous growths from the bones, polypous excrescences from the nose, and tumours of independent origin, are occasionally met with encroaching on the cavity of the orbit, and causing a correspondent protrusion of the eye. Vision is generally impaired or destroyed by the stretching of the optic nerve thus occasioned, but is regained when the eye returns to its place, unless the organ has participated in the morbid action. Before resolving on the removal of an orbital tumour, it is necessary that its nature and connexions should be carefully investigated, in order that an attempt at excision may not be made unless the morbid part can be completely extirpated. Fatty, fibrous, and encysted tumours, must be completely dissected out. Polypous excrescences ought to be treated according to the principles that will be explained in relation to the nose; and growths from the bone should not be interfered with unless they proceed from the malar or superior maxillary portion of the orbit, so that the root is within reach.

Eyelids.

The eyelids are subject to a chronic inflammation named *Ophthalmia Tarsi*, which chiefly affects their external edge at the roots of the cilia. The tarsal margin is swelled, red, and the seat of disagreeable itching. The eye-lashes are small, or altogether absent. The eye is weak and watery. Children, especially those of scrofulous constitution, are most liable to this complaint, which generally proves extremely obstinate, in recurring again and again

during the period of childhood up to puberty, though relieved for a time by the remedies that are employed to remove it. Stimulating ointments, such as those containing the red oxide of mercury, or the nitrate of mercury, are the best local applications, and should be rubbed along the margin of the inflamed eyelids at bedtime. Great attention ought to be bestowed on the maintenance, or restoration, of the various secretions, particularly those of the skin and intestinal canal, and counter-irritation, by blistering the back of the neck, or introducing a seton into it, is often very serviceable.

The upper eyelid, and also, though much more rarely, the lower one, is liable to inversion of the margin, which is named Entropium. This occurrence is usually in the first instance caused by the swelling attendant upon *ophthalmia tarsi*, and afterwards tends to its own increase, as well as obstinacy, by the irritation which proceeds from the friction of the eyelashes upon the eyeball, and also from the tarsal cartilage acquiring a correspondent curvature, which opposes the return of the eyelid into its proper position. Tumours of the eyelid, and sometimes mere relaxation of it, lead to the disease. It occasions constant uneasiness, and in consequence of this, chronic inflammation of the conjunctiva, nebula, arborescent red vessels, and ultimately complete opacity of the cornea, are sooner or later produced.

The treatment is conducted with the view either of palliating or radically removing the disease. The former of these objects may be attained by pulling out the cilia from time to time, or applying straps of plaster, so as to maintain the eyelid in its proper place. As such means are very troublesome and ineffective, much attention has been bestowed on the radical cure, and various modes of procedure devised for its completion. The principle on which these are founded is, to counteract the tendency to turn inwards, by removing a portion of the integuments of the eyelid, so as to tighten or tuck up its external edge. This may be done either by cutting, or applying escharotics; but the former method is unquestionably preferable, since the latter, though recommended by some respectable authorities, is infinitely more painful, tedious, uncertain, and inefficient. The redundant skin is cut away with scissors much more conveniently than with a knife. The requisite portion should be embraced between the blades of a pair of dressing forceps, and removed at one stroke. It should in general

extend from within a line of the edge of the eyelid, or roots of the cilia, to the same distance from the lowest hairs of the eye-brow, and reach the whole length of the eyelid, so that the form of the raw surface may appear nearly round when the eye is closed. Scissors of the usual form are quite sufficient for the purpose, but they prove more convenient when curved on the side. The cut edges must be brought into accurate contact by stitches of the interrupted suture, or small pins introduced at the distance of a quarter of an inch from each other. The wound heals by the first intention, and leaves hardly any vestige of its existence. In very aggravated cases it has been found necessary to divide the eyelids at their external commissure, in order to obtain sufficient relaxation for effecting the requisite eversion.

By Trichiasis is understood a morbid state, which produces nearly the same symptoms as entropium, but depends upon somewhat different circumstances. It seems to consist in an improper direction of the eyelashes, which, instead of defending the eye, turn inwards upon it, so as to cause constant irritation. Attempts have been made to remedy this, by pulling out the cilia, cauterising their roots, and cutting away their secreting bulbs, or even the whole edge of the eyelid; but all these means are very ineffectual, and, at the best, afford only a temporary relief. The only method of curing the disease is to treat it like entropium; and, by effecting a very decided eversion of the ciliary margin, prevent the eyelashes, though still possessing their improper direction, from touching the surface of the ball.

Ectropium is an opposite condition, chiefly affecting the lower eyelid. In this case the edge is turned outwards, exposing the lining membrane to external irritation, presenting an unseemly appearance, and allowing the tears to run over the cheeks. The causes of this eversion are thickening, or excrescence of the inner surface, relaxation of the orbicular muscle, and the contraction occasioned by the healing of sores in the integuments. The treatment must of course be varied according to these different circumstances. If the disease depends merely upon a thickened state of the mucous lining of the eyelid, touching it occasionally with nitrate of silver, or concentrated sulphuric acid, or shaving away a portion at once with curved scissors, are the means usually employed. If the eyelid is preternaturally relaxed, a V shaped piece may be cut out of it, and the edges then united together by one or two pins; and if the edge is drawn outwards by a cicatrix of the

integuments, the contraction should, if possible, be cut out, so that the lips of the wound may be united together directly.

Encanthis is a tumour which sometimes presents itself at the inner angle of the eyelids. It has a fleshy consistence, and tubercular surface. The colour is generally pale red, but sometimes very dark, and almost black. It grows from the *caruncula lacrymalis*, and by its pressure not only causes a disagreeable deformity, but impedes vision, and also the motion of the eyelids. The remedy consists in excision, which may be performed either with a knife or scissors, care being taken to stretch the attachments of the tumour, by pulling it out with a hook or forceps, so as to prevent any chance of cutting the lacrymal ducts, which lead from the puncta to the sac.

Encysted tumours are often met with in the eyelids, particularly the upper one. They are sometimes seated immediately under the skin, and may be removed by dividing it to the requisite extent, and then dissecting out the cyst. Much more frequently they lie deeper, and adhere to the mucous lining of the eyelid, which is discovered by their immobility, and the appearance presented by the inner surface of the eyelid when it is brought into view by being everted. The part with which the tumour is connected has a yellowish colour, streaked with red, from the arborescence of vessels over it, and seems flatter than the neighbouring surface. In this case the extirpation could not be accomplished by cutting externally without making a breach through the eyelid, and the proper method is, to remove an elliptical portion of the sac from within, squeeze out its contents, and then apply the nitrate of silver so as to hasten healthy granulation of the cavity. The best way of doing this is to evert the eyelid, transfix the sac with a hook, and then cut out a portion of it with a sharp-pointed knife.

Cancerous ulceration sometimes affects the eyelids; and, as excision of course affords the only effectual mode of remedy, it is important to determine how far these coverings of the eye may be removed without incurring the necessity of removing the eye itself. It appears that the whole of the lower lid may be taken away without almost any inconvenience, and that a large part of the upper one may also be extirpated without depriving the eye of its necessary protection from external irritation. But if the whole of the upper eyelid required removal, it would be necessary to take away the eye along with it, as the patient could not otherwise avoid suf-

fering extreme distress from the exposure of the organ until it acquired a cuticular covering, which, while it afforded protection against irritation, would effectually destroy the power of vision. It will seldom be necessary, however, to cut out a sound eye on this account, as when the cancer is so extensive as to require removal of the whole or greater part of the upper lid, it almost always extends to the conjunctival covering of the ball.

Obstruction, Abscess, and Fistula of the Lacrymal passage.

