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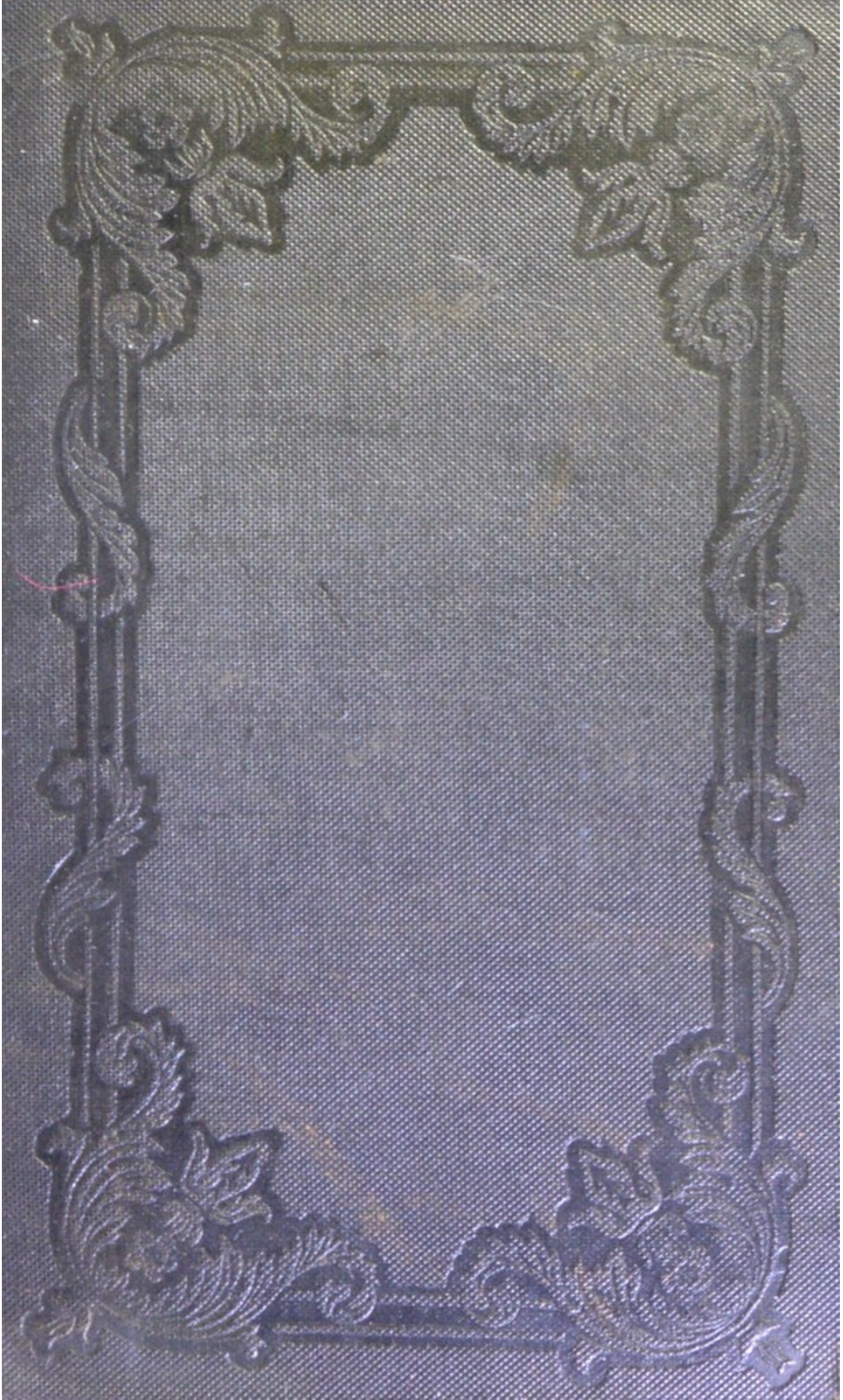

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PRACTICAL SURGERY.

LABORE
ET CONSTANTIA

52049

A SYSTEM

OF

PRACTICAL SURGERY.

BY

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WITH 246 ILLUSTRATIONS BY BAGG.

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HIS FORMER AND PRESENT PUPILS,

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IS RESPECTFULLY DEDICATED,

BY

THEIR SINCERE FRIEND,

THE AUTHOR.

TON & SUSSEX

PREFACE.

It has been the object throughout the whole of this work to produce a manual of the details of Practical Surgery, which shall, in some degree, meet the wishes and wants of the Student, as well as of the Surgeon already engaged in practice, and it is hoped that the volume may prove of some value to both parties.

All hypothetical doctrines have been avoided as much as possible, and alluded to only when they have afforded palpable illustration of certain methods of practice. The prevailing custom of interspersing surgical works with scraps of Physiology has been dispensed with as much as circumstances would permit, chiefly on the ground that the latter subject, besides being too extensive to be treated in such a manner, forms only a part of that extended education on which a scientific knowledge of Surgery can alone be based. For the same reasons, too, the sciences of Chemistry, Pharmacy, Materia Medica, and others, which are included in the curriculum of medical study, have scarcely been referred to ;—not because they are irrelevant to the Practice of Surgery, but because each, in a manner, forms a separate department of that system of instruction which belongs alike to the Physician and the Surgeon, and which every properly qualified medical man must have pursued ere he becomes a recognised practitioner.

The mode of investigating the Surgical Anatomy of each part will, it is presumed, be of value to those who may wish to refresh their knowledge ;—elementary details have, in general,

been omitted, and the descriptions have been arranged more with a view to encourage ocular inspection than to facilitate the prevalent, baneful, and schoolboy system of acquiring names from printed lessons,—a kind of knowledge which is totally worthless to the Practical Surgeon: no special attention has been given to that laboured style of certain treatises on surgical anatomy, which, in describing minute divisions and subdivisions of regions has, it is feared, induced the Student to suppose that these imaginary, or, at best, artificial lines, are of equal importance with the relative position and appearance of the organs and textures themselves.

The arrangement of the contents is such as has been thought most desirable. In the progress of the work it was found that unless such a section as that which has been named "The Elements of Practical Surgery" were given, there would be a series of repetitions elsewhere, which could not have been avoided. The section in question is, like the others, devoted almost exclusively to practical details, and the author hopes that it will be taken in this light alone by the Student and all who may look into these pages,—for, strictly speaking, the true elements of Practical Surgery are to be found chiefly in a complete system of education.

Each subject has been treated according to the author's estimation of its utility and importance, and this estimation has been founded partly on his own education, partly on the writings of others, but more particularly on his experience among pupils, among surgeons of his own age, and among his seniors in the profession; and he has assumed that his personal opportunities have been such as to entitle him, on all fitting occasions, to illustrate his precepts by his own practice, although he must here express a hope, that in the following pages he will not be found deficient in respect for the opinions of others.

The limited extent of the work has necessarily prevented notice being taken of many subjects which are of interest to the Practical Surgeon, and also of those historical details which

some might desire. While the author cannot but regret the omissions, he trusts that, in some degree, they will be compensated for in other respects, and that few of his readers will be without that admirable emporium of surgical lore, "Cooper's Surgical Dictionary," or the "Cyclopædia of Practical Surgery," as far as it has gone, in which they will find all that may be desired on such topics.

The present work has not been produced to compete with any already before the profession,—the arrangement, the manner in which the subjects have been treated, and the illustrations, are all different from any of the kind in the English language. It is not intended to be placed in comparison with the elementary systems of Mr. Samuel Cooper, Mr. John Burns, Mr. Liston, Mr. Syme, Mr. Lizars, and that excellent epitome by Mr. Druitt. It may with more propriety be likened to the "Operative Surgery" of Sir Charles Bell and that of Mr. Averill—both excellent in their day, or the more modern productions of Mr. Hargrave, and the "Practical Surgery" of Mr. Liston, which are so well known, and so justly appreciated, that no praise of the author of the following pages can possibly add to the estimation in which they are held. There are subjects treated of in this volume, however, which none of these gentlemen have noticed, and the author is sufficiently sanguine to entertain the idea, that his work may, in some degree, assume that relative position in British Surgery, which the classical volumes of Velpeau and Malgaigne occupy on the Continent.

With many imperfections of which he is himself conscious, and doubtless many more which he has overlooked, the author ventures to hope that the good, if any, may be put against the bad, and that the result will be, that he has contributed in some measure to the advancement of a profession to which he has been devotedly attached for nearly twenty years.

The author feels assured that the illustrations will in every respect sustain the high character which the Messrs. Bagg have already secured for their beautiful and useful art, and he can-

not find language sufficiently expressive of his own estimation of the artistical skill and professional knowledge of Mr. Wm. Bagg, by whom the drawings have been executed.

For most of the designs the author is himself responsible, and for others he has been indebted to the diagrams left, for the use of the chair which he has the honour to occupy, by his predecessors Mr. Green and Mr. Arnott.

To many friends he has to offer thanks for valuable communications and assistance, among whom he may mention Sir George Ballingall, Mr. Lizars, Mr. Watson, Mr. A. Miller, Dr. Handyside, Mr. Goodsir, Mr. Norman, Dr. Machardy, Mr. Elliot, his former pupils Dr. Dods (Connaught Rangers), Dr. George Williamson (Fort Pitt), Dr. Richard Mackenzie, and in an especial manner to his present assistant, Mr. Robert Storks, whose services have greatly contributed to lessen the labours attendant on the author's task.

8, Dover Street, Piccadilly.
1st October, 1842.

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A SYSTEM

OF

PRACTICAL SURGERY.

PART I.

INTRODUCTION.

THE ELEMENTS OF PRACTICAL SURGERY.

CHAPTER I.

SURGICAL ANATOMY AND PRACTICAL SURGERY.

The inseparable connexion between Practical Surgery and Surgical Anatomy, induces me so to associate these two subjects in the following pages, that I may be enabled to give full scope and effect to those objects and intentions, which influence me in undertaking the arrangement and elucidation of what I have ventured to term "A System of Practical Surgery."

The term Surgical Anatomy is used to express the relative position of the different textures and organs of the human frame, as the surgeon finds them in the treatment of the diseases and accidents which belong to his department of the profession. The term is usually understood as applicable to the parts in their normal state; but this by no means gives a sufficiently comprehensive idea of what the practical surgeon implies by Surgical Anatomy. In addition to a knowledge of relative position, it may be said that no one can possess a thorough knowledge of Surgical Anatomy, who is not conversant with the various alterations effected by disease or accident, in the appearance, shape, and size, as also with the differences in relative position, occasioned by disease, in or near any portion of the body. The operation for strangulated hernia affords a good illustration of these remarks, as it is well known to the practical surgeon, that the study of the parts in their natural state, through which a hernia protrudes,

gives but an imperfect idea of what is met with during the operation. Perhaps, before the knife is used, the skin and other textures to which it is to be applied, may have become inflamed and swollen,—infiltrated with serum or sero-purulent fluid, and consequently much altered from their more healthy condition: even under more ordinary circumstances where inflammation has not as yet attacked those textures, the skin, fasciæ, and openings are all very different from the usual appearances met with in the dissecting-room: the hernial sac on many occasions bears but a slight resemblance to the peritoneum, and the bowels generally present few traces of what is usually considered the healthy condition.

It may be affirmed that the elements of Surgical Anatomy can only be acquired by application to the healthy frame, and that a comprehensive knowledge of it can never be obtained without a study of the effects of disease and accident. In some rare instances, as for the performance of certain amputations, or ligature of main arteries, (operations generally done at a distance from the seat of disease,) a knowledge of healthy anatomy is what is chiefly required by the operator; but in the greater number of instances, when a practitioner's knowledge of Surgical Anatomy is called into requisition, there is a necessity that it should be much more comprehensive than is required merely for the appreciation of healthy textures.

From what I have stated, then, it will appear, that I include a certain amount of knowledge of what is termed Pathological Anatomy in my definition of Surgical Anatomy; and I need not here do more than simply state, that I cannot believe any one to possess a competent acquaintance with either of these two departments of knowledge, who is not conversant with what is termed Descriptive or Elementary, and also with General Anatomy.

Having this extended view of Surgical Anatomy, I shall in the following pages, when I deem the subject of much importance, not confine my descriptions to the healthy parts alone, but shall occasionally digress, when I think I can do so with advantage. Indeed, without a constant reference to injuries and surgical diseases, I cannot conceive it possible to treat of the subject of Surgical Anatomy with much practical efficiency.

Under the term Practical Surgery, I shall include the symptoms of disease and injury, the principles and objects of treatment, and such medicinal means of cure as seem to me to belong to the province of surgery; and under what is commonly called Operative Surgery, I shall describe not only those operations which are performed with cutting instruments, but also the various duties required on the part of the surgeon, as in the setting of fractured bones, reduction of dislocations, application of bandages, and other manipulations of Practical Surgery.

CHAPTER II.

INSTRUMENTS, DISSECTIONS, AND OPERATIONS.

A WORK professing the views, objects, and intentions, referred to in the preceding chapter, cannot be more appropriately commenced than with some general remarks on the manner of making those dissections, which are necessary for the display of surgical anatomy; and, for similar reasons, some general remarks on operations and surgical instruments and apparatus, may be advantageously introduced at the same time.

For the investigation of surgical anatomy, a subject should be selected on which disease has not caused too great emaciation; nor, on the other hand, should the textures be obscured by an over abundance of fat. In the latter case the parts cannot be displayed so clearly as may be wished; and in the former, although they can be most distinctly made out, no very correct notion can be formed as to the appearance of the same structures, when exposed in the living body, as operations are seldom required or performed on individuals who are much emaciated by disease, being most generally done on those of an average bulk of developement.

In all instances, dissections and operations on the subject should, if possible, be performed with instruments similar in every respect to those intended to be used on the living body. The scalpel is the cutting instrument in most general use, and one with a blade of this size and shape (fig. 1) will be found to answer most purposes to

Fig. 1.

which the instrument is applicable. The handle and blade together should be about six inches in length; the former of ebony, and the latter of steel so finely tempered, that its edge cannot readily be turned or broken. Ebony should always be preferred to ivory for the handle, as it is less likely to slip in the fingers when covered with blood or moisture of any kind, and its surface should be smooth throughout its whole extent. The blade and handle should be firmly joined, and the rivet pins should be made of such a material as will not readily corrode or rust. German silver is a good metal for the purpose. A stronger and more bulky instrument is preferred by

some, and others, again, occasionally select a smaller one; some have the cutting edge more convex, others less so; a few prefer a double edge, and some choose the point on a level with the back of the blade. Each anatomist and surgeon has a taste of his own in these matters, and it is of no great moment which shape or size is selected, provided he who wields the instrument has the skill and dexterity requisite for its proper application. With such an instrument as is here recommended, I have performed most of the capital operations of surgery,—from those requiring the most careful dissection, to the most coarse that can be imagined; from cutting on large arteries, for hernia, for lithotomy, for the removal of tumours from important parts, to the extirpation of large growths where extensive and rapid incisions have been resorted to: indeed, in case of necessity, an instrument of this kind might even be used in amputation of either extremity; but in proper time I shall describe others which are better adapted for the peculiarities of each operation.

Fig. 2.

The scalpel should be held between the thumb and fingers, by the thickest part of the handle, with such a degree of firmness only, that its weight may still be felt. Either of these positions may be resorted to, although the first (fig. 2) is usually deemed best for general purposes. The little finger may be placed on the neighbouring parts,

Fig. 3.

so as to support the hand, and assist in steadying it; but when extensive incisions are required, the instrument should be laid on with the hand unsupported. The other method, exhibited in the second sketch on this page (fig. 3), requires great steadiness natu-

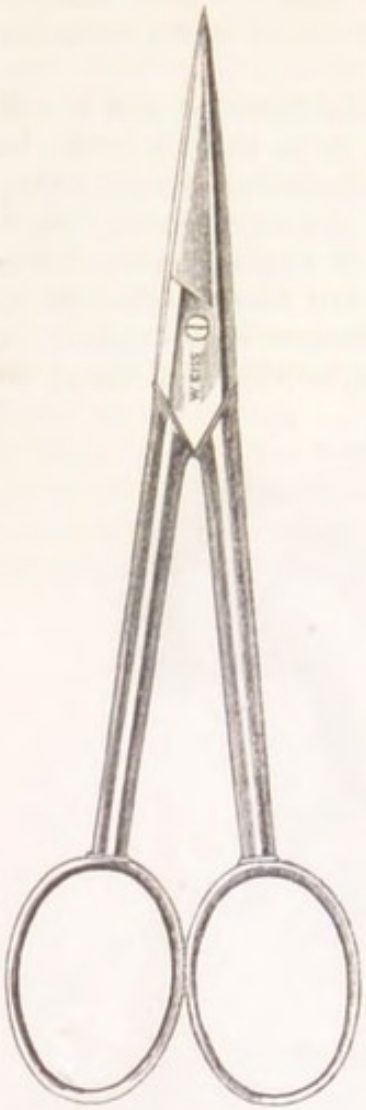
rally, but with practice, much ease, elegance, and dexterity, may be displayed when the knife is thus held, and even the most minute dissections may be effected with the hand and scalpel in the attitudes here represented.

Many operations are now performed with the bistoury, and it will be advantageous to practise dissections with it, as well as with the scalpel, so that it may be handled without awkwardness on the living body. A blade of the shape represented in the next sketch, about three or four inches in length, fixed in a handle similar to that of the scalpel, or in such a one that the blade can shut like a pocket-knife, may be used on these occasions. The instrument may be held in the same manner as the scalpel; it is awkward, however, to do so in

Fig. 4.

the manner exhibited in figure 2, in consequence of the fingers being so near the point, and that here represented (fig. 4), perhaps, combines more elegance, freedom, and firmness of movement than any other. Whatever attitude is chosen at first, it is necessary, with appropriate movements of the fingers and wrist, so to change the position and movements of the hand during the incisions, that the cutting edge of the instrument may be drawn towards the operator, or from him, at will. There are different kinds of bistouries that I shall speak of afterwards, and both this instrument and the scalpel require to be held in particular attitudes, which will be most advantageously explained and exhibited, in describing the manner of performing the various operations, in which particular instruments and positions are of consequence.

Fig. 5.



In minute dissections, scissors of this shape will be found of service, and as they are frequently required in the practice of surgery, the hand will thus become habituated to their use. The shape indicated in the sketch is such as I prefer, and the length should be about five inches and a fourth. It will be afterwards found that I seldom recommend scissors for any operation when the knife may be used instead, but they are useful in a variety of ways in almost every occasion of the kind, — in cutting ligatures, stitches, straps, bandages, and for such-like work they are indispensable: some deem them best adapted for certain operations, and I shall therefore refer to them again at fitting opportunities.

There are various shapes of scissors, and for ordinary surgical purposes, I prefer another kind exhibited a few pages further on. The straight blades and sharp points, represented by this cut, (fig. 5,) are best suited for dissecting purposes.

In dissections or operations requiring cautious cutting, the knife should be drawn lightly and steadily along the surface, and with such force that the textures, as they are divided, shall fall gently to each side. The pressure must be regulated by a variety of circumstances, such as the depth to which it is wished to carry the incision, the nature of the texture to be cut, the proximity of important parts; and, on most occasions, the instrument ought to be carried along, as if it were more the intention to draw it over the textures than against them, for the purpose of their division. Sometimes a bold and free incision is required through a considerable thickness of parts, when a sawing motion of the hand is of advantage; but in general, if the knife be sufficiently fine in the edge, and dexterously drawn along, the textures will be readily separated without much apparent rudeness, or without the appearance of scratching, as if a pin was used instead of a sharp-edged weapon.

It may appear supererogatory to state, that the knife should, with few exceptions, be held in the right hand. It is proper to mention this, however, as some, on the often-quoted authority of Celsus, contend that the surgeon should be as dexterous with the left hand as with the right; affirming, that he should do all the operations of surgery as well with the one as the other. To me it has always

appeared that this may not have been the meaning of that distinguished authority, nor do I think it at all requisite on the part of the surgeon, that he should use the knife as dexterously with the left hand as with the right. It will be of advantage to dissect occasionally with the left hand; but there are few who will attain the same command over it as over the opposite one. From infancy we apply each hand to special purposes; the left hand has its peculiar duties to perform whilst the other is engaged,—it may be said to be the servant of the right; and on the part of the surgeon this seems to me all that is necessary; for it appears as absurd to expect ambidexterity with him, as it would be to expect, or recommend it, with the painter, sculptor, or common mechanic. I have never yet seen a surgeon who possessed equal power and grace in either hand, nor do I consider that the efficient practice of his art requires that kind of dexterity possessed by the juggler, who tosses his daggers, and catches them again as they twirl through the air, as freely with the one hand as with the other, and with whom the movements of each hand are, on such occasions, of necessity, nearly alike.

Fig. 6.

In all instances where the thumb and forefinger of the left hand can be used to put the parts, about to be divided, on the stretch, they should be preferred to the forceps. In minute dissections the latter instrument is in general use, although, with a little practice, great nicety and firmness may be acquired with the thumb and finger used as a forceps. For ordinary purposes, forceps similar to those represented in this sketch (fig. 6), will be found generally useful; they should be between four and five inches in length, and where the free ends of the blades meet, the surfaces should be grooved obliquely, so as to fit accurately into each other. The points should be rounded, and of considerable breadth; and whilst capable, from being thus shaped and nicely fitted, of seizing the most minute objects, they may, when required, grasp others of greater size, and secure them firmly. This construction of point is, in my opinion, greatly to be preferred to the slender and dangerously sharp extremity, which I see in many of the instruments which come under my frequent notice. The spring in the blades should not be very strong, as the hand would speedily get fatigued. In dissection this instrument is usually held between the thumb and fore and middle finger of the left hand; but it is often used in

the right during operations, in securing arteries, from the greater facility in manipulating with this hand.

A variety of hooks, sharp or blunt at the point, may be used in place of forceps, but the latter is generally preferred. In dissections the chain-hooks here represented (fig. 7) will often be found of ser-

Fig. 7.

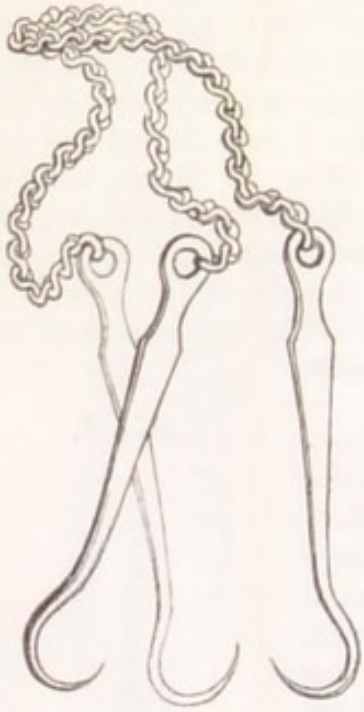


Fig. 8.

vice; but if the parts can be put on the stretch with the thumb and fingers, or between the forceps and little finger of the left hand (the instrument being held between the thumb and fore-finger), their use had better be dispensed with, as the fingers often get scratched with their points. Instead of these, a hook fixed in a handle like that of a scalpel, as here exhibited (fig. 8), may be had recourse to; its point it will be observed is sharp, and it is often of advantage to have it so, whilst on other occasions a blunt point is to be preferred, such as in fig. 9, and either of them may be single, as they are here represented, or double, as is seen in fig. 10. The hooks set in handles are mostly used during operations, and then they are held by assistants; they are of service in keeping parts out of the way of the surgeon, and there are few operations in which they can be dispensed with. They take up less room than fingers on the edge of a wound, and generally hold the parts more securely. Slips of copper bent at

the points, or flat pieces of wood, are sometimes used for similar purposes, as, for example, in holding asunder the edges of the wounds

Fig. 9.

Fig. 10.

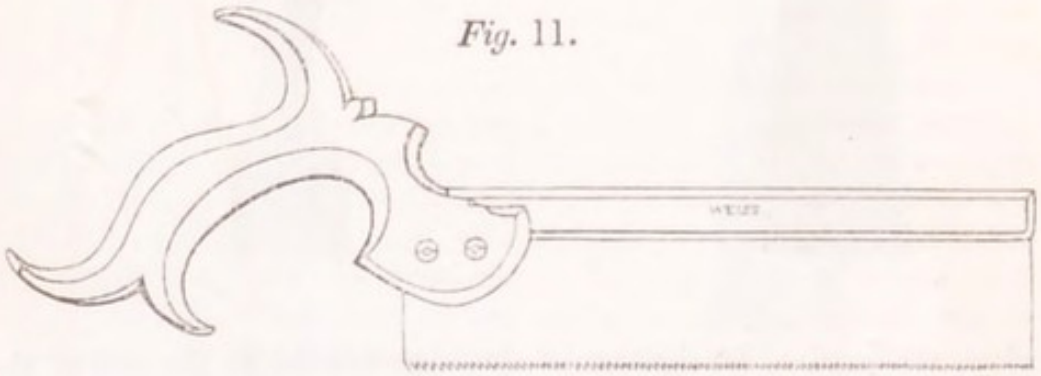
which are required for ligature of the large arteries at the root of the neck, or in the pelvis.

When sufficient familiarity with the different parts of the body has been attained, by frequent dissections, the operations of surgery should then be performed on other subjects. The cutting instruments, above referred to, are now in general to be used in a more free and bold style than in ordinary dissection, and more extensive movements are required in the hand and arm, though occasionally the operator has to proceed with as much caution as if making the most minute dissection on the dead subject. There cannot be a greater mistake in a young surgeon's education, than to commence the performance of operations before he has acquired a thorough knowledge of anatomy. If he enters into practice without such knowledge, he can neither operate

with safety to his patient nor satisfaction to himself; all must be hap-hazard; whilst on the other hand, in prosecuting his dissections, he takes the surest way of acquiring that dexterity in the use of his hands and instruments, which will be of infinite service to him afterwards in the ordinary performance of his professional avocations; and here I do not so much allude to the performance of capital operations, as to the more common manipulations required in bloodletting, bandaging, dressing sores, opening abscesses, and the numerous little manual proceedings which constitute the routine of surgical practice, and which, though seldom named as "operations," should be deemed as characteristic of good practical surgery, as the dexterous removal of a limb, or the rapid and successful extraction of a stone from the bladder.