The duct which discharges the tears into the nose is apt to become obstructed at its inferior orifice, so as to impede or altogether prevent the fluid from descending. This usually occurs in persons who have been previously suffering from chronic inflammation of the conjunctiva or *ophthalmia tarsi*, and it has consequently been ascribed to the accumulation of thick mucous matters resulting from the morbid secretion thus produced. It seems more reasonable to suppose, that, by an extension of diseased action, the lining membrane of the nasal duct swells so as to contract or close the canal. The distinctive symptom of obstruction is distension of the lacrymal sac, forming a flattened round tumour at the inner angle of the eye, lying under the tarsal ligament, and hence often appearing as if bilobated. It is immoveable, and when subjected to pressure usually diminishes or disappears, the contents being forced either downwards through the duct, which remains pervious though contracted, or upwards through the *puncta lacrymalia*. When the secretion of the tears is excited by mental emotion, or external irritation, such as that caused by a cold wind blowing on the eye, they run over the cheeks more copiously than in ordinary circumstances, and the patient frequently complains of a disagreeable feeling of dryness in the nostril.

The treatment of Epiphora, as this morbid condition of the lacrymal passage has been named, is conducted on different principles, according to the view that is entertained of its origin and cause. There can be no doubt that a diseased state of the eyelids, whether regarded as leading directly or indirectly to the obstruction, ought to be remedied, if possible, without delay. It is then customary to inject fluids into the puncta, and introduce small gold or silver probes through them in order to clear the passage; but such means are found to be very ineffectual. The probe should be round, and very smooth at its extremity, to prevent its being caught in the lining of the canal, and slightly curved to suit the direction

of it. Either the upper or lower punctum may be selected; but unless they happen to be unusually expanded, it will be proper, before attempting the introduction of the probe, to dilate the orifice by means of a common pin, the conical point of which, when rotated, answers very conveniently for the purpose. The probe should first be passed directly inwards, and either upwards or downwards, accordingly as the lower or upper opening is chosen, until it fairly enters the sac. The direction must then be altered, so as to be parallel with the mesial plane, the convexity of the instrument resting on the eyebrow, and the extremity pointing downwards and backwards. By gently, but steadily, urging the instrument, alternately pushing or withdrawing a little, it is at length introduced into the nose. By repeating this operation, and using probes of larger size in succession, some relief may be afforded, but hardly any complete or permanent benefit. The introduction of probes from the nose into the duct, though very easy in the dead body, is hardly practicable in the living, especially when the entrance to the passage is obstructed. Injections thrown in through the puncta, by means of Anel's syringe, are of so little avail that they need not be particularly considered.

If the disease prove so obstinate and troublesome as to make the patient willing to suffer the pain and inconvenience attending the following operation, it ought to be performed. The object is to remove the obstruction, and prevent its reproduction. With this view an incision is made into the lacrymal sac, by pushing a sharp-pointed knife into it, immediately below the ligament that extends from the inner commissure of the eyelids to the nasal process of the maxillary bone. After the point has been fairly introduced into the sac, by pushing it backwards and inwards, the handle must be raised so as to alter the direction of the blade, and push it downwards into the duct. A thick probe should then be passed through the opening, down the duct into the nose. The obstruction having thus been removed, a piece of bougie, or a small metallic instrument named a style, is introduced. The style may be made of silver, lead, or any other metal not readily oxidised; it is suited to the form of the passage, and has a broad head to prevent it from descending too far. It should be taken out daily, washed, and replaced. So long as it is worn, the patient is relieved from the inconvenience he formerly suffered, but when it is withdrawn, the passage is apt to close again. Trials may be made from time to time, at the interval of six or eight weeks, to ascertain whether

or no the foreign body can be dispensed with. Some practitioners, to supersede the necessity of this tedious and imperfect process, immediately after removing the obstruction, introduce a small silver tube, which is allowed to remain permanently, so as to insure the canal against closure in future. The objection to this practice is the risk of exciting irritation, which appears so serious as to deter most surgeons in this country from employing it; but the statements of some continental practitioners would make it appear that this apprehension has been allowed to exercise an undue influence.

When the obstruction is permitted to continue, it sooner or later occasions suppuration of the sac, and the abscess thus formed being opened naturally or artificially, allows the tears to issue on the cheek, in which case there is produced what may be more strictly named a *Fistula Lacrymalis.* The neighbouring integuments become thick and red; the eye is weakened; and the patient suffers so much from the deformity and inconvenience resulting from the disease, that he readily submits to the operation required for his relief. This does not differ from the one that has been described for epiphora. It was formerly the custom to apply the actual cautery, through a cannula introduced into the entrance of the duct, in order to destroy the diseased parts which were thought to oppose recovery; but this practice is now obsolete.

CHAPTER XXIII.

MOUTH.

Salivary Glands.

THE ducts both of the parotid and submaxillary glands are liable to become the seat of calcareous concretions, which are named Salivary Calculi. Their composition is phosphate of lime, agglutinated by a small quantity of animal matter. They have usually a yellowish-white colour, oval figure, and finely tuberculated surface. They vary in size from that of a millet-seed to that of an almond with the shell. In the parotid duct they are very rarely met with, but in the submaxillary one not unfrequently. They occasion pain, swelling, and hardness, and sometimes give rise to the formation of an abscess. In the parotid duct, the symptoms thus produced are apt to be confounded with those of rheumatism, toothache, gum-boil, or suppuration of the maxillary antrum; while under the tongue they may be occasionally mistaken for those of encysted tumours. In all cases of doubt, it is right to search the duct with a probe, and to feel for the calculus, by pressing on the place where it is suspected to be. So soon as a free incision is made, the concretion escapes, together with the fluid accumulated about it. The usual situation of these concretions is immediately within the orifice of the ducts; but they have also been found imbedded in the substance of the submaxillary gland, where they excited an increased and unhealthy secretion, with general swelling and hardness of the gland. In such cases the calculus, if distinctly recognised, may be extracted by cutting down upon it, from the mouth, which I have had occasion to do.

When the Parotid duct is included in a wound of the cheek, unless the edges of the integuments be very closely approximated, a salivary fistula is apt to remain at the part. In case it should take place, the patient will labour under the double annoyance of dryness of the mouth during mastication, and a discharge of fluid

on such occasions from the preternatural orifice. The use of soft or fluid food, and pressure applied to the gland, afford some palliation of these complaints; but the radical cure of them requires the re-establishment of a passage into the mouth, and obliteration of the external aperture. Both of these objects may be readily obtained by introducing a small seton through the cheek, from the fistula, into the mouth, withdrawing it after the lapse of a few days; and then, having rendered the edges of the external opening raw by paring them with a knife, uniting them together by means of the twisted suture. Until the cure is completed, the patient should subsist on fluid articles of nourishment, and abstain from moving the jaws by speaking, or any other exercise of them.

The neighbourhood of the parotid gland is frequently affected with diffused inflammation and suppuration of the cellular substance, which, owing to the presence of a thin but dense fascia lying over this part of the face, does not form a prominent tumour, and spreads extensively instead of pointing. The patient in consequence suffers great and protracted distress, until an incision is made to let the matter escape.

Morbid growths also often occur here, and by causing absorption of the parotid in proportion to their own enlargement, at length sometimes completely take the place of the gland. These tumours are generally of the fibrous kind, frequently containing cysts in their substance, and tending at length to assume the medullary sarcomatous action. Blistering and iodine ointment occasionally check the increase, or even excite the removal by absorption of enlargements in this situation; but when they prove obstinate, the only remedy for them is the knife. If the morbid mass is deeply seated, it is necessary, in effecting its removal, to avoid cutting the common trunk of the temporal and internal maxillary arteries, and also the *portio dura*, or facial nerve, the consequence of which is an unseemly and distressing paralysis of the face. A very free incision of the integuments should be made to facilitate the subsequent dissection. After the whole of the external surface of the tumour has been exposed, its anterior edge should be turned back by degrees, as the subjacent connexions are divided, which ought to be done by cutting upon the tumour so as to divide the connecting cellular substance, without endangering the neighbouring parts by carrying the knife parallel to the surface of the tumour. The arteries that require ligatures are to be tied, and as a troublesome oozing of blood is apt to take place from the glandular sub-

stance of the parotid, a piece of lint or sponge should be placed over the wound.