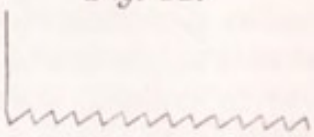
In the performance of many operations, as well as in certain dissections, a saw is necessary, and as it is difficult to use it in a workmanlike manner, it will be well to practise with it on wood or bones, the latter being preferable when they can be procured in sufficient abundance; for it is not by sawing through the bones of one or two extremities merely that a dexterous use of this instrument can be acquired. The common dove-tail saw is that best fitted for general purposes. One with the blade about nine inches long and two and a half deep, exclusive of the back, will serve on almost all occasions on which a saw is required. I prefer a handle, such as is here exhibited (fig. 11) on a diminished scale, similar in shape to that used by the

Fig. 11.



cabinet-maker, made of ebony, and of such a size that it can be firmly grasped by three fingers, whilst the fore-finger and thumb are placed parallel, on a level with its upper margin, to keep it steady. The blade should be sufficiently firm not to bend on the application of moderate force; the teeth should be about this size (fig. 12), and well set out, so as to make such a breadth of groove as will allow the blade to move in it with facility. In using this instrument, it should be held in the right hand, as above directed, the part of the serrated margin nearest

Fig. 12.



the hand should be placed on the bone, and by drawing it steadily backwards, a slight groove will be made; it should then be pushed forwards, and, by a repetition of such movements, extending on each occasion nearly the length of the blade, with a moderate degree of force and rapidity, a bone, the femur, for example, may be cut through in a few seconds. There are varieties of saws, which I shall speak of afterwards, as being better adapted for particular operations, and I shall then also describe the manner in which these, as well as that now alluded to, are to be applied and used for each special purpose.

The cutting forceps (fig. 13) may be used for the removal of portions of bones, when the saw cannot be readily applied; and in some instances, as in excision of portions of the jaws, this instrument may be substituted with great advantage; there is but little skill required in using it, strength of hand being the chief requisite. The cutting edges are brought together by compressing the handles betwixt the thumb and fingers. The pressure should be forcible and steady, and on no account should there be any shaking or twisting of the handles. In partial amputations of the fingers or toes, hand or foot, it may on all occasions be used in preference to the saw. I have even divided the femur with it on the young subject; though the saw ought to be preferred for the large bones in amputations of the extremities.

Fig. 13.

For the removal of diseased or dead portions of bone, when the neighbouring healthy bone requires to be cut, it may entirely supersede the common saw, or the more complicated one, termed the chain-saw. Indeed, though this is a somewhat ancient surgical instrument (for it was figured by Scultetus nearly two hundred years ago), and though it had become in a manner obsolete till within these thirty years, I know of no single instrument whose re-introduction to practice in modern times has conferred a greater boon on the operating surgeon; and for this I believe we are solely indebted to Mr. Liston, whose example in using it has been most extensively followed by a large proportion of the present race of operating surgeons.

The usual length of the instrument is from eight to nine inches; but it may vary in size according to circumstances. The blades behind the joint should be very strong, so that they will neither bend

nor break with the strength of the hand ; the cutting edges should be sharp, and come nearly in contact when the handles are shut ; and they should be finely tempered also, so as not to be readily turned or broken. When about to be used, the flat surface of the blades should be placed nearest the healthy parts, and if sufficient force be exerted, the cut surface looks as level as if made with a saw. In a hard bone, such as the lower jaw, or in the tibia when it is required to remove a portion of the hard part of the shaft, as in compound fractures, I believe this instrument breaks the bone at the part where it is applied ; in softer bones it partly bruises, as well as cuts. Some theorists have objected to its use from the latter circumstance (bruising) ; but on no occasion, so far as I know, has this instrument produced more serious consequences on the remaining portion of bone, than the saw might have done, had it been used instead.

Besides the shape of cutting forceps represented in the sketch on the preceding page, I have for many years been in the habit of using others more conveniently adapted for particular purposes : sometimes I have found that when the blades were curved in this manner (fig. 14) at the point, I could effect with them what I could not with

Fig. 14.

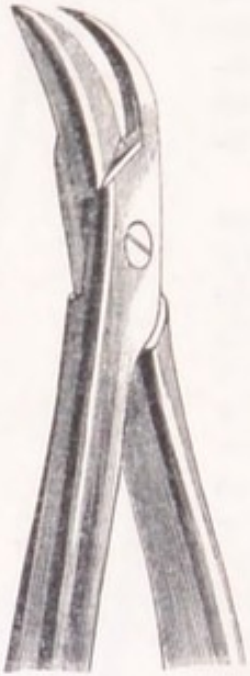


Fig. 15.

the straight ones ; and in other instances I have had reason to be much satisfied with the bends as here exhibited (figs. 15, 16). I have other shapes, too, most of them being derived from the same "Armamentarium," but these I have found most generally useful in all the ordinary operations on bones.

The gouge (fig. 17) is an instrument which, I imagine, has been in a great measure overlooked by the modern surgeon; but I cannot here omit giving it a full measure of praise. It was used by the Moreaus in the excisions of carious joints which they performed, and has been recommended by various authorities; yet I have seldom seen it in the

Fig. 16.

Fig. 17.

surgeon's hands. In operations for necrosis and caries I deem it quite indispensable, more particularly for the latter; and the amount of good which I have seen accrue from its use in my own practice, leads me to give it the strongest approbation as a most useful surgical instrument. Cases will be referred to in after parts of this work, when its efficacy in operations for caries of the tarsal bones, of the shaft of the tibia, and of the articular surfaces of several of the large bones, will be fully exemplified. The instrument which I generally use is about four or five inches long, including handle and blade, about half an inch broad, and sharpened at the point like a turner's gouge. Both handle and blade are short, to enable me to rest my hand on the surface near where the instrument is applied, and thus prevent any sudden plunge, such as might happen were it of greater length. The round handle is kept in the palm, whilst the point of the forefinger directs the scooping movements.

As a preliminary step to dissection, the arteries should be filled with a coarse injection of tallow and vermilion, to which has been added a small proportion of carbonate of magnesia. This composition runs sufficiently minute to fill all the vessels of much surgical import-

ance, and keeps well in a dried preparation, should it be thought desirable to prepare any of the parts in this manner, after the vessels have been dissected: but if the dissector be already a little familiar with the parts, they will appear more as they are met with in the living body, if the arteries are not thus distended, and the veins being usually filled with dark blood, there never can be much difficulty in detecting them.

The body should be placed on a firm table, of a convenient height, and in a good light. Before using the knife, the contour of each part should be carefully studied; the prominences of bone and muscle should be looked at and fingered, and each joint should be examined, and put through its movements. These matters are too generally neglected in the dissecting-rooms, and I know of no exercise, or minor part of education, if it may be so called, which will be more useful to the young surgeon, in enabling him to detect distortion, whether from disease or accident. Both eyes and fingers may be advantageously exercised on these occasions: with the former we can detect the most conspicuous deviations from nature; but, to make assurance "doubly sure," we in general use the latter also; indeed, in all instances, where accurate examination is requisite, we must use the fingers, and by the touch we can often acquire a knowledge of important circumstances, of which we might otherwise be ignorant: we should so use both in the practice of surgery, as to be able to make out the cause of ophthalmia to be an eyelash in contact with the conjunctiva, or the symptoms of ileus to be occasioned by the presence of a small hernial tumour,—too minute to be discerned by the eye, but sufficiently large to be detected with the fingers. Mistakes occasionally happen on these points, (I have known them both,) and it is notorious that a common dislocation of the shoulder-joint has often been detected by a glance or touch by one individual, when it had not been discovered by another who had previously examined the case, but who has been devoid of the "*tactus eruditus*," which is considered so essential to the efficient practice of surgery, and to the acquisition of which, a due attention to the above hints will in no small degree contribute.

It will also be well before commencing, to have made some arrangements as to the chief objects to be attended to in the dissection. A previous knowledge of descriptive anatomy, and what the dissector may already know of surgery, will enable him to arrange some convenient plan: a work on anatomy or surgery may be consulted, but it will be perceived that, in the following pages, every care has been taken to point out the manner of displaying each part to the greatest advantage for surgical purposes.

The dissection may now be commenced, and pursued in accordance with the object in view. It is a good general rule, in prosecuting surgical anatomy, to cut away as few textures as possible, and to displace no structure until its relations to the neighbouring organs have been fully examined. In order to examine deep-seated parts, it is necessary

to lay aside, or cut away, those that lie over them; but it should never be forgotten, that removing, or even turning them aside to any great extent, cannot be done on the living body; and the more, therefore, that a person accustoms himself to look at deep-seated textures with the surrounding parts in as near proximity as circumstances will permit, so much the more readily will the same individual expose such textures, should it be necessary to reach them, on the living body.

It will be of consequence to become familiar with many deep-seated tissues by touch as well as by sight, and the fore-finger, of the left hand in particular, should be employed on these occasions. In lithotomy, for example, though the surgeon ought to be familiar by sight with all the parts concerned in the operation, the touch is of as much consequence to him as the sight: more so, I should say, as all the most difficult steps are done, where and when the eyes are of little or no avail. The portion of the body about to be dissected should be put in the most convenient attitude; each texture about to be cut should be put on the stretch, with the fingers and thumb of the left hand, or with the forceps and hooks, as already described at p. 8. Occasionally, the assistance of a friend will be of service; but, undoubtedly, the more the dissector trusts to his own resources, the better will it be for himself; and, with practice, the ring and little finger of each hand can be used to stretch the parts, even when the scalpel and forceps are both in use.

It is well known that much of the dissector's skill may be exhibited by attention to these matters, and an equal extent of arrangement and design are of the utmost consequence to the practical surgeon. Before commencing any operation, its various steps should be carefully thought over, and all reasonable contingencies provided for; some will occasionally occur which no experience or foresight could have anticipated; but no such negligence as the formation of the flaps in a capital amputation, without a saw being in the apartment, wherewith to divide the bone, should ever occur. I have seen such a dilemma, when the surgeon, who had trusted to his assistant to have all the requisite instruments at hand, had to wait till a saw was procured: fortunately, in this instance the saw was in a contiguous apartment; but Sir Anthony Carlisle used to refer to a similar oversight, when the instrument was many miles off. If the surgeon does trust to an assistant to have all things properly prepared, as he may be obliged on certain occasions, he ought still to satisfy himself before commencing an important operation, that nothing is wanting which may be of service. Undoubtedly the responsibility rests with him; and in practising on the dead body, these preliminaries, for the sake of rendering the lesson more complete, should all be as carefully attended to, as if the proceedings were about to be done on the living. The positions of both patient and surgeon are of much moment also; occasionally it may be necessary to change both; but there can be no excuse for a surgeon, who, after forming the first flap in amputation

of the thigh, only then discovers that he is on the wrong side of the patient, and, in order to complete the operation, has to walk round to the place where he should have been at the commencement. I have also seen an occurrence of this kind, and, as a teacher, I must say, that although such untoward events may not be of much consequence to the patient, assuredly they reflect little credit on the surgeon, or on the art which he professes.

On the dead subject it is not necessary to provide all that may be required on the living; but, for the sake of illustration, I shall suppose a case occurring in practice, in which event, then, to make sure that all the requisite apparatus for an operation is provided, the best plan is to lay everything in order on a small table or tray, which can be placed near the surgeon; as, for example, in a capital amputation, they may be placed thus: the knife, to cut the soft parts; saw to divide the bones; cutting forceps to remove spiculæ of bone; forceps and tenaculum to lay hold of the arteries requiring to be tied; ligatures to apply to these vessels; needles with thread to stitch the wound; straps of adhesive plaster, lint, and bandages, to dress it; sponges with water, cold and hot, to wipe away the blood; and such other apparatus as, from the circumstances of the case, the surgeon may deem requisite: moreover, no capital operation should ever be commenced without some cordial being ready, in case the patient should grow faint. Wine is generally provided on such occasions; but it may be well in some instances to have stronger stimulants at hand, as brandy, whiskey, or carbonate of ammonia. The quantity of wine which a patient will take during the performance of a severe and protracted operation is often remarkable; and this should be kept in view when a formidable operation is contemplated. Some time ago, in performing amputation in the thigh, an accident occurred with the tourniquet, and the patient, already much exhausted by disease, grew faint from the sudden loss of blood, as well as from the shock of the operation: his pulse was gone at the wrists, and scarcely to be felt in the arms; his face was pale, cold, and clammy, and his eyes had the glassy stare of speedy dissolution; yet he was roused from this alarming state by the rapid exhibition of wine, having in the course of a few minutes swallowed fourteen ounces of that fluid.