Tumours are occasionally met with under the tongue varying in size, and producing accordingly more or less inconvenience. Of these the most common is named Ranula. It consists of a sac containing fluid, which is usually thick and glairy like the white of eggs, but sometimes is watery, or of a pultaceous consistence, like that of porridge or boiled rice. Hardly any limits can be assigned to the extent of such formations, if allowed to increase without interference. The tongue is impeded in its movements—articulation and deglutition are rendered very difficult—the cavity of the mouth is completely occupied by the tumour—and it also appears under the chin. The swelling is generally attributed to distension of the submaxillary duct, owing to obstruction of its orifice, but really depends on the presence of an encysted tumour. The treatment it requires is excision of an oval piece of the cyst, together with the superjacent mucous membrane, which may be easily effected by means of a hook and knife or pair of curved scissors. The cavity suppurates and granulates, and if the lining membrane is very thick, or slow in taking on a proper action, it may be touched with caustic. In some cases I have succeeded in removing the whole of the cyst, so as to prevent any delay in healing from its presence.

Fatty tumours occasionally grow in the situation of ranula, and present characters so similar as to be distinguished from it with difficulty by external examination. The best way of deciding the question is to make an incision, which, in the event of the swelling proving solid, may be extended sufficiently for its removal.

The Lips afford subject of surgical treatment chiefly on account of congenital malformations, and cancerous ulceration. The former of these are usually comprehended under the title of Hare-Lip. They consist in fissures of the upper lip, varying in extent and number, and either simple, or more or less complicated with malformation of the jaw and palate. The simplest form in which they are presented is that of a single fissure, extending from the edge of the lip to its connexion with the gum, and seated a little to one side of the mesial plane. In double hare-lip, there are two such fissures, with an intermediate portion of lip, which varies in size. The imperfections of the palate consist in a longitudinal split or division, which is either confined to the soft part, or extends throughout the whole partition between the nose and mouth. This Split

Palate may exist independently of hare-lip, but rarely does so. The malformation to which the jaw is liable consists in a projection of the central part that holds the cutting teeth, forming a tumour from which the teeth grow out at an angle to their ordinary direction. In most cases of this kind the projection comprehends an equal portion of both superior maxillary bones, the portion, namely, which in the lower animals is occupied by two distinct bones, the *ossa incisiva* or *intermaxillaria*. It forms a round knob, connected by a narrow neck to the septum of the nose, covered with a firm substance, similar to the gum, and having at its anterior part a similar shaped, but smaller sized, appendage, consisting of the tissue that should have constituted the lip. The fissures on each side of this knob meet together behind it, and are then continued through the palate backwards. Instead of this conformation there is sometimes merely an overlapping of one edge of the split gum over the other, and the degree to which the projection thus formed takes place is extremely various.

The impediments to deglutition and articulation, and the deformity which result from these imperfections, render their complete and early reparation very desirable; but several circumstances in respect to the age of the patient must be taken into consideration before any operation for this purpose is attempted. Infants before the sixth month, especially if weak or irritable, are apt to die from convulsions or exhaustion occasioned by the pain, hemorrhage, and struggling which attend it; and, besides this danger, there is another of less magnitude, which is the risk of union between the edges of the lip not taking place or being destroyed, in consequence of overaction resulting from the excitability of the patient. Between the sixth and twelfth months, another source of irritation occurs from the process of dentition; and for some time after this, though there may be little or no chance of a fatal issue, failure in effecting the object of the operation is still to be feared from the irritability of the parts. The surgeon, therefore, if he has his choice, should not operate before the child is two or three years old, and in no case ought he to do so before the fifth month, or during the process of dentition, until all the incisors at least have appeared. So long as the child is at the breast the operation, of course, cannot be performed; and it must consequently be weaned, if an early attempt at reparation should be determined on. When the jaw is preternaturally projecting, the prominent portion must be either reduced to a proper level by continued pressure, or removed by the

knife. If of small extent it may be treated in the former way, but if at all considerable it requires the latter; and it is evidently proper to execute this preliminary part of the process as soon as possible, in order to render the condition of the lip more favourable for union when the time for attempting it arrives.

The operation must be varied in some respects according to circumstances, but always essentially consists in joining the edges of the lip after making them raw by paring the respective surfaces. This may be done by means of scissors, or by embracing the lip between the blades of forceps and shaving off the portion of the edge that is allowed to project beyond them, or lastly, by seizing the edge of the lip by catch-forceps while it is held between the finger and thumb of an assistant, transfixing it with a knife a little above the angle where the two edges meet, and then removing a slice of the requisite extent or thickness. This last mentioned mode is on many accounts the one that ought to be preferred, and particularly because it enables the operator to regulate the shape of the cut surfaces more accurately than any other. The margins of the fissure present a convex outline, which, if allowed to remain, would cause the edges, when joined, to form an unseemly angle in the lip at their point of meeting. The respective surfaces should therefore be made straight, or rather slightly concave, so that when brought together they may give the lip its natural fulness. He next unites the two raw surfaces by means of either the twisted or the interrupted suture. Silver pins with moveable steel points, or hare-lip pins, as they were called, used to be employed for this purpose, but needles of soft steel are on many accounts much more convenient. Two are required in general, and at most three. One ought to be inserted close to the margin of the prolabium, or where the coloured part of the lip begins, and so deeply as to leave little more than the mucous membrane not included. Another, or two more if necessary, being introduced in a similar way, a silk thread is wound round each needle separately, so as to draw the edges into close contact. The points of the needles are easily cut off, and no dressing is required for the wound. I generally employ one needle at the margin of the lip, and two stitches of the interrupted suture. The needles may be taken out on the fourth day after the operation, but the cheeks should be supported for a week or even longer by a strap of adhesive plaster placed across the face.

In cases where there are two fissures, the intermediate portion would not reach the margin of the lip, so that both of its edges

should be made raw at the same time; three needles being then introduced, one at the margin of the lip, one near the nose, and one in the middle passing through the apex of the triangular piece.

Split palate does not admit of any remedy for the division of the hard part, except the closure of the communication between the nose and mouth by a piece of silver, enamel, or other substance so fitted as to remain in it without shifting. Fissure of the soft palate may be united in favourable cases by an operation similar to that for the hare-lip, but which is uncertain of execution, owing to the situation of the parts, their mobility, and the involuntary efforts of the patient. It would be impracticable, except in adults possessed of considerable fortitude, and in cases where the state of the parts is favourable to union, the difficulty of course increasing with the width of the breach. The edges may be made raw by means of either the scissors or the knife, the latter of which is the most convenient. As it is impossible to employ the twisted suture, stitches must be introduced, and for this purpose various instruments and modes of procedure have been contrived. The best means on the whole appears to be the simple curved surgical needle with a fixed handle. The patient for some days after the operation must abstain from food, except what is absolutely necessary, and this should be of a fluid kind. Several repetitions of the process have repeatedly been required to complete the union of the whole fissure, and therefore the failure of one attempt or more ought not to occasion discouragement. Small apertures in the soft palate resulting from ulceration may be closed by repeated applications of the cautery to their margins.

Cancer of the Lip.