Besides these arrangements, some previous understanding ought to exist between the surgeon and assistants, who must, of necessity, be present at a capital operation. One must be placed to compress the main artery, if a tourniquet is not used; another, supposing the operation is an amputation, to retract the flaps; a third to hand the instruments or take them from the surgeon; a fourth to take charge of the sponges and warm water; there may be others to assist in securing the patient during his struggles, and of course if a large portion of a limb is to be removed, an assistant must be instructed to keep it steady during the operation, and to lay it aside as soon as it is separated. When the surgeon has it in his power to provide a sufficient number of assistants, he ought always to do so; occasionally, how-

ever, he must economize his forces, which he will have little difficulty in doing, if he be possessed of that natural coolness, aptitude in emergencies, and knowledge of what he is about, which are almost equally essential to the welfare of his patient and his own comfort.

Fig. 18.

There are various instruments and apparatus in constant use in operations on the living body, which are but rarely used either in dissections, or in operations on the subject, with which, nevertheless, the young surgeon requires to become acquainted, and which I think, may, in a work of this kind, be advantageously referred to at the present time.

The probe (fig. 18), which is here represented of its ordinary shape but slightly diminished in size, being usually about five inches in length, is a simple instrument of great service in the practice of surgery. With it the course of deep wounds and sinuses, the presence of foreign bodies, the condition of bones, and a variety of important knowledge can be ascertained: it is of use in many operations, and though the finger is a preferable probe, when its presence is admissible, the silver rod is altogether so serviceable, that the surgeon cannot possibly dispense with its use. It ought to be made of pure silver, so that it will not readily break on being bent: one extremity (the point) is rounded off, and a little larger than the body, the other is generally made with a slit (or eye), through which a thread may be passed, when it is wished to employ the probe for the purpose of drawing a thread or seton through a sinus, passing a ligature under an artery, or for other objects, as shall be more particularly stated afterwards. Other metals are occasionally substituted for silver, and other shapes and sizes may be required to track a sinus or wound, or to detect a deep-seated foreign substance. The sound or searcher, which is used to detect a stone in the bladder, is a modification of the probe adapted to the peculiar circumstances of the case; but, for ordinary purposes, that now referred to, is best adapted for the surgeon's pocket-case of instruments.

Fig. 19.

A director (fig. 19) is sometimes of use, partly as a probe, and partly to guide a cutting instrument in a desired course. It may very generally be dispensed with, as the finger is much to be preferred even in cases where this instrument is by some considered absolutely necessary, as, for example, in cutting the stricture in hernia, on which occasion the finger is the best and safest guide for the bistoury. I have known a surgeon push a director into the gut in this operation, and thus inflict an injury by using it, which it was his object to avoid with the point of the bistoury. There are instances, however, where it will be highly proper to use this instrument; and, on many occasions, it will be found serviceable, in permitting a tolerably free escape of matter through its groove, when it has been thought advisable to open an abscess by a puncture: indeed, some have recommended an instrument of a similar construction with a sharp point, called an "exploring needle," to be thrust into swellings of doubtful nature, so as to allow of blood or matter, if either be present, to flow along the groove. On such occasions, I am in the habit of passing a bistoury into the seat of disease, and by gently turning it half round on its long axis, I make a sufficient opening to permit the exit of a few drops of blood or matter; or, should there be any apparent obstruction, I then pass the common director along the flat surface of the blade, which is next withdrawn, whilst the matter, if any be present, is evacuated through the groove. This instrument is generally made of silver, of the shape and appearance here exhibited, and between four and five inches in length. The handle may either be flat, of a triangular shape, or in the resemblance of a small oblong spoon, like that in the sketch.

CHAPTER III.

MEANS AND INSTRUMENTS FOR SUPPRESSING HEMORRHAGE.

THE means and instruments for temporary suppression of bleeding from wounded arteries, (the most troublesome and also the most formidable occurrence in all cutting operations on the living body,) are few and simple, in the hands of a good surgeon. In amputations of large portions of the extremities, a slight degree of pressure with the fingers or thumbs, will, if judiciously applied over the main artery, be sufficient.

Fig. 20.

On the upper extremity the circulation may be readily arrested with the fingers thus (fig. 20): if their points are properly placed over the artery, a very slight force suffices, and any part of the arm may be selected.

In all amputations of the lower extremity, when such pressure is required, it had better be made on the brim of the pelvis thus (fig. 21): if made lower down much additional force is necessary; and,

Fig. 21.

even then, is not always effectual. Occasionally the circulation is stopped in the leg by thrusting the fingers into the ham; but unless the patient be much emaciated, and considerable force is used, the plan is far from being a certain one. Some consider it advantageous to compress as near to the place of operation as possible, in the likelihood of less blood being lost than when done at a distance; the principle is a good one, when judiciously acted on; but, in attempting to put it into effect, care must be taken that no impediment is cast on the due performance of the operation,—as by preventing a proper retraction of the soft parts, and, also, that the pressure is not applied in a situation where it will be of little or no avail.

In the generality of instances, I prefer having the pressure applied

over the brim of the pelvis, considering that the ease and efficiency with which it is done, are fully equivalent to the loss of the small additional quantity of blood, intended to be saved by applying it lower down.

In either the lower or upper extremity, compression may be applied in a variety of places, as will be afterwards explained in describing the different amputations and other operations.

Fig. 22.

For the purposes above alluded to, most surgeons prefer the tourniquet (fig. 22), as being in general more trustworthy than the fingers of assistants, which in protracted operations become fatigued and benumbed.

On the upper extremity, the tourniquet is generally applied about the situation indicated in figure 23; but any other part between the

arm-pit and elbow may, according to circumstances, answer equally well.

Fig. 23.

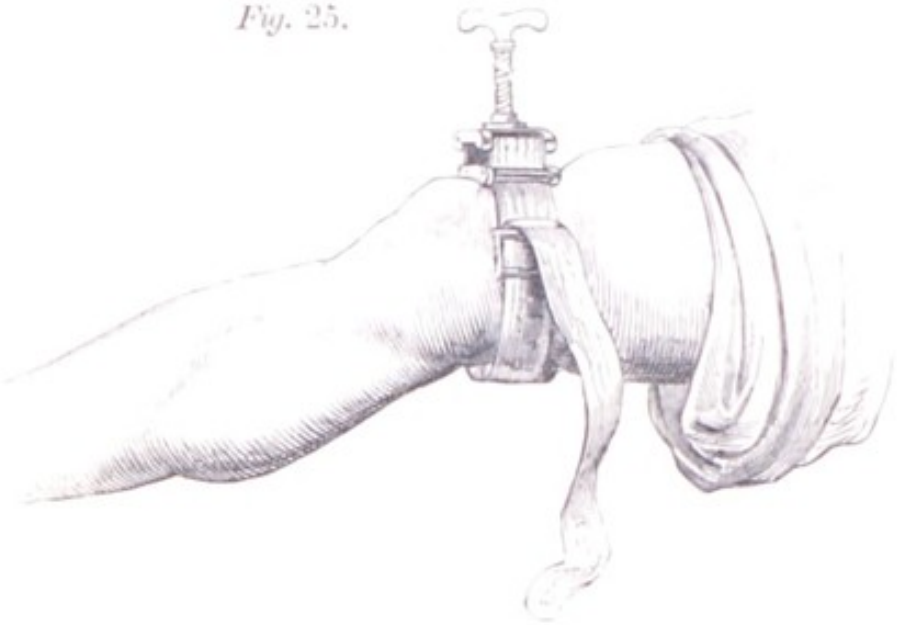
On the lower limb, the place usually selected for the application of this instrument is the upper third of the thigh, as represented in sketch 24. If amputation in the thigh is to be performed, it should be placed as high as possible; and it should always be remembered that its presence impedes the retraction of the soft parts. In amputations of the leg or foot, some place it on the lower third of the thigh, a large pad, proportioned to the depth of the popliteal space, being used on the occasion, and I give a decided preference to this situation in such operations.

If the instrument is properly applied at the knee, in the position represented in figure 25, amputation may be performed anywhere between the knee and ankle, without the loss of a single ounce of blood; and so far from the pressure being less effective in this situation than elsewhere, I deem it the most eligible of all the extent of the lower extremity, when the operation is to be done below the knee.

The tourniquet may be applied to either extremity, as here exhibited, in the following manner: a pad, such as is seen in the sketch

Fig. 24.

Fig. 25.



on the strap of the instrument, may be used; or, what I consider better (such as exhibited in the other cuts), a hard roll of calico, about two inches in length and one in thickness, is to be put on the skin over and parallel with the course of the main artery, and secured there by one or two turns of its free end; the strap of the instrument is then to be carried round the limb, and fastened by means of the buckle, when the requisite amount of pressure can be applied by turning the screw. The latter movement effects the separation of the two plates with which the strap is connected, and thus diminishes the circumference of that part which is round the limb, and at the same time forces the roller against the artery. If care be not taken in its application, there may be as much danger in trusting to this instrument as to the fingers; the strap must be strong enough not to break on the application of any reasonable degree of force. It seems to me of little consequence on which side the screw is placed: some prefer it over the main artery, others directly on the opposite surface of the limb, but in any way the roller or pad must be directly over the vessel, and the buckle must not be so close to the plates as to come in contact with them, when the screw is turned. After the vessels are cut in an amputation, it is sometimes found necessary to apply additional pressure, which could not possibly be done were the buckle close to the plates. It is of consequence, too, that when the strap is fastened in the buckle, the screw should be immediately turned, for a very slight pressure round the limb, even that occasioned by the weight of the tourniquet, will retard the circulation through the veins, the superficial in particular; and thus, whilst the blood still passes, in its usual full stream, into the lower part of the limb, a considerable accumulation occurs in the veins below the instrument, and a larger quantity is lost during the operation, than can be deemed in accordance with good surgery.

There are other pieces of apparatus which may be used for the same purposes as the tourniquet, but the above, since its invention by Petit, has generally been considered the most perfect, and it is an instrument which every surgeon should have in his possession. Though he may dispense with its use, when surrounded by able assistants, and is himself possessed of great self-confidence, he may, on some occasions, have reason to regret that one has not been at hand; or even should this never be so, he will, at best, only display a degree of foolish vanity in his own resources or good fortune, if, in vaunting of his temerity, he attempts to bring into desuetude an instrument which has the sanction of the highest authorities, and which has been so long considered indispensable in the practice of surgery.

Various pieces of mechanism have been used and recommended, as tourniquets; but I know of none worthy of superseding that just referred to. Of late, a very ingenious and simple foreign contrivance has been exhibited by some of our instrument-makers, consisting of two elliptical bars, joined at two ends by a kind of hinge, where they are so acted on by a screw, that the other two ends, which are pro-

perly padded and covered with leather, can be opened and shut at will. I have made some trials of this machine, but see no reason to alter the opinion above given, regarding the tourniquet.

The fingers, or tourniquet, only afford temporary means of arresting hemorrhage; the open ends of the divided vessels must be secured with ligatures, which are to be applied in the following manner: Each artery which is not likely to cease bleeding without the ligature, is to be taken hold of with the common dissecting forceps, held in the right or left hand of the surgeon, drawn slightly out of its sheath, and separated from the vein or veins in contact with it, when a thread is to be tied round it by an assistant, a little beyond the point of the instrument, with a degree of tightness that will prevent the noose from slipping; and thus each vessel may be closed until nature effects its permanent obliteration.

The thread for a ligature should be a small round cord of hemp or silk, about twelve inches long, possessed of sufficient strength to allow of some force being used in forming the knot; which should be tied in such a way that it will not loosen.

The surgeon's knot (fig. 26), as it is called, which is made by pass-

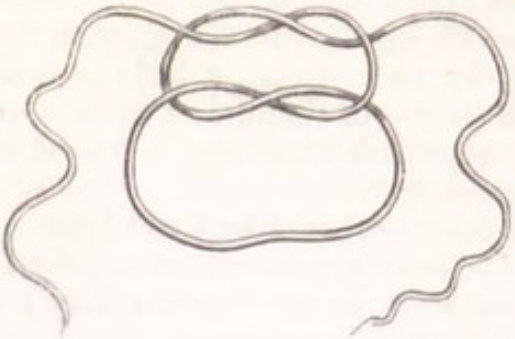
Fig. 26.

ing one end of the thread twice over the other, before turning each end back again to form the second noose, may be applied, but it seems little used by surgeons of the present day, perhaps in consequence of what was stated by Boyer, that Chopart, in the presence of some of the most distinguished professors in Paris, in operating for popliteal aneurism, could not completely restrain the flow of blood by tying the surgeon's knot; a second ligature was applied, and then a third, without success; when, after some deliberation, it was thought advisable to amputate, as it was supposed that the artery was so ossified, that it would not close with a ligature. On examination of the vessel after the operation, it was found in a natural state, and that the knots had not completely closed the canal.

The sailor's or reef-knot, as exhibited in figure 27, when the noose and loops, of course, are drawn tight, will make all secure; but there can be no harm in casting a third turn of the ends, when there is the slightest apprehension of its slipping. One end of the thread should then be cut off, and the other left hanging out of the wound. In all

instances where a wound is dressed with a view to union by the first intention, this plan is preferable to that of cutting away both ends of the ligature, close by the knot; and so far as my experience goes, I would rather even leave both ends, so that as we remove them when free from the artery, the noose may be drawn out at the same time, than leave the noose to find its own way to the surface,—a process

Fig. 27.



which is sometimes both tedious and troublesome, as well as the source of much anxiety and pain to the patient. Taking into consideration the injury inflicted, and the extent of wound when a ligature is required, I deem the presence of one, or even both of its ends, a matter of little additional consequence. I have on many occasions left both ends of a ligature on the main artery, hanging out of the wound (as in the operation for aneurism), without having had cause to regret doing so, and in instances where numerous ligatures have been applied, have had more trouble with some small part of the wound (perhaps the aperture of a stitch) than with the tracks of all the ligatures used. When a wound is expected to heal by granulation, both ends may be cut away; but even here, though I in general practise the plan, much annoyance may be caused by the noose remaining imbedded in the granulations.

The ligature which I generally make use of is small, smooth, and well-spun twine, which as it comes from the shops, is sufficiently stiff, without the aid of bees-wax, to permit a noose to be cast without trouble from the ends being too limber. Silk may be used, but it should not be supposed that the finer material produces less irritation in the wound; indeed I think that some practical surgeons have been far too nice on some points regarding the size and material of ligatures. In my own practice I am in the habit of using a greater number of ligatures than I know to be the custom of other surgeons, often preferring the thread to the chance of the vessel closing naturally, and I feel bound to say, that on no single occasion have I ever had reason to suppose, that any subsequent unpleasant occurrence has been in any way attributable either to the size or number of ligatures. I do not wish it to be imagined, however, that I am an advocate for thick ligatures, or for using more than may be reasonably deemed

proper; but I decidedly recommend a substance of such a bulk that the person who uses it can, in the bustle of an operation, readily feel that there is something between his fingers. Fine dentist's silk I object to, on the latter account, and also because it may possibly cut the textures through altogether, instead of merely making a groove as the other does, sufficient to keep it in its place, until it is separated by nature. Mr. Lawrence recommended fine silk, with the object of cutting away both ends of the ligature, and leaving the smallest possible size of foreign substance (the noose and knot) in the wound; but although the objections stated above may be avoided, by great care and by not pulling too hard, I cannot see any particular advantage in the plan, even though the part left may not weigh more than $\frac{1}{20}$ or $\frac{1}{80}$ part of a grain. I must admit that, in my own practice, in removing both ends (for I have frequently done so), and more particularly in witnessing the practice of my former colleague, Mr. Lizars, who invariably removed both ends in all kinds of wounds, I have not in every instance seen bad results follow; on the contrary, I have seen wounds heal as kindly as could possibly be wished; but I nevertheless believe, that they would have healed equally well had the ends been left on. Sometimes the foreign substances probably remain in the wound, but much more frequently they are carried away in the discharge, either during the first healing of the wound, or by a subsequent process of suppuration. It may happen that a wound will at first close over a thread left in this condition; but, in the course of a few weeks or months, inflammation and swelling come on, then suppuration, and when the abscess is opened, or bursts of its own accord, the noose will make its appearance. This result forms, in my opinion, the principal objection to the practice; if, for example, a patient who has undergone an operation for a scirrhus mamma, be dismissed after the lapse of three weeks or a month, with the wound healed, and some time after, a painful swelling and suppuration occur in the cicatrix, she naturally supposes that there is a return of the original malady, and will not be convinced to the contrary until the abscess has closed; and as it may even then be uncertain if all the knots are away, (for they cannot always be seen, or may be overlooked in the discharges,) she may, during the lapse of a considerable period, still dread that she will again suffer in the same manner.

Fig. 28.

Instead of the ordinary forceps, an instrument with a slide or catch upon it (fig. 28), will occasionally be of service, when no com-

petent assistant is near. When the artery is seized, the blades will remain shut, and the instrument may be allowed to hang till a ligature is applied. The catch may be so put on that it can be slipped out of the way or turned aside, to allow the instrument to be used, at the will of the surgeon, like the common forceps. Various ingenious contrivances exist to make this kind of forceps efficient and of general utility, all of them being modifications of the instruments used by Amussat in torsion of the arteries,—a method of arresting hemorrhage which, though it has been much practised on the continent, has never yet received the sanction of English surgery, and which seems to me to possess such trifling advantages over the ligature, as to induce me still to prefer the latter. The points of the forceps may be finished in the manner represented at p. 7, or they may be constructed as shown in the last sketch. The hook-like point is admirably fitted to seize and hold firm any object, such as an artery, and I have found these forceps, either with or without the catch, of invaluable service in removing small tumours from the neck, axilla, and other such parts, where it is desirable to draw the swelling well out, before using the knife to divide the textures behind.

Fig. 29.

It sometimes happens that the vessels cannot be readily got hold of with the forceps, or cannot be drawn out of their sheaths, so as to allow a thread to be applied. A pointed hook or tenaculum (fig. 29) will then be of advantage; some even prefer it to the forceps on all occasions. The sharp point is thrust through the bleeding vessel and some of the surrounding parts (for we can scarcely include the artery alone, where the parts are condensed) and then raised, so that the thread may be tied beyond the convexity.

Of these methods I give the preference to that with the common forceps, and either of them I consider superior, both in point of facility and security, to that of twisting the ends of the vessels till the blood ceases to flow. Torsion of the main arteries, to suppress hemorrhage, seems to be gaining few advocates among British surgeons; and, so far as my experience enables me to judge, I have never seen reason to change the opinion which I have above expressed: small vessels may, however, be advantageously treated in this way, and such a practice has been long followed among surgeons.

In arresting the flow of blood to particular parts, as for secondary hemorrhage after amputations, or in the operation for the cure of

aneurism, when the main artery is cut down upon at a distance from the disease, an instrument of this kind is generally used,—the common aneurism needle (fig 30), as here represented. Various sorts and shapes are recommended by different surgeons; but one like the sketch will be found most convenient for general purposes. The metal should not bend nor break with moderate force, and the eye should be near the point, which should not be so sharp as to endanger either artery or vein. The handle should resemble that of a common scalpel.

Fig. 30.

When a ligature is applied to an artery, the nearer it is placed to the neighbouring textures, so much the better; great care should be taken, however, that none of these are included, particularly the veins and nerves; and, in operations for aneurism, the less an artery is disturbed in passing the needle and thread under it, so much the more favourable opportunity is supposed to be given for its permanent closure.

In some rare and troublesome cases of bleeding, when the vessel or vessels cannot be got hold of with the forceps, it is necessary in order to arrest the flow of blood, to pass a needle and thread through the textures on each side, so as to include some of the surrounding parts in the noose. Common surgical needles, such as are here represented (fig. 31), may be used for this

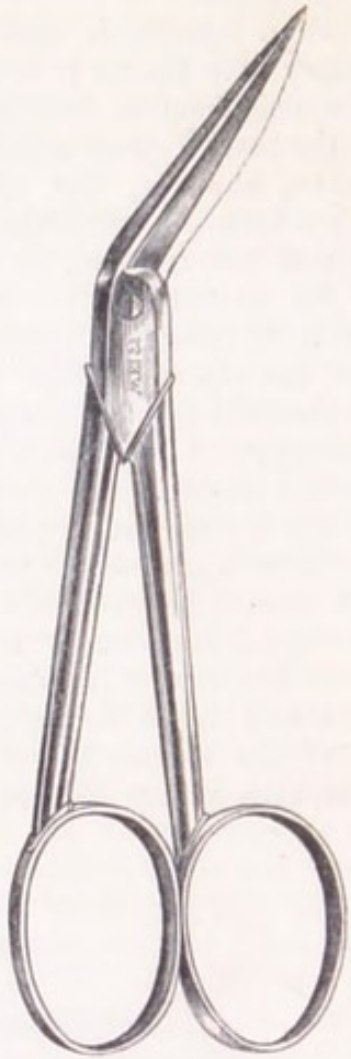
Fig. 31.

purpose, or one of this sort, (fig. 32,) set in a handle like that of the aneurism needle. If the parts be deep-seated and difficult to reach, the latter form will be most convenient, more particularly if some considerable force is required to pass the needle. In passing threads through small tumours, too, such as nævi and hemorrhoids, this kind will be found exceedingly convenient.

When these means are resorted to, a little more than the bleeding-vessel must necessarily be included in the ligature; and though, in general, this circumstance is of no great moment, the rule in surgery ought never to be forgotten, of including the bleeding vessels only, when such a proceeding is practicable.

Fig. 32.

Fig. 33.



The end of each ligature should be cut with scissors, as when a knife is used for the purpose, however sharp its edge may be, it will drag out the end of the vessel, and, besides causing additional pain, may actually separate the ligature. The common dissecting scissors (p. 6) will answer; but there may be danger in some cases from the sharp point, and such as those here exhibited (fig. 33), which, for

the sake of distinction, I shall call the surgical scissors, had better be employed. Their length should be between four and five inches, and the curve near the hinge will be found of advantage on many occasions.

CHAPTER IV.

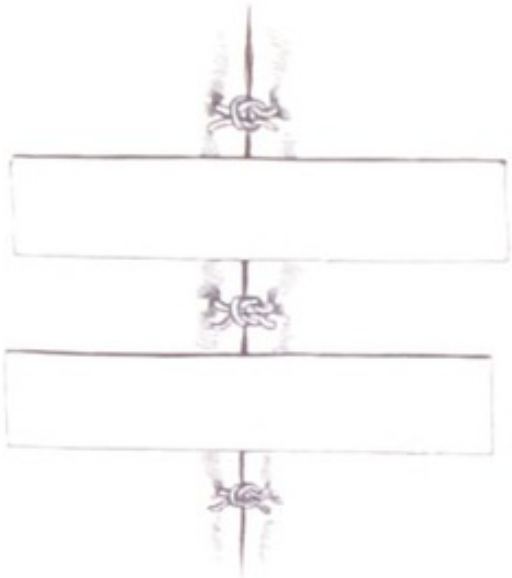
SUTURES. DRESSINGS.

When bleeding has been arrested from a wound, its edges are generally brought in contact, in hopes that they will speedily unite. Various means are resorted to for keeping the cut surfaces in apposition, which characterise the different kinds of sutures. A combination of stitching and bandaging is applied, in almost all instances, where a wound is of such magnitude that its edges gape.

The interrupted suture (fig. 34) is in most frequent use. It is formed by passing a needle and thread, such as are represented on a preceding page (fig. 31), through the skin and subcutaneous cellular texture from without inwards on the one side, and from within outwards on the other, at about the fourth of an inch distant from each margin, and fastening the end of the thread with sufficient tightness to prevent the surfaces from separating. The stitches are proportioned in

Fig. 34.

Fig. 35.



number to the extent of the wound; they are commonly placed about an inch from each other: where the distance is greater, the parts may be supported by a few straps of adhesive plaster, placed between each stitch, thus (fig. 35); and, over all, it is usual to ap-

ply a few turns of a roller, which gives a more uniform support to the whole parts, and thus prevents any dragging on the stitches, from a tendency of the edges of the wound to fall asunder. In a large wound, — a stump, for example, — the roller can seldom be dispensed with.

Some object to stitches in the dressing of wounds, on the ground of the additional pain and irritation they occasion; but I am firmly convinced, from considerable experience, that the pain is amply compensated for, by the security they give, and the irritation seems to me considerably less than that caused by the farrago of straps and bandages often employed instead.

During my connexion with The Royal Infirmary of Edinburgh, as pupil and surgeon, I have had most ample experience of stitches, as they were invariably used by the surgeons of that institution. I cannot remember a single instance where they seemed to have been productive of harm; on the contrary, I often observed their remarkable efficacy. If they are employed in improper cases, or not removed at a proper period, then they may do harm; but the injury in such cases ought to be attributed to the want of surgical skill which has led to their use, and not to the means themselves. Thus, sometimes a surgeon foolishly endeavours to drag the edges of a wound together by means of stitches, when the gap is really so great, and the surrounding parts are so unyielding, that they cannot be approximated without much force, which produces great pain, and, moreover, is certain to bring on speedy ulceration in the site of each thread; also, if the stitches are allowed to remain too long they may do harm by causing ulceration, even in instances when there is no strain upon them. Occasionally, when the threads seem to produce little or no irritation, they should not be meddled with for the first three or four days, but it is doubtful if they are of much service after the first eight-and-forty hours; they are generally, therefore, removed on the second day from their introduction, but there need be no fixed rule for the practice, as the surgeon should allow himself to be guided by circumstances, and use his own discretion as to the proper period. When they are to be removed, the knot should be seized with the dissecting forceps, gently turned aside, and the point of one blade of the surgical scissors insinuated under the thread, which should then be divided, and withdrawn through one of the apertures.

In many instances a bandage is not at all necessary when stitches have been applied, and wherever it can be dispensed with, it will be better to do so; as, in my opinion, the dressing on a wound intended to heal by immediate union, cannot be too light and simple.