Cancerous ulceration frequently occurs in the under lip, but hardly ever affects the upper one, except by extending to it from the other, which seldom happens. This difference probably depends on the greater or more frequent irritation to which the lower lip is exposed by its situation and mobility. The disease rarely commences before middle age, and is met with more frequently in males than in females. It originates in different ways, at one time being preceded by a hard warty excrescence, possessing the carcinomatous texture, and at another appearing first in the form of a superficial chap or excoriation. The cancer, once established, increases progressively, but with variable rapidity, being attended with burning

or lancinating pain, and surrounded with a remarkable induration. The aspect of the sore is extremely various, but always dissimilar to that of a sound granulating surface. All sorts of applications and modes of treatment, except removal of the diseased parts, are found quite unavailing; but in proceeding to this extreme measure, it is necessary to beware of regarding as cancerous, ulcers not possessed of malignant action, and obstinate merely on account of the peculiar circumstance of their situation. Ulcers occurring on the lip at or before middle age may often be traced to the influence of local irritation, proceeding from the motion of the part, or the asperities of the teeth; and in all cases, unless the cancerous characters should be very distinct indeed, it is right to try the effects of rest by confining the lip with a bandage, and of removing any sharp points of the teeth that may be found to project, by filing or extracting them. While this trial is made, the sore should be dressed with black-wash, or solution of the sulphate of zinc, care being taken at the same time to remedy any derangement that may be discovered to exist in the state of the general health.

If it is determined to remove the sore, there can be no hesitation in choosing excision as the best mode of doing so. Caustic of different kinds has often been used, but, besides being tedious and painful in producing its effect, it is always apt to aggravate the disease by eradicating it imperfectly, and irritating the part which is allowed to remain. The method of excision generally followed is to cut out a triangular or V shaped piece of the lip, by making an incision obliquely downwards on each side of the ulcer, so that the one may meet the other at an angle sufficiently acute for permitting the cut surfaces to be brought together and united, as in the operation for hare-lip. When the cancer is of no great extent, and the lip possesses considerable fulness, this procedure is very convenient, and renders the resulting deformity little perceptible. But when a large part of the surface of the lip is affected, there would then be removed so great a portion of the sound structure as must prevent or very much impede the union of the cut edges. In such cases, the method proposed by M. Richerand is certainly to be preferred. It consists in cutting away the morbid part alone with curved scissors, after which the skin and mucous membrane may be stitched together. Ulcers extending over almost the whole surface of the lip may in this way be completely excised, with hardly any deformity or inconvenience. On all occasions the surgeon should take care that the whole of the induration sur-

rounding the sore is removed, and he ought to abstain from operating when the glands under the chin, or in the neck, are affected.

Tongue.

The Tongue is liable to ulceration in consequence of chronic derangement of the digestive organs,—the injurious effect which is produced on the system by the excessive use of mercury,—and the influence of local irritation, such as that proceeding from sharp points of the teeth. In the first of these cases, the ulcers are generally small, round, and yellowish-coloured; they are seated chiefly on the edge and inferior surface of the organ, which usually appears somewhat swollen and marked with the shape of the teeth. Their remedy consists in an alterative course of diet and medicine, together with some astringent application, such as powdered borax or alum. The ulcers that are met with in persons whose constitutions are vitiated by mercury present a bluish colour, and are extremely irregular in shape. They affect the edge of the tongue especially, and appear in the form of chaps or superficial excoriations. The sulphate of copper used once a-day, either solid or in solution, is the best local application; and the gradual improvement that takes place in such states of the system, through time and a proper mode of living, must be trusted to as the means of affording permanent security against their continuance or recurrence. The sores which result from the irritation of the teeth occur, of course, at the part exposed to its operation. They present various appearances, according to the circumstances of the case, but are easily recognised by the existence of a tooth presenting a sharp edge in their neighbourhood. The treatment obviously requires immediate removal of the irritation, by smoothing the rough surface of the tooth, or extracting it; and advantage is also derived from touching the ulcer with nitrate of silver, or the sulphate of copper, in order to destroy its morbid sensibility.

Cancer of the tongue is occasionally met with chiefly at advanced periods of life, but also not unfrequently at an earlier period. It is attended with the usual characters of hardness and pain, and leads to similar disease of the glands of the neck. The only remedy is extirpation, and this unfortunately can seldom be effected with advantage, owing to the diffusion of the morbid tendency. When the cancer is seated on the apex or edge of the tongue,

it may be safely cut out with the knife or scissors, after being grasped and forcibly stretched by means of a hook or hooked forceps. But the result of experience forbids almost any hope of effecting permanent relief by extirpating cancer even of this part, and, of course, if possible still less when the disease is seated further back.

The Frænum of the tongue is sometimes originally formed so as to present the appearance of a narrow white band when the apex is turned backwards, and more or less impedes the motions of the organ. This imperfection is easily remedied by cutting the edge of the tight frænum, and then rupturing the remaining part of it as far as seems necessary, by pushing the tongue backwards. When children are late of beginning to articulate, whether this be owing to mental weakness, or any other cause, the relatives are apt to suppose that the frænum is confining the tongue, and it is necessary to be cautious in acceding to their wish of having it divided, as the raninal arteries might be opened by making an incision for this purpose in a natural state of the parts.

The tongue is liable to a general enlargement of both a chronic and an acute nature. The former occurs in children; and, indeed, is probably always congenital, although apt to be overlooked at an early stage. It gradually increases until the organ may be so enormously enlarged as to protrude from the mouth to the extent of several inches, with a corresponding degree of thickness and breadth, so that the teeth are displaced, and the jaw even becomes altered in shape. The treatment requires pressure together with astringents, such as the sulphate of copper, and, if necessary, after the use of these means, excision of the redundant portion. The acute form of the disease is very rare. It possesses an inflammatory character, and not only occasions great inconvenience by impeding deglutition and articulation, but has even proved fatal by causing suffocation. The most effectual remedy consists in making two or three deep longitudinal incisions into the upper surface of the distended organ. Relief is thus very speedily obtained; but if it should not be so, soon enough to protect the patient from the risk of suffocation, tracheotomy ought to be performed without delay. In cases of less urgency, leeches and fomentations applied to the throat prove sufficient.

Tonsils.

The morbid conditions to which the tonsils are chiefly subject,

are inflammation, suppuration, ulceration, and chronic enlargement.

Inflammation of the tonsils constitutes the most common kind of sore throat, *Cynanche Tonsillaris.* It is induced by exposure to cold,—is recognised by pain and swelling in the region of the glands, particularly observable during deglutition,—and is remedied by general or local bleeding, cathartics, and, after the intensity of the symptoms has been subdued, counter-irritation.

When suppuration takes place, the matter is not confined to the gland, but extends into the surrounding cellular substance, and forms a diffused tumour of the fauces, which depresses the palate, renders swallowing almost impossible, and sometimes interferes with respiration also. If the disease be allowed to follow its course, evacuation of the matter is accomplished sooner or later by the natural process; but, in order to hasten the patient's relief, and prevent the risk of suffocation that might attend the fluid escaping into the throat, while the patient is not prepared for it, as during sleep, it is often thought right to puncture the abscess. In doing this, the situation of the carotid artery must be kept in mind, as it would be exposed to injury, if the knife were directed outwards, in the line of the ear. If it is introduced a little nearer the mesial plane than the wisdom tooth, and pushed directly backwards, there will be no possibility of wounding the vessel; and it seems safer to proceed on this principle than to confide in the instrument which has been in use for this particular purpose, consisting of a lancet blade inclosed in a cannula, from which it may be protruded, more or less, by means of a screw at its other extremity.

Ulceration of the tonsils is sometimes of an acute, but much more frequently of a chronic nature. Astringent gargles, and attention to the general health, are sufficient for its remedy in ordinary circumstances; but when obstinate, it must be treated more actively, by touching the surface every day or two with a strong solution of the sulphate of copper, or some other application powerful enough to change the morbid action. Along with these local measures, an alterative course of medicine and diet is frequently required.

Chronic enlargement of the tonsils generally results from one or more attacks of inflammation in childhood, and tends to disappear after the period of puberty. In most cases both of the glands are enlarged, but one, in general, exceeds the other in size.

The swelling is firm in consistence, pale in colour, but often streaked with vessels, and unequal on its surface. There is great variety in the extent which the swelling attains, from the slightest perceptible fulness to a magnitude that leaves hardly any space between the two tumours. The symptoms are, uneasiness in the throat, huskiness of the voice, noisy respiration, which is generally performed with the mouth open, and sometimes deafness, from obstruction of the Eustachian tubes. But what usually occasions the patient greatest annoyance, is the frequency of sore throat to which the morbid state of the gland exposes him.

The ordinary treatment for sore throat affords some palliation of this disease, but the only effectual remedy of it consists in removing the tumour. Caustic, the cautery, and the ligature, though they have all been often employed for this purpose, are decidedly less eligible means than the knife. The two first are tedious and painful in their operation; and the ligature, while it is liable to these objections, is also attended with great difficulty in its application, owing to the depth of the parts concerned, and the involuntary resistance of the patient. The only ground of declining excision is the apprehension of hemorrhage; but, if the cutting instrument is kept parallel with the great vessels, there cannot be the slightest risk of this. It is not necessary to remove the whole of the tumour, since the portion that remains is soon diminished by absorption, so as to occasion no further inconvenience. Curved scissors might be supposed the most efficient instrument for this operation, but on trial are found not to be so. They can hardly be made to cut through the whole thickness of the mass at one stroke, and it is extremely difficult to make a second, owing to the struggles which are induced by the bleeding. The tumour thus partially detached, hangs down into the pharynx, where it excites irritation that causes coughing or retching, and it has even happened that death resulted from this circumstance. The easiest and safest method is to seize the tumour with hooked forceps, and having put it on the stretch, to cut away as much of it as seems necessary with a probe-pointed slightly curved bistoury.

Teeth.

The teeth generally begin to appear in the mouth between the seventh and tenth months, and present themselves in the following order:—1. The two front incissors of the lower jaw; 2. The four incissors of the upper jaw; 3. The two lateral incissors of the

lower jaw; 4. The four anterior grinders; 5. The canine; and 6. The four posterior grinders. The process of dentition, particularly that part of it in which the teeth, by pressing upon the gum, induce absorption of it, and thus form a breach to allow their protrusion, is attended with irritation, which varies in degree, and produces effects of corresponding importance, both local and general. Uneasiness of the mouth, swelling and pain of the gums, inflammation of the eyes, and eruptions of the skin, particularly that of the head, diarrhœa, convulsions, and fever, are the symptoms most frequently observed. Soothing measures, such as the warm bath and gentle opiates, ought to be employed for allaying them, and whenever they are at all severe, the gum should be freely scarified where the teeth are supposed to be pressing on it. A convex-edged instrument answers best for this purpose, and it ought to be carried fairly down to the teeth in two directions, so as to make a crucial incision.

When the teeth decay, so as to lay open the internal cavity, and expose the sensible pulp to external irritation, pain, or Toothache, as it is called, usually commences. It is not constant, and varies extremely in the degree of its severity. Various irritations besides those of a local kind induce its fits, or occasional attacks, such as cold operating on the surface of the body, derangement of the digestive organs, or anxiety of mind. Pregnancy is observed to favour their occurrence. The process of decay which leads to this complaint may often be averted, by scooping out the dark-coloured part of the tooth that surrounds the cavity, and filling the hollow with gold or silver foil, or gum mastic. Opium in substance or solution, some essential oils, as that of cloves, chloroform, and also the strong mineral acids, when introduced into the hollow, often procure temporary relief from suffering; but in general the only effectual remedy is extraction of the tooth affected. This operation is best performed by means of powerful forceps, of which the blades are short, concave, and placed obliquely in regard to the handles. Many ingenious apparatus have been contrived with the view of pulling the teeth perpendicularly from their sockets; but a little attention to the shape and direction of the fangs will render it evident that this mode, granting it to be practicable, would not be convenient. In order to dislodge the roots, it is often necessary that the alveolar processes should be broken more or less; and the best way of accomplishing this is to draw the tooth towards that side which makes the least resistance, at the

same time raising it from its bed. The forceps in the hand of one not practised in their use, are apt to detach the crown of the tooth from its fangs, and must therefore be employed with caution.

After the process of decay has proceeded so far that the roots of the tooth alone are left, the patient is relieved from toothache, but exposed to other symptoms of a troublesome kind, in consequence of the irritation caused by the stumps, as they are called. These useless remnants become loosened in their connexion with the jaw, and are apt to occasion similar effects to those which would proceed from foreign bodies in the same situation. Inflammation of the gum, leading to abscess (gum-boil or parulis), suppuration of the cheek, followed by fistulous ulcers opening externally, ulceration or purulent discharge of the nasal cavities, sore throat, and disorder of the digestive organs, are the most common of these; and their mere mention will be sufficient to shew the importance of removing the stumps of decayed teeth. This is done by means of an instrument named a punch, which should be forcibly pushed into the socket close to the stump, in a perpendicular direction, and then, by moving the handle to one side, made to loosen and elevate it.

Hemorrhage occasionally occurs to a troublesome or even alarming extent after the extraction of teeth or stumps. The best application is dry lint forcibly pressed into the cavity, which proves much more effectual than the use of caustic or the actual cautery.

Abscess of the Antrum.

The cavity of the maxillary bone is liable to become the seat of abscess in consequence of the lining membrane taking on a suppurative action. The fluid escapes partially into the nasal cavity when the head is laid in the horizontal posture, but the outlet thus afforded is not sufficiently free to allow the parts to return to their healthy state. The bone is gradually expanded, so as to elevate the cheek and depress the palate; dull aching pains are felt at uncertain times throughout the face and head; and the superjacent integuments are usually thick and red. A dependent opening into the cavity may be easily formed by pulling one of the grinders, or a stump remaining in the place of one of them, as the partition between the bottom of the alveolar hollow and the antrum is so thin as to afford no resistance which a common probe is not able to overcome. In this way, however, little advantage is obtained,

as the matter is still not evacuated with sufficient freedom, and it is usually found necessary to establish a more ample aperture by separating the cheek from the gum opposite the bicuspid teeth, and breaking down the anterior wall of the cavity, sufficiently to admit the point of a finger, which, owing to the weakness of the bone at this part, may be executed more easily than might be expected. The expanded bone slowly and gradually resumes its natural shape; and while this change is proceeding, a solution of sulphate of zinc may be injected occasionally.

Tumours of the Gums and Jaws.

Excrescences of a firm substance, irregular surface, and usually whitish colour, are not unfrequently met with proceeding from the gums. If allowed to pursue their own course, they increase in size, loosen the teeth in their neighbourhood, and at length, taking on a malignant action, prove fatal to the patient by causing hemorrhage, profuse discharge of matter, or excessive and long-continued pain. These growths, when small and within reach, ought to be freely cut away, and the actual cautery or caustic potass should then be applied, so as to destroy, if possible, any tendency to their reproduction that may remain in the part. If the tumour extends to the alveolar processes, the adjacent teeth must be extracted, and the excision will require the assistance of cutting forceps.