A small bit of lint covered with some simple ointment may be laid along the wound over the stitches; but even this may, in general, be dispensed with.

Fig. 36.

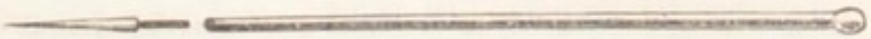
The twisted suture (fig. 36) is often applied with great advantage, in instances when the parts require to be kept very steady, and in particular when some considerable stretching of the neighbouring textures is necessary; as, for example, in the operation for hare-lip. In some cases of this malformation, the interrupted suture will serve to keep the cut surfaces of the lip together; but, in general, the drag upon the threads would be so great in the seat of each stitch, that ulceration would be almost certain to come on; and, supposing the edges of the wound did not separate, much pain and trouble, to say nothing of the unseemly scars that would follow, would be the inevitable result. The twisted suture is, therefore, highly advisable in all such instances, and considering the extent of parts kept steady by the needle and thread, it seems impossible to retain surfaces in contact, on the living body, in a more simple and efficient manner.

Fig. 37.

This kind of suture is made by passing a common sewing needle through the skin and other textures, from one side of the wound to the other, and twisting a thread over each end of it, as represented above, with such a degree of tightness as to keep the surfaces in contact. When two or three needles are used, it may be an additional security to carry the thread from one to the other, in the way represented in the sketch, and in all instances each needle must be passed sufficiently deep to prevent any part of the wound being open behind, as sometimes happens in the lip, where, besides, the labial arteries may still continue to bleed from the surface thus improperly left. After the thread has been applied, the point of each needle should then be cut off with a pair of common pliers, (fig. 37,) similar to those represented here. Various kinds of instruments have been recommended for this purpose, but I have found none so convenient, either as to efficiency or price, as those used by the workers in wire.

Needles made of gold or silver have been recommended and used for the above purpose, with steel points, which can be screwed off and on at pleasure, (fig. 38,) under the absurd idea that

Fig. 38.



these precious materials are less irritating to the parts than the baser metal. The polished surface of the common sewing needle, is as little likely to do harm as that of either of the other metals, it possesses greater proportional strength, and its size is likely to produce less pain and irritation than the more clumsy instrument above referred to. A needle of this size, (fig. 39,) with the eye covered with a bit of sealing-wax, to enable the

Fig. 39.

surgeon to push it through the textures, will answer for general purposes. It is such as was recommended by John Bell, with the addition of the round head of wax, whereby the surgeon can dispense with any assistance from the *port-aiguille*, or the handle of a tambouring needle. Of late I have frequently used a needle made expressly for the twisted suture. It is flat and sharp at the point, and makes its way more readily than the common needle; it is, moreover, not so highly tempered, and its point can, therefore, be more readily snipped off with the pliers, whose edges will always suffer from the hardness of the former.

The thread for sutures should be a little thicker than that for tying arteries. For the common stitch nothing answers better than ordinary linen thread doubled, but I prefer a bit of thin twine for the twisted suture; and with either of these, as also with the ligatures for arteries, if the material appears too limber, a little bees-wax on the surface may be advantageously used, to prevent entanglement, and to facilitate the casting of the noose as already explained at p. 25.

In consequence of the recommendation of Mr. Nunnely, I have lately used caoutchouc thread for the interrupted suture, but after giving it repeated trials, it seems to me, for various reasons, inferior to the common silk or linen thread. It is more difficult to procure; the slightest stretching causes it to extend irregularly; it becomes thin at one part and thick at another; it curls up into knots, and is not so readily fastened as the common thread; and when I add, that it does not seem to produce less irritation than that for which it has been substituted, and is, besides, somewhat more troublesome

to remove, I think I have given sufficient grounds for the opinion above expressed.

Other sutures are described by surgical authors, but they are seldom used in practice; and, so far as my experience goes, I am inclined to think that with either of the above, slightly modified by circumstances, all the desired objects of the suture can be obtained. In a deep wound, for example, I would prefer passing the thread or needle deep in proportion (taking care, however, not to carry either under important textures,) to the complicated, trifling, and inefficient quilled suture recommended by some. In certain parts of the body, as in the female perineum, a straight needle can scarcely be passed so as to penetrate deeply, but one of a curved form, such as may be seen at p. 29, can be used either for the interrupted or twisted suture.

In the twisted suture, as in that previously described, the needles should be removed on the second or third day. Removing them earlier might be attended with danger of the wound opening; and leaving them longer might cause such irritation as to produce a similar result. In some persons they occasion little or no evil when allowed to remain; but, on the other hand, I doubt if their presence is of any service after the first eight-and-forty hours, though I have, nevertheless, frequently allowed three and four days to elapse without interfering with them at all. In removing these sutures, the wax on the needle should be seized betwixt the fore-finger and thumb, or by the forceps, and with a gentle twirling motion the needle should be withdrawn. The threads may possibly remain, and as they may still give some support, and cannot produce any harm, they had better be allowed to drop away of their own accord. It is scarcely necessary to state, that the parts should be kept as steady as possible whilst these proceedings are going on. The withdrawal of the needle is apt to be attended with a sudden jerk, and care should be taken to avoid it, by also keeping a steady command over this instrument

After the removal of any kind of suture, although the surfaces of the wound may have united, it is good practice in general, to re-apply straps and bandages, so as to give support to the tender adhesions. Sometimes straps alone will suffice; at other times a bandage may seem best: commonly both at once will be found most efficient. If the wound has not united, a variety of dressings may be required, as will be noticed in the chapters on suppuration and granulation, and here I may refer to the chapter on wounds, and to my remarks on dressing stumps, for further illustrations of this department of practical surgery.

CHAPTER V.

INCISIONS.

It would be impossible, or, at all events, a useless proceeding, to lay down any set of rules, to which the dissector or surgeon is to give a strict adherence, in practising dissections and operations on the dead or living body. I do not intend in this work to describe what may be done on such occasions, but shall now, as in the after parts of the work, content myself with stating what I consider the best methods of procedure, and from time to time referring to such modifications and circumstances as I consider worthy of being noticed. These remarks are, for the purpose of this introduction, very apposite to the subject of incisions, about which so many different directions have been given: indeed, it is no trifling task to study the various lines of incisions, and the different positions for holding the knife whilst making them, which have been described by some authors. To the practised dissector, who of necessity must be familiar with anatomy, such directions are of little service; the different movements of the hand and knife, and the different incisions, are done by him instinctively, as it were; and they are in some respects still less serviceable to him who is ignorant of anatomy. It is not merely by holding a knife in a certain position, or making an incision of a definite length or form on the surface of the body, that an operation is to be performed: unless a person has a competent familiarity with the structures under the surface, he will do well not to interfere with cutting operations, and I cannot avoid stating here my decided aversion to the method of teaching how to find certain parts,—arteries, for example,—by drawing lines on the surface of the body. With few exceptions, the system is a bad one; for no sooner is an incision made than the line is in a manner lost, and the incision itself may inadvertently be drawn to one side or the other, by the surgeon or by an assistant, so as to be completely off the parts over which it was originally made. Undoubtedly a knowledge of the appearance of textures is of infinitely more value to the operator; and he who can distinguish each by the touch and sight (which can be properly done by him only who has had a previous course of dissections), may satisfy himself, that he is possessed of that legitimate knowledge, which alone ought to embolden him to operate on the living body.

Notwithstanding these observations, I deem it necessary, in a work of this kind, to make a few general remarks on those incisions that are in most frequent use; and also, as I shall do in the progress of the work, to describe the most approved incisions for each operation.

Fig. 40.

The simple incision (fig. 40), consisting of a straight line, is the one in most common use, and ought on all occasions to be preferred when the circumstances will permit, as there is not only less injury done to the parts than by any other, but, in addition, the scar left is less observable. It is more readily made, too, than most others, and its edges can be more accurately brought together.

To effect this incision, the point of the scalpel, or bistoury, held as shown on some of the early pages, should be thrust into the skin at a right angle with the surface; the wrist should then be depressed, and the edge inclined upon the skin; when, after a requisite length of incision has been made, the wrist should be elevated, and the instrument, ere it is withdrawn, should again be held nearly at the same angle as when introduced. In this way no "tail," as it is technically called, is left in the incision, or, in other words, there is no scratch made on the surface at the beginning and end of the wound, (which merely causes pain to the patient without being of any advantage in the operation,) but a fair cut through the skin, which is fully available for the purpose of reaching the subjacent parts, in proportion to its extent, which latter may vary from the smallest imaginable length to twelve inches or more.

Occasionally, such a wound may be advantageously made by pinching up the skin between the fore and middle finger of the left hand, then thrusting the knife through both layers at once, and cutting outwards: indeed, when the skin is very loose, this is perhaps the best manœuvre;—as in the removal of small tumours, or the operation for crural hernia, when the integuments have not become inflamed, or firmly adherent to the parts underneath.

The semilunar incision (fig. 41) is in almost as frequent use as the one above described. It is made by carrying the knife in a lunated direction, as shown below, with similar movements of the wrist, and the same care that the whole thickness of the skin is divided, the convexity being upwards or downwards as may be deemed best.

Fig. 41.

Fig. 42.

Fig. 43.

When a large extent of the subjacent parts must be exposed, a crucial incision (fig. 42) may be made; or wounds may be devised after the form of different letters, such as figs. 43, 44, 45, and 46, with the

Fig. 44.

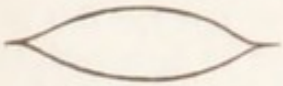
Fig. 45.

Fig. 46.

points at the side, uppermost, or in any other convenient place, whereby one flap or more can be shaped out, elevated by dissection, and replaced after the operation is accomplished. These, it will be perceived, are merely simple incisions meeting each other at certain angles.

When it is necessary to remove a portion of integument, as in the extirpation of a diseased mamma, or large tumour, an ellipsis (fig. 47) may be described, by two semilunar incisions, and the parts within the figure removed with the disease. The cut edges in such cases when placed together form a single line, unless a very large portion of skin has been taken away, when probably they cannot be brought into apposition.

Fig. 47.



There are various modifications of these incisions which are had recourse to in different operations, as will be afterwards shown; and, from time to time, the surgeon meets with diseases requiring operation, where it is necessary to set aside all general rules, and to shape his incisions in such a way as he judges best fitted to the peculiarities of each case.

CHAPTER VI.

LANCET. LEECHES. CUPPING.

Some notice of certain means of practice and minor operations (as they are usually called), may be more conveniently introduced here than at any other part of this work. Besides the cutting instruments, already referred to, the lancet is indispensable in general practice, for although its use has in a great measure been superseded by the bistoury, in the hands of the modern surgeon, it is undoubtedly more applicable to certain proceedings than that or any other cutting instrument. The shape and manner of holding it are exhibited at another page, where it is represented as applied to its legitimate purpose,—that of opening a vein at the elbow. It may still, however, be considered the fittest instrument for sundry other operations, as in making the slight scratch in the skin in vaccination, or in opening small superficial abscesses, such as the pimple and boil, or in puncturing vesicles, although for the latter purpose a common pin will answer equally well. Sometimes the lancet is used for the purpose of dividing small vessels near the surface. In certain forms of inflammation of the eye, for example, it is more efficient than any other cutting instrument, chiefly, perhaps, in consequence of the fineness of its edge. It may be used to divide certain enlarged vessels, such as are so frequently seen in chronic conjunctivitis, or in the acute forms of the disease, when this membrane becomes infiltrated with serum and blood. In

other instances the lancet is used for the purpose of opening the skin, in great tension of that texture from effusion of serum, as in anasarca, and also in the œdema resulting from erysipelatous inflammation. The scalpel, or bistoury, is often used in these cases; but many practitioners object to long incisions, more particularly in anasarca, and as the lancet makes openings sufficiently large for the purposes they have in view, they give it the preference. For all those proceedings the instrument is held between the thumb and forefinger, as afterwards represented, the position of the hand being occasionally varied according to circumstances. Sometimes the instrument is merely thrust in, so as to make a puncture, when it is withdrawn immediately, whilst at other times it is carried along, so as to make a wound of some length; but for the latter purpose it is certainly less efficient than one of a more substantial size. Formerly a larger lancet was generally preferred for opening abscesses near the surface; but I can scarcely say that I have seen one of the kind for the last ten years, the scalpel or bistoury having been always used instead.

When the lancet is used for the purpose of abstracting blood, it is generally in instances where a large vein, or an artery, such as the temporal, is to be opened; but, by making, with such an instrument, a variety of punctures in the skin, a considerable quantity may be allowed to escape, more especially if means are used to promote its flow. Such means are found in the various forms of cupping apparatus. Instead of a single lancet, held between the fingers and thumb, being used to make the punctures, a number of blades, six, nine, or twelve, are placed in a brass case, and so connected with springs, that by proper management, the whole of them may be carried through the surface in an instant, with a rapidity as great as the motion of a gun-lock; and then, to promote the flow of blood, an exhausted receiver is placed over the wounds. The latter is usually made of glass, and various shapes and sizes have been recommended and used. The air has been exhausted in a variety of ways, too, as by the mouth, for example, the most ancient of all, applied either directly to the wound, or to an opening in the upper end of the receiver: a syringe has been used for the same purpose, or another receiver, from which the air has already been pumped out, has been placed over the cup covering the wound; but the flame of a spirit-lamp seems most in service with those who practise this operation. There are few instances in which local blood-letting is required where cupping will not be found applicable; but in some the lancet only can be used, or else leeches; and there are certain cases where these seem the most applicable. On the hands or feet, the gums, the cervix uteri, or on hemorrhoidal tumours, leeches are usually deemed more advisable than the lancet. A variety of circumstances may dictate the preference of one of these methods over the other, for abstracting blood locally; but I need not detain my readers to point out what common sense and observation may render apparent: for the sake of illustration, however, I may state that, on

the face the lancets might leave unseemly scars, and, in addition, the glasses could not be advantageously applied, owing to the irregularity of the surface. Here, therefore, leeches are to be preferred, as in the case of ophthalmia, when they are set on the eyelids.

I know of no objection to leeches on any part of the body under circumstances requiring local depletion, excepting such as reason might dictate; yet the latter seems with some to admit of most unbounded liberties, for I have known a person allow a leech to fasten on the cornea, in an instance where the surgeon had ordered a number to be applied to the eyelids. To those who know that the wound inflicted by the bite of this animal would be certain to occasion opacity of this transparent part, (and what Tyro in the profession should not know the likely result of such an injury?) it may appear supererogatory to limit the bite of the leech to the skin, or at most, to the mucous membrane of the eyelids, or that covering the sclerotic; but the mistake above alluded to, must, with them, plead my excuse for offering an advice to others who may be less familiar with such matters. With this exception, and the still more apparent one of not placing these animals on such parts as may enable them to crawl out of sight into any of the cavities, I know of no instance where they may not be applied. I have used them extensively on the raw surface of ulcers, and also on parts affected with erysipelas, and have never had reason to trace the slightest harm from their application: in the former case, I have had much reason to be satisfied with their services; and in the latter, I have never seen a single example where mortification of the bitten part could be attributed to the injury of the leech bite.

The necessity for diligent fomentation after the use of lancets, or the application of leeches, ought not to be forgotten, nor should the difficulty of arresting the bleeding from the bites of the latter be overlooked. In the adult it can scarcely be imagined that prolonged bleeding from one or more of these wounds can ever be productive of harm; but in an infant, after a leech has been applied, there may be danger; or, at all events, the continued oozing may be a source of much alarm to the parents and attendants: in such a case, if any ordinary astringent, such as cold air, cold water, solutions of the sulphates of alum, zinc, or copper, which may be at hand, will not check the flow of blood, the lunar caustic may be used, or what will be still more certain, a fine needle may be thrust across the skin in the seat of the wound, and a thread tied over it, as in making the twisted suture (p. 33): indeed, I believe that this plan will be productive of less pain to the little patient than the caustic.

CHAPTER VII.

COUNTER-IRRITANTS. CAUSTICS. CAUTERIES. ISSUES. SETONS.

THE various means of counter-irritation are not unworthy of notice here. Perhaps the simplest of all such means is that of hand-rubbing, with the bare palm, or with a little olive oil, or more stimulating fluid in the shape of a liniment or soft ointment, or perhaps with the dry towel or flesh-brush; but all of these are in such common use among the non-initiated, that I need not do more than allude to them here, although I am inclined to think, that frictions and manipulations are less resorted to in the practice of surgery than they really deserve. Perhaps these means may scarcely be deemed worthy of being held as counter-irritants; yet, in some instances, I believe they are so, whilst in others they seem to be direct stimulants, either by inducing nervous or muscular action, or an increase in vascular excitement, whether arterial or absorbent.

I conceive dry cupping to be a source of considerable counter-irritation, and feel assured that the practice is far less resorted to, among modern surgeons, than it deserves to be. The method of dry cupping consists in using the receivers, or glasses, and exhausting the air from them before or after they are placed over any particular part. The increase of blood in the part within the vacuum seems, in some instances, to produce as good an effect as a blister, or even a more severe form of counter-irritant, such as the caustic or cautery; indeed, I have in some instances perceived more benefit from the dry cupping than from any such severe measures. In certain cases of deep-seated pain in the spine, in the hip, or in the knee, I have known the practice to be attended with vast benefit; and, although I am far from considering it as an infallible remedy, I do not hesitate to speak highly in its favour.

Amongst the various ointments which have been used as counter-irritants, I know of none which has been so much used, or which possesses such powerful influence on the skin, as that formed by the combination of a drachm of tartar emetic with an ounce of spermaceti ointment. Sometimes it is used with a smaller proportion of the salt, and it seldom fails, when rubbed in small quantities on the skin night and morning, of producing a crop of pustules, which cannot but be of service, if counter-irritation is likely to be of any avail at all. Sinapisms and blisters need no particular comments here: the former I believe to be, if properly made and applied, nearly as powerful as the latter, and the modern preparations of cantharides, in the shape of blistering fluids and papers, I look upon as great improvements on the older ointments and plasters. In warm climates, and in all diseases,

when it is of consequence to induce vesication rapidly, I imagine that these latter means, which produce their effects in the course of three or four hours, may be resorted to with great advantage. It should not be forgotten that if these irritants to the skin be often repeated, they may actually destroy the vitality of the surface; thus small sloughs are by no means unusual where the tartar emetic ointment has been used, and extensive mortification of the skin has been known to follow the application of a blister. In children this is more likely to happen than in the adult; and I have known death to be the result of such an occurrence.

Some seem to consider that the nitrate of silver, when rubbed freely over the cuticle, produces a stronger effect than the cantharides; but I do not imagine so, and therefore, when I wish to apply a more sure degree of counter-irritation than can be produced by the means above referred to, I frequently apply the caustic potash. This preparation is generally used thus: a slip of adhesive plaster is placed over the skin, having a hole in its centre, perhaps an inch long and half an inch broad, or of such other size and shape as may be deemed advisable: this hole being placed opposite or over the deep-seated pain, a bit of the stick of caustic, moistened with water, is rubbed on the surface until it assumes a grayish colour, and the opening seems filled with the caustic in a fluid state, when another piece of plaster, without any hole in it, is placed over that already present, and over all a poultice may be applied immediately. In a few hours the pain will be excessive, and a portion of the skin will be killed by the caustic, and converted into a slough, which will separate in the course of time, under the use of poultices, and other measures to be afterwards taken notice of. Occasionally, instead of rubbing on the stick of caustic, a portion of the size of a pea is placed on the skin, and allowed to deliquesce slowly, being retained there by a piece of plaster put over it.

Instead of the potash some resort to actual fire as a counter-irritant, and the moxa is then put into requisition. The moxa may be made of any material which will burn readily; but perhaps the most convenient will be a little wadding cotton, or if that be not at hand, a little tow or surgeon's lint, which has been previously dipped in a weak solution of nitrate of potash, well dried, and then stuffed into a small pill-pox, with both its ends open. The box should then be held over the part about to be burnt, by means of a bit of wire twisted round it, or a kind of forceps made for the purpose, and, after ignition, the combustion should be kept up by means of a long blow-pipe, or a pair of bellows. The moxa is sometimes merely held over the skin so as to excite a glow, but more frequently the ignited material is held close upon the surface, so as to destroy its vitality at once. When the substance is nearly burnt out, the patient experiences acute pain, and the skin may be observed to shrivel and become brown under the intense heat. At the end of the process, a fold of lint, moistened with cold water, should be applied, and in the

course of an hour or two should be succeeded by a poultice. Instead of applying heat in this way, some prefer to cauterize with the heated iron, thus producing death of the part touched with the metal, in a more rapid manner than with the moxa.

Of these three modes of counter-irritation, I give a decided preference to the last. The caustic potash (the potential cautery, as it is usually termed) produces its effects far more slowly, and with less certainty, than either of the other two, being in some instances apt to go deeper than might be wished, or to spread too extensively over the surface; and it is chiefly on the latter account that the plaster with the hole in it is recommended, as a preventive. The moxa is troublesome to apply effectively; and often, after the patient has been put to a deal of pain, its results on the surface are so limited that the counter-irritation is slight indeed. My old colleague, Mr. Lizars, used the potash most extensively, and the groans and stifled screams of agony heard in his wards a few hours after his visit, bore ample testimony to the pain which it produced: I have myself used it frequently, and, of course, must plead guilty of the same kind of cruelty. The moxa, I believe, produces much more acute pain than the caustic, and possesses no advantage over it that I am aware of. At one time I used this remedy pretty often, but for the reasons above stated I have latterly almost entirely given it up; and now, when I have the power of selection, I almost invariably resort to the heated iron,—the actual cautery, as it is usually termed, in contra-distinction to the potential, the same term being commonly given to the moxa also.

The horrors and cruelties attending the use of the heated iron in former times, afforded too good reason for the neglect with which it was subsequently treated; and it cannot be thought wonderful that, when men high in the profession, disputed about the superiority of gold or iron as a cautery, about the shape and size of the instruments, and also the smallest number with which it was possible to practise surgery, and when, moreover, it was the custom to apply it in every disease to which the human frame is liable, the character of the profession suffered, and as it suffered in public estimation, so did that of the once "powerful sceptre,"—the actual cautery. Though there are still many prejudices against it, and certainly many just objections to its indiscriminate use, it seems to be more in vogue among modern surgeons than it once was; and, under judicious guidance, it appears to me a more manageable, equally efficient, and less painful counter-irritant than either of those last mentioned. It is, besides, highly serviceable in arresting hemorrhage, when no other means will answer, and is altogether of much use in surgery, as will be explained more particularly afterwards. It must be confessed, however, that there is an appearance of rudeness and cruelty in its application, which must always render its frequent use objectionable in modern practice.

In continental hospitals surgeons often take greater liberties with their patients than is the custom in this country, and the cautery seems in more general use with them than with us. Many persons

imagine that we need be less nice about the feelings of patients in hospitals than of those in private practice; but with reference to the cautery, I see no reason why this should be so; and as it will seldom happen that a person, whatever his circumstances in life may be, will anticipate with calmness the idea of the contact of heated iron, and will not prefer what he is led to consider a milder and less painful application, the opportunities for using it are probably not so often met with as its utility deserves. The effect which the seeming cruelty has upon the neighbouring patients in a hospital, and the character for rudeness which the surgeon who persists in using it frequently may acquire, often cause it to be dispensed with, even among its most strenuous advocates; yet one cannot but hold in contempt that so-called "amiable sensitiveness" of the practitioner, who, whilst he objects to the application of the heated iron, because it is used upon horses, and because, too, it is a coarse, vulgar, and seemingly unscientific remedy, will practise a wilful imposition by means of caustics, which do their work after he has left the house, but certainly with a greater amount of pain. Such a person is one of those "amiable" beings, too, who will open an abscess by the repeated application of the caustic potash, because, forsooth! the use of a knife is a painful expedient, although, in reality, the pain of the latter, however acute it may be, is probably not greater at any moment, nor does it continue for a hundredth part of the time that the other lasts.

Various shapes and sizes of cautery will be found of service. Thus, if it be desired to touch merely a small point,—as the orifice of a bleeding vessel, a bit of wire will suffice, or there may be a small bulb at the end of a fine rod of iron; but when a large surface requires to be seared, a ball of metal the size of a boy's marble or of a walnut may be necessary. Sometimes a large flat surface is best, whilst on other occasions a narrow edge may be thought most desirable.

In certain hemorrhages, as when a vessel has run in a bone, I have seen the cautery effectual; but I confess that I do not admire its use in cases where it is intended to burn out diseases which are beyond the reach of the knife. In malignant tumours of the jaws, for example, the custom has been but too prevalent of cutting away the bulk of the disease, and trusting to the destructive powers of the cautery, to eradicate the remaining portions. Whenever I have seen this done, no benefit has resulted; and although I do not deny the efficacy of the plan in some instances, I should be very unwilling to undertake an operation with such uncertain means of execution. I used at one time to apply it to carious surfaces; but have now abandoned it for the more efficient and more controllable means with the knife, forceps, saw, and gouge, to be particularly described in after parts of this work.

The use of the cautery to promote the contraction of sinuses, fistulas, and other abnormal orifices, I strongly recommend, and I place great reliance upon it as a counter-irritant.