Both the upper and the lower jaws are liable to morbid degeneration of structure, giving rise to medullary and fibro-cartilaginous tumours. The former occurs more frequently in the upper than the lower, and generally extends to the bones of the nose and orbit; the latter is more common in the lower jaw in a still greater proportion. The medullary growth, as in other parts of the system, is attended with severe pain, an unhealthy appearance, and in its more advanced stage, profuse fetid discharge or hemorrhage. The fibro-cartilaginous production, though sometimes in the first instance the seat of uneasy sensations, usually produces no inconvenience except by its bulk, to which no limits can be set. At length occasional bleeding takes place from the surface, but this seldom happens until the tumour has existed for years, and attained a very large size. There is never any purulent or fetid matter discharged, and the substance of the mass remains as dense and entire as at the commencement of its formation. This kind of

growth is usually met with in young persons between puberty and middle age.

The only method of relieving the patient from these tumours, whether of the one kind or the other, is complete excision. This used to be attempted by cutting out with saws, forceps, and chisels the diseased mass alone, the adjacent part of the jaw being allowed to remain. Such operations, with hardly any exception, proved ineffectual in accomplishing a radical cure, as the smallest portion of bone possessing the morbid disposition, that was not eradicated, insured a return of the disease. The great improvement has been introduced into modern surgery of amputating the jaws when they become the seat of these formations, at the articulation, or at all events in a part of their extent which is perfectly free from enlargement, or any other indication of unhealthy action. The names of Gräfe of Berlin, Dupuytren of Paris, Mott of New York, Crampton and Cusack of Dublin, and Gensoul of Lyons, are most deserving of mention for adopting and establishing this operation. It has been performed with almost uniform success in cases of the fibro-cartilaginous tumour both of the upper and the lower jaw, and also on account of the medullary growth. From the nature of the bones entering into the formation of the upper jaw, complete eradication is practicable only when the disease is confined to the superior maxillary bone. Growths from the forehead and bones of the nose must be carefully distinguished from those that possess this limited origin, as no satisfactory result would attend their removal.

In performing excision of the superior maxillary bone, an incision should be made through the cheek, extending from the junction of the maxillary and malar bones to the angle of the mouth. The flap thus formed is to be dissected from the tumour, and the margin of the orbit exposed. One blade of a large pair of cutting pliers is then introduced into the nose, and the other into the orbit, so as to divide the nasal process of the maxillary bone. The connexion with the malar bone is next separated in the same way, and then the palate is divided, previously to which one of the incisor teeth must be extracted if necessary. The surgeon having now deprived the bone of all its principal attachments, wrenches it out. There is seldom much bleeding, but the patient should be seated during the operation, to prevent any risk of suffocation. No advantage is obtained by tying the carotid previously, and if it is desired to save the blood as much as possible, an incision ought to be made

through the integuments between the neck of the jaw and the mastoid process, to enable the assistant to compress the internal maxillary artery, or the common trunk of it and the temporal. The only vessels that require to be tied are the facial and posterior palatine arteries, and the latter not always. The cavity of the cheek should be moderately filled with pieces of lint, and then the edges of the wound are brought carefully together by means of the twisted or interrupted suture. The deformity which remains after the cure has been completed is very inconsiderable, and the patient is able to speak, eat, and swallow with much less imperfection than might be expected. In the event of the cure proving permanent, an artificial substitute for the palate may be adapted to the cavity.

Excision of the lower jaw is an easier and less formidable operation. The mode of performing it must be varied according to the size and situation of the tumour. It is usually either confined to one side of the bone, or engages one side more than the other. The base is the part most frequently affected, but the ramus is sometimes implicated, so as to require disarticulation. The best direction for the incisions through the cheek is first downwards from that angle of the mouth which is opposite a sound part of the jaw, then along the base as far as the tumour extends, and, if necessary, up along the posterior margin of the ramus to the condyle. The flap thus formed having been separated from the tumour, the jaw is partially cut through with a small saw, and completely divided by strong cutting pliers. The surgeon then grasping the detached portion turns it outwards, and separates its connexions with the muscles and mucous membrane of the mouth. If the symphysis is included, means must be employed to prevent suffocation from the tongue being drawn back by the muscles of deglutition, owing to the power which kept it forward having ceased to act. As it is only for a minute or two that there is any risk of this occurrence, the best mode of proceeding is to seize the tongue with a towel, and confide it to an assistant until the tendency to retraction ceases. The only arteries that require to be tied are the facial, and the transverse branches of the temporal, in the case of cutting over the ramus. The cavity of the wound should be gently filled with pieces of lint, after which stitches or needles are to be introduced so as to retain the cut edges in accurate contact. If it is necessary to remove the bone at its articulation, the operation should be conducted as has been described until the jaw is divided on that side of the tumour where it remains sound. The tumour

is then pulled outwards, while its connexions with the mouth are detached, and at the same time depressed so as to bring the coronoid process within reach. The attachment of the temporal muscle having been divided, the bone is more fully depressed, so as to expose the articulation, into which the knife is carried close round the condyle, in order to avoid the internal maxillary artery, which crosses the neck of this process on its inner surface about half an inch below the joint. The remaining connexions are lastly divided, and the operation concluded as has been directed.

The small amount of deformity or inconvenience of any kind occasioned by the excision of the greater part of the lower jaw, can be conceived only from actual observation, and, as well on this account as the relief afforded to the patient from an oppressive and ultimately fatal disease, the operation may be regarded as one of the greatest improvements in the practice of modern surgery.

CHAPTER XXIV.

NOSE.

Extraction of Foreign Bodies from the Nose.

CHILDREN frequently introduce small bodies, such as peas or cherry-stones, into the nostrils, where they are sometimes detained in consequence of the enlargement which they suffer, the swelling that takes place in the parietes of the cavity, or simply from their being pushed in with greater force than can be applied from within for their expulsion. The immediate inconvenience is seldom considerable, and the presence of the foreign body often escapes observation for a long while. Sooner or later a purulent discharge and ulceration are induced, and it may happen that surgical assistance is required on account of these symptoms months after the body has been introduced, and when its existence is not known, either from having never been discovered, or from having been completely forgotten. In all cases, therefore, of matter being discharged from one nostril of a child, the surgeon should search the cavity to ascertain if it contains any foreign substance. This is most effectually done by means of forceps with narrow blades terminating in small rings. They should be introduced with the branches fully expanded, and held in a vertical direction, parallel with the septum of the nose. From the flattened shape of the nostril they may thus be passed behind any body, however firmly impacted in it, and, after being fairly introduced, they should be closed so as to seize anything that may be present. One or two trials conducted in this way will enable the surgeon to satisfy himself whether or no there is a foreign body lodged in the cavity, and to extract it if detected. When the extraneous substance has been recently introduced, the process of removal should be performed in the same manner.

Epistaxis, or Bleeding from the Nose.

Hemorrhage from the nose frequently takes place, either commencing spontaneously, or being induced by the injury attending

operations in which the parietes of the cavity are concerned. Spontaneous bleeding is generally suppressed by applying cold to the forehead, or introducing a piece of lint, moistened with spirits or some astringent saline solution, into the nostrils. The same means usually prove sufficient when mechanical violence has been the exciting cause. But, in both cases, it occasionally happens that more efficient measures are required; the blood, though prevented from flowing through the anterior openings of the nose, being observed to trickle down into the throat. It is then necessary to close the posterior nares also, by introducing a piece of sponge or lint. This may be done in various ways, and instruments have been contrived for the purpose; but the most convenient method is to pass a probe, curved to the form of the palate, through the nose into the pharynx, and then draw it out of the mouth, conveying by its means a piece of strong ligature, about a foot and a-half in length. A compress of lint, large enough to obstruct the posterior opening of the nostril, is next tied securely to the middle of the thread which issues from the mouth. The other end being pulled, this plug is drawn backwards, and, with the assistance of the operator's left fore-finger, is lodged behind the soft palate, at the nasal orifice. The two ends of the thread are then secured; and when it is judged safe to remove the plug, the thread that lies in the mouth affords the ready means of doing so.

Polypus of the Nose.

Tumours of several different kinds are met with in the nasal cavities; and though comprehended under the general denomination of polypus, must be carefully discriminated in regard to their prognosis and treatment. The most common of these growths possess a soft, but rather tough consistence, and yellowish-gray colour; they bleed slightly when injured, and have not much sensibility; they often contain collections of limpid fluid, so as to constitute thin bags. These are named Simple, Mucous, or Benign Polypi. They grow from the mucous membrane generally, where it covers the upper part of the nostrils, sometimes where it lies upon the inferior spongy bone, but never from the septum. They seldom exist singly, and are often met with in great numbers together. One nostril is very rarely affected alone. They occur at all periods of life, but are most frequent about middle age. They enlarge until the cavity is filled, and then remain stationary, rarely

causing any expansion of the face by the pressure proceeding from their continued increase. The symptoms which they occasion are, obstruction of respiration, an uneasy sensation of stuffing of the head, dulness or total loss of smell and taste, and sometimes deafness. It is generally observed that these symptoms are most distinct in moist weather, and least so in an opposite state of the atmosphere.

The treatment of mucous polypus consists in removing the excrescences; and though various methods have been, and still are, occasionally employed for this purpose, there can be no doubt that the best mode of effecting it is evulsion by forceps. The instrument must be so small that its blades can be passed up along the sides of the polypus to its root, where they should be fixed by strong compression of the handles. The surgeon then, by a compound movement of pulling and turning, the latter of which should be steadily in one direction, endeavours to disengage the connexions of the tumour. He may fail in the first or several subsequent attempts, but by careful and persevering efforts, guided by acquaintance with the shape of the cavity, he is sure of ultimately eradicating the disease. Except in those rare cases where the polypus is single, the patient can hardly be completely relieved by one operation; and the notrils, though seemingly quite cleared, are again and again found more or less occupied by a similar excrescence. The cause of this is probably not so much reproduction as expansion of the polypous growth, and the repeated relapses, therefore, ought not to occasion discouragement. Astringent washes and caustic are sometimes employed to repress the tendency to new formation, but there is reason to believe that the good effects obtained in this way are very inconsiderable, and it would be improper to confide in them so far as to withhold the use of the forceps, so long as any vestige of the disease can be discovered to exist. It is necessary to beware of mistaking for this disease a mere thickening of the mucous membrane over the inferior spongy bone, which is common in children, or a projection of the septum to one side, which exists to a slight degree in most people, and not unfrequently encroaches so much on the nostril as to occasion serious inconvenience.

The next kind of polypous growth from the nasal cavities that may be mentioned is of variable consistence, from the softness of brain to the firmness of glandular tissue, but is always extremely friable in its structure, so as to tear easily, and when subjected to

extension, gives way at the part where the force is applied. It bleeds profusely when injured — tends to increase without any limitation, making room for its accommodation by expanding and separating the bones of the face—and is found to originate from the osseous substance of the parietes of the cavity. This medullary, bleeding, or malignant polypus, as it is named, usually occurs at the middle and later periods of life. It is distinguished by the characters which have been mentioned, and by being attended with pain, and bloody or purulent fetid discharge. The rapidity of its progress is very variable, but its result is always unfavourable.

The radical removal of this disease is impracticable, and when the morbid disposition is very active, or when the disposition to bleed is great, any attempts to delay its progress by extracting as much of the mass as can be reached, are hardly prudent, being more likely to accelerate than prolong the patient's fate. In cases of a milder description, advantage seems often to be derived from clearing the nostrils occasionally, which is easily accomplished, and relieves the patient from time to time. The operation cannot be performed well with forceps alone, as the want of cohesion in the morbid structure prevents them from removing any more of the mass than what is actually embraced between their blades. Knives, scissors, and hooks are employed, but the best instrument for the purpose is a finger, which, being introduced into the expanded nostrils, feels where the polypus is attached, and forces it away from the bone. The cavity having been thus emptied, is stuffed with lint to stop the bleeding, and caustic or astringent lotions may be afterwards applied.

The third and last kind of polypus that requires to be noticed is remarkably distinguished by the extreme firmness of its texture, which nearly equals tendon in strength. It is distinctly fibrous, and has hence been named the Fibrous Polypus. It bleeds profusely when injured, increases without any limit, descending into the pharynx, and proceeding beyond the external orifice of the nose, and ultimately proves fatal by causing hemorrhage, suffocation, or pressure on the brain. It almost always exists singly, and occurs chiefly in young adults of the male sex. M. Dupuytren, who first remarked the peculiarities of this fibrous structure, supposes that it frequently exists as an antecedent of the medullary or brain-like polypus, into which it degenerates, first at the part most distant from its root, and ultimately throughout its whole extent.

It may be stated, however, on the evidence of extensive observation, that the soft kind of growth often (so far as I have seen, always) displays its proper characters from the commencement; and there are cases on record in which the fibrous polypus retained its distinctive firmness of texture after existing for years, and attaining a great size. It seems to adhere to the bone, but not to depend on any diseased condition of that tissue, so that if torn out by the root it may be permanently removed. This method has been recommended by Dupuytren as the only mode of effectual treatment,—and in order to obtain a secure hold for the instruments, he did not scruple to slit open the nose. Sometimes it distends the *antrum maxillare*,—and having caused absorption of the walls of the cavity, protrudes under the cheeks, where it may be exposed by dividing the mucous membrane of the mouth, and seized with forceps. The instruments for this purpose should be very strong, and provided with numerous large projecting teeth. Several pairs in general are required to be fixed in succession as space is gained,—and the strength of two or more stout assistants has been found necessary to effect the evulsion.* In performing such operations, the surgeon should be prepared for a profuse hemorrhage,—and, as a precautionary measure, ought to pass a thread for plugging the posterior opening of the nostril, if this should prove necessary.

Polypous growths of different kinds sometimes, instead of growing forwards into the nose, descend into the pharynx. In such cases the principal part of the tumour may perhaps be removed by introducing the loop of a doubled silver wire through the nose into the pharynx, guiding it with the finger round the body of the growth, and then pulling the wire so as to draw it up to the neck or thin part near the root. But it is a far better plan to detach the polypus by seizing its roots with forceps introduced through the nostril, and then to push it into the throat.

Ulcers and other Diseases of the Alæ of the Nose.

It has already been observed that warty excrescences on the face are apt to degenerate into malignant sores in the advanced period of life. When cancers, originating from this or other sources, are seated over the cartilages of the nose, it is prudent to cut away a portion of the whole thickness of the parietes, as the disease can hardly be extirpated otherwise, and ineffectual attempts would pro-

* Sabatier, Médécine Opératoire, par Sanson et Begin, 1824, t. iii. p. 280.

bably promote the diseased process. If this operation is performed early, the cut edges may be brought together and united so as to leave no perceptible deformity.

The skin of the nose is liable to an over-growth, which at first makes it present a warty or tuberculated appearance, but when more advanced, completely alters its shape, and constitutes large, irregular, pendulous masses, which occasion great deformity and inconvenience. In cases of this kind, that are so aggravated as to warrant an operation, the redundant substance may be shaved off, while the surgeon, by keeping his finger in the nostril, ascertains the extent to which he should cut. Cold applications restrain the bleeding; and when cicatrisation is completed, wonderfully little trace of the disease remains. It may afterwards return and require similar treatment, but the operation is seldom necessary more than once.

Lupus, or *noli me tangere*, is an obstinate ulceration of the nose or adjacent parts, always superficial in the first instance, and generally continuing so, but sometimes extending more deeply and causing extensive destruction of the face. It presents various appearances, but in general has the character of healing at one part while it extends at another. The ulcer is usually covered with a scab, and surrounded with inflamed skin. The disease, though left to itself, sooner or later suffers a spontaneous cure, but seldom until great deformity is occasioned by its ravages. It occurs chiefly in youth, and affects females more frequently than males.

The treatment of this affection is very unsatisfactory, since the mode employed often proves unavailing, or procures merely a temporary amendment. The general health, if deranged, ought to be restored if possible by an appropriate course of alterative medicine and diet; but it is on local applications that the principal reliance is usually placed. Of these, different preparations of arsenic are regarded as the most efficient; but I have found most advantage from the alternate use of sulphate of copper and red oxide of mercury.

Restoration of the Nose.

The nose may be defective as a fault of original formation, or from the effects of violence, or in consequence of ulceration. The want of this feature not only causes a most disagreeable deformity, but impairs the sense of smell, and exposes the patient to annoy-

ance from the entrance of foreign matters into the nostrils. Ingenious practitioners have endeavoured to construct a substitute for the lost part, by attaching in its place a flap of skin taken from some other part of the body. There are two methods that have been chiefly followed in doing this, which are named the Italian and Indian. The former was contrived and practised by Taliacotius. It consisted in dissecting from the arm a flap of skin, uniting one of its edges to the face, while the other remained attached to the arm, and after the union was completed, separating the piece of skin entirely from the arm, fashioning it properly for representing the nose, and completing its union with the face. This operation seems to have been repeatedly performed by Taliacotius, and some of his contemporaries, but has not been adopted in modern surgery. The Indian method is simpler, and better calculated to attain the object in view. It is executed by dissecting from the forehead a flap of skin sufficient for constructing the absent feature. The size and shape requisite for this purpose having been determined by fitting a piece of card or wax into its place, and then expanding this upon the forehead, where its extent is defined by marking the skin round it with ink, the flap is detached, with the exception of a narrow slip at its lower part, which is left to supply it with nourishment, and its edges are connected by stitches to raw surfaces formed where they are required on the face. Tubes are inserted into the nostrils to permit respiration, and a sufficient quantity of lint is introduced to give them the requisite shape. Cloths wet with cold water are then applied to moderate the subsequent action, and promote union by the first intention. This operation, which seems to be of very ancient origin, was first adopted in this country by Mr Carpue.* It has since been frequently practised both at home and abroad, and often with results highly creditable to the dexterity of the operators. But though noses may thus be formed which would not attract attention at a distance, and appear tolerably well in a drawing, where the disparity of colour, surface, and other characters are not expressed, it must be admitted, that the substitute is almost always even more disagreeable than the deficiency; and there is good reason for regarding such achievements as more curious than useful, especially as by means of enamel or other suitable compositions, imitations of the lost part may be constructed, which prove more seemly, and much less uncomfortable to the patient.

* Carpue. Account of Two Successful Operations for the Restoration of a Lost Nose. 1816.

CHAPTER XXV.

THE EAR.

Foreign Bodies in the Ear.

CHILDREN are very apt to introduce peas and other small bodies into the ear, and attempts to remove them with forceps of the usual construction tend to press them inwards. The forceps, or a slightly curved steel probe, is the most convenient instrument for the purpose. It has happened that the extraneous substance, by swelling after its introduction, or by being very forcibly inserted, resisted the most careful efforts at removal in this way, and it has become necessary to make an incision into the tube of the ear at its posterior side, so as to permit the introduction of a hook or probe for effecting the dislodgement. Such a proceeding can be very rarely necessary, and the surgeon should beware of having recourse to it in cases where he cannot detect the foreign body by external examination, and is led to believe in its presence merely by the relation of the patient's friends, as an erroneous impression of this kind is frequently produced by disagreeable feelings in the ear, remaining after the removal of some irritating substance.

The ceruminous secretion of the ear frequently accumulates in undue quantity, and occasions deafness more or less complete. When this is discovered by inspection of the cavity in a bright light, a little oil should be introduced to soften the mass, after which repeated injections of warm water are to be thrown in to wash out the wax. The patient should afterwards avoid exposure to cold, and take measures to prevent the same thing from happening again.

A preternaturally dry state of the meatus and membrane of the tympanum, depending upon a deficient secretion of wax, also impairs the sense of hearing, and benefit in such circumstances is often derived from anointing the surface with some stimulating

ointment, as a mixture of axunge with a small proportion of oil of cloves, or any other of a similar kind.

Inflammation and Suppuration of the Ear.

Inflammation of the ear is generally induced by exposure to cold. It is attended with pain, more or less acute, and either confined to the ear, or extending through the head. Pressure or motion of the auricle increases the patient's distress, and there is constitutional disturbance in proportion to the severity of the local complaint. The attack terminates in resolution or suppuration, the matter in the latter case being effused, either exteriorly to the membrane of the tympanum, or within it, so as to cause pressure and absorption, for obtaining vent to escape. In the former case there is merely a running, which admits of cure without loss of hearing; but in the latter, there is apt to be caries of the temporal bone, and a permanent discharge, with partial or complete deafness.

The treatment of the inflammatory state requires bleeding, cathartics, warm fomentations, and the antiphlogistic regimen. The chronic discharge of matter demands the injection of metallic washes, and blistering on the back of the neck. And when the bones are affected, the same means may be employed, but with an unfavourable prognosis. Recovery from this state sometimes occurs; but more frequently the disease proves obstinate, and occasionally fatal, by leading to a morbid condition of the brain, particularly the formation of abscesses in its substance.

Polypus of the Ear.

Polypous excrescences are occasionally met with growing from the cavity of the ear, and protruding either through the external aperture, or an opening caused by absorption in the posterior wall of the canal. They usually possess a florid colour, and vascular structure. They are attended with a thin muco-purulent discharge, and seem to agree in their nature with the growths which spring from the lining membrane of the prepuce and the conjunctiva, in consequence of inflammation terminating in suppuration. The best mode of treating them is to pull away with forceps as much as possible of their substance, and then touch the remaining surface with nitrate of silver, afterwards using injections of sulphate of zinc, or other metallic solutions, to correct the morbid action of the membranes.

Obstruction of the Eustachian Tube, and Perforation of the Membrane of the Tympanum.

The Eustachian tube is liable to be obstructed at its pharyngeal extremity by a variety of circumstances, of which the most deserving of notice are, thickening and adhesion of its lining membrane, consequent on inflammation of the throat, enlargement of the tonsils, and nasal polypus. It has been already mentioned, in regard to the two last of these affections, that they occasionally give rise to deafness in this way, which is relieved by their removal. But when the tube is closed, the only method of restoring the patient's hearing is to remove the obstruction, by introducing probes or injections through the nose into the contracted or obliterated tube. This operation is so extremely difficult and uncertain, that it cannot be regarded as affording any real advantage; and it has therefore been proposed, in such cases, to make an opening in the membrane of the tympanum, so as to place it in equilibrium as to the pressure of the atmosphere, on its internal as well as external surface. Numerous attempts have been made with this view, and frequently with temporary benefit. The return of deafness, which the patient has almost always suffered, has been ascribed to closure of the aperture, and various modes of making it have been proposed, in order to prevent the edges of the wound from uniting. It is probable, however, that the relapse depends on other circumstances, as it is not easy to conceive how the edges of such wounds could unite, except as a rare accident, and since the deafness has returned, even after a part of the membrane was actually removed.

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