Instead of applying a ball or single mass of iron, so as to cause a

slough on the surface, an inch or more in length, and perhaps half the breadth, I generally bring a larger extent of surface under its influence, by scoring the skin much in the same way as the operation of firing is done in the horse. The process is slower, and therefore more painful than a single touch of the instrument, but in some cases it presents such advantages, in my opinion, that, when the cautery is actually appealed to, the difference may be overlooked. I was first led to apply it in this way, from drawing some analogy between certain nodes on the tibia and splints on the young horse. In such instances it is well known that when the animal continues lame for a length of time, and when stimulating ointments and blisters have seemingly had no effect, the application of the cautery effects a cure, more particularly if due rest is given afterwards. Although in most instances a painful node requires constitutional treatment as well as local, and differs in almost all respects from what is termed a splint in the lower animal, yet occasionally painful chronic swellings are met with on the surface of the tibia, which have resisted all the ordinary modes of treatment, internal as well as external. Many years ago a case of this kind occurred in my practice. A young man, aged twenty-three, had two years before contracted syphilis, and after the primary symptoms were cured, a node formed on the tibia, which occasioned him much pain:—from being a person of stout appearance, he now seemed like one exhausted by a painful and malignant disease. Before I saw him he had undergone various courses of mercury and other medicines, and had the part repeatedly leeched and blistered. I again subjected him to similar practice, and also tried iodine freely, both internally and externally, but with no mitigation of his sufferings. Rest seemed to produce as little benefit, and his disease was worst at night. For six months I watched the progress of the case, and then I applied the cautery in the mode referred to, and such as is here represented by these lines (fig. 48), each being about half an inch from the other. During the evening he slept better than he had done for three months before, and from that time his disease was cured. I saw him occasionally for years after, and he had never subsequently experienced another twinge of pain in the swelling. I have had similar success in other examples; and though I would not wish any one to imagine, that I predict or would anticipate invariable success from the measure, I cannot but strongly recommend it, in such-like instances, especially where the affection seems to be, and perhaps is, entirely local.

Fig. 48.

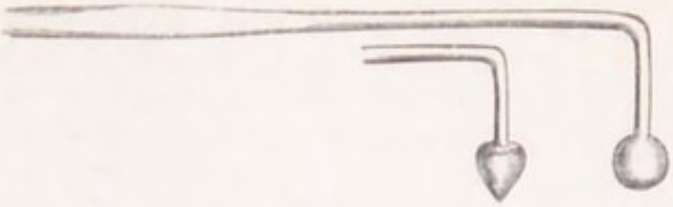
The following cut (fig. 49) exhibits the shape of the instrument I use on these occasions. It will be observed that it is similar to the cauterising iron of the veterinary surgeon. The convex edge of the one I generally use is about one inch and a quarter in extent; but when I

Fig. 49.

wish to cover an extensive surface, as in spinal or hip disease, then I have one of larger dimensions.

The two heads of the cauteries here (fig. 50) represented, are such as are most generally in use among surgeons: the round head, for making large eschars, the pointed one for touching the surface less

Fig. 50.



extensively. Sometimes the instrument is made of a flat button-shape, at other times quadrilateral ; but there can scarcely be a limit to shapes and sizes of such tools, for I have known the most cautious of surgeons, an advocate for the cautery, use almost every shape and size, from a wire,—such as the stilet of a bougie, or a steel bougie itself, to an ordinary fire-poker.

The iron should be heated to a dark red, and its margin, after having been rubbed clean on the hearth-stone, floor, or on a bit of wood, should then be drawn along the skin, as indicated in the preceding sketch, the lines being of such a length and number as may be deemed requisite. As soon as the process is completed, lint dipped in cold water should be applied, and renewed from time to time during the lapse of two or three hours, when a poultice should be put over the injured surface. Cold seems to have a good effect at first in allaying the pain.

The chief advantage which I fancy the plan above described to possess is, that sudden excitement is produced over a large surface, whilst at the same time the skin is not destroyed and converted into a slough, as with the caustic or moxa, so as to leave a large open surface, which will heal but slowly, and will always leave a considerable scar. If, on the other hand, a round or flat piece of iron is applied even once to the surface, a slough must be produced, which separates more slowly, and leaves a more troublesome sore than the small lines of sloughs, and the consecutive sores, resulting from the practice above recommended.

There are other counter-irritants which I have occasionally used,

such as the corrosive sublimate, sulphuric and other strong mineral acids, which, however, I do not deem worthy of especial notice here.

Among the different forms of counter-excitement, I may allude to that which has been termed the pea-issue, and to the seton. The former is effected by means of placing a common pea, or a pepper pellet, in a wound made on the surface for its reception, or on a sore already made with caustic, and keeping it there by means of a strip of plaster, so that it acts as a source of excitement and irritation, —the latter effect being further promoted by the addition of some stimulating ointment, such as the savine. So far as I know, this practice is but rarely followed in the present day; and I have myself, in the trials which I have made of it, seen no reason to induce me to recommend it in preference to others. The seton is a remedy which seems to me to be also in less repute than it once was. It is still, however, occasionally used, and from time to time I have met with individuals, somewhat advanced in years, who were bigoted in its favour. Its supposed efficacy in averting apoplexy, and other affections within the head, still induces its frequent necessity, and the introduction of a seton is usually considered a surgical operation. The seton generally consists of a cord of worsted, cotton, hemp, or silk thread, passed through and under the skin for the distance of an inch or so. The back of the neck, or the arm, opposite the attachment of the deltoid, is usually selected for its locality; but it may be applied in any region of the body, as over the pubes, in the perineum, loins, or wherever else it may be thought advisable. The thread is commonly conveyed under the skin by means of a large flat needle, about three or four inches long, and a quarter of an inch in breadth, but the necessity for this instrument may generally be avoided by using the bistoury and probe, which are instruments that cannot be dispensed with in the modern pocket-case. When the skin is lax, it should be pinched up betwixt the thumb and fore-finger, and the blade of a bistoury should then be pushed through both layers; the point of the probe should then be carried along the flat surface of the blade, and the cord, which has been previously attached to its eye, should be drawn through after it. Inflammation in the track of the thread will be the speedy result, suppuration soon follows, and the excitement may be kept up for any desired length of time, so long as the foreign substance is allowed to remain, the savine ointment being occasionally useful in promoting further suppuration.

Objections have been made to threads of any kind being used as setons, owing to the filth which accumulates upon them, and I cannot but concur in this objection, although I have nothing to say in favour of the modern substitute in shape of a slip of tape covered with caoutchouc, which also, at best, is but a filthy affair, and often, by the irritation of its sharp margins, makes one glad to supplant it by the common thread.

As a counter-irritant, I place less reliance on the seton than other means already mentioned, but as a direct irritant I esteem it highly; thus, in certain erectile tumours, in sinuses, and in hydrocele, I deem it of much value: its application in these cases will be more appropriately considered in other parts of this volume.

CHAPTER VIII

INFLAMMATION.

THE practical surgery of this work will be found, chiefly in those pages, where the injuries and diseases of the different regions of the body are considered; but certain general principles of treatment are so universally applicable, as to induce me to refer to them at the present stage of our progress; thus saving the necessity of frequent repetitions, and also being more in accordance with the nature of an introduction.

The treatment of inflammation and its consequences constitutes a large and important share of the practice of surgery, and as the disease is met with under so many different aspects and circumstances, even in the ordinary routine of the surgeon's duty, each probably requiring certain modifications, or perhaps decided alterations of practice, I shall now, in accordance with the plan of this work, proceed with such practical remarks on the kinds of inflammation likely to be met with in the diseases and injuries which it is my intention to treat of in the following pages, as may elucidate my own practice, and guide the young surgeon, until he has acquired sufficient experience to act on his own resources.

The common divisions of inflammation into acute, chronic, simple, and specific, answer sufficiently well for general purposes of illustration, although it is often difficult to determine the accuracy of these appellations. The terms "acute," and "chronic," in their ordinary acceptation, clearly indicate that in one case the phenomena of the disease are all developed rapidly, in another slowly; yet practitioners do not in all instances agree on the distinctions which may be thought to constitute acute or chronic action. For example, when inflammation attacks the female mamma, particularly during the period of lactation, and when, in the course of a few days, a large quantity of pus is formed, and from the first attack up to the period of suppuration all the symptoms of inflammation have been well-marked, the meaning of the term "acute," can scarcely be misunderstood; but, on the other hand, a swelling may form in the same part, progress slowly, and, after the lapse of months, within a couple of days, perhaps, there may be every evidence

that matter has formed: here the term "chronic" is usually applied; but, nevertheless, the formation of pus has, in all probability, been a rapid—an "acute" process. The terms "simple" and "specific" are, probably, much more vague in their signification than those referred to: the latter implies a vast deal in the estimation of some, whilst with others there seems really so little precision in the term, that no importance is attached to it. Thus, no difference in action can be pointed out, in inflammation and suppuration of an inguinal gland, occurring where there may be a venereal sore on the genital organs, or one arising from other causes, or where no sore,—no apparent source of irritation, is present; yet, in the instance of chancre many persons would consider the inflammation "specific." It may or it may not arise from the presence of venereal poison in the gland, yet the actions in either case seem precisely alike, nor will they be observed to differ from those occurring in an instance where the origin of the disease cannot be accounted for. The term "specific," when applied in such cases, conveys to my mind no important signification, in so far as the inflammation itself is concerned: but here I beg to be understood, that these observations apply chiefly to the kinds of inflammation which are met with in ordinary surgical practice.

The causes of inflammation are usually sufficiently clear to deserve the term specific; thus, a broken, or dislocated bone, is a sure and specific cause of inflammation; the presence of a foreign substance in any texture, such as a detached fragment of bone, a bullet, bit of wood, cloth, or other extraneous body, is almost certain to bring on the disease, and give it a more severe aspect, the latter resulting entirely from the "specific" irritation or cause. Here, the importance of distinguishing a cause must appear very evident; for if it be discovered, and within the reach or power of the surgeon, its removal, whatever be the means resorted to for the purpose, forms the most important feature of the treatment. These means may be applied in various ways, as the case may require, and if used with success, it seldom happens that nature does not complete the cure; for, under favourable circumstances, (in a young and healthy subject for example,) no sooner is the cause of inflammation removed, than the phenomena of the disease gradually disappear, and the parts return to a state of health, as nearly resembling their normal condition as is compatible with circumstances.

Before resorting to such measures as are deemed most applicable in the treatment of inflammation, it may be well to make sure that the disease actually exists, and in surgical practice, fortunately, the symptoms are generally so well marked as to leave little room for doubt. The common local symptoms of pain, heat, redness, and swelling are, in many instances, so very conspicuous, that no surgeon can for a moment be uncertain about the nature of the disease. There are many examples of this affection, however, wherein some of these local symptoms cannot be appreciated; but, the quick and full pulse,

thirst, headache, dryness of the skin and mucous membranes, brown and dry tongue, buffy blood (if that fluid be drawn), high-coloured and scanty urine, will all give additional and certain indications of the disease. Some of these, even, are not entirely to be depended on, seeing that they may be present without the existence of inflammation; whilst, again, that disease may be in full vigour, and yet the symptoms may be such that the most experienced may be deceived. Exceptions to these observations must be familiar to every one who has seen even a little practice, and it must be acknowledged that ignorance or carelessness will occasionally produce most gross mistakes. One exception I think of sufficient importance to demand notice here, viz., the smallness of the pulse in inflammation of the peritoneum. It is a frequent subject of remark that the unwary are misled by this anomaly; but the experienced practitioner well knows that, after the reduction of a hernia, whether by the taxis or a cutting operation, it is generally a favourable symptom when the pulse becomes fuller, even although it should beat somewhat quicker. If there be pain in a part, and if it depends on inflammation, it is not necessary that the surgeon should perceive either redness or swelling, to enable him to identify the disease: for, in deep-seated parts these latter symptoms are seldom, if ever, to be observed, although the accomplished practitioner may not have a doubt that the disease is in full activity. Thus, in the chest these symptoms cannot be appreciated by the eye or touch; yet, by reference to the pulse and other symptoms, and an appeal to auscultation and percussion, the nature of the affection, if it is inflammation, can scarcely be overlooked. Again, in inflammation of the cartilages, of the hip or shoulder joints, neither redness nor swelling can be perceived; yet the pain which is experienced when the cartilages are rubbed against each other, is sufficient, with the other symptoms, to indicate the presence of the disease.

The consequences of inflammation are often more conspicuous than the disease itself; as for example, suppuration, ulceration, granulation, and gangrene, in all of which the symptoms of inflammation are thrown into the shade, as it were, by the remarkable features peculiar to each, and therefore the treatment of the disease, in all its phases, can only be rightly understood by one who is well acquainted with the nature of these conditions. As it is, in general, a most desirable object, however, to prevent any of these consequences occurring, the chief aim at the commencement of the treatment is to endeavour to do so, and to bring about what is usually called the resolution of the disease,—that is to say, to cause the subsidence of all the symptoms, and to leave the part as if no disease had ever been present. Although this is a result which cannot always be expected, it nevertheless often happens, and whenever it does, it is the most satisfactory that can possibly occur. If the means do not prove sufficient for this end, they may possibly mitigate some of the after consequences; they can seldom do harm; and, unless there be express indications to the

contrary, they should, in some form or other, according to circumstances, be always administered. In one instance the disease, as it is evinced locally, will produce an effect on the constitution, so very slight, that the chief attention of the practitioner may be required and devoted to the seat of the affection, whilst in other examples the constitutional symptoms appear so overwhelming, that all his skill must be displayed in this direction.

It rarely happens that some kind of constitutional treatment will not be of advantage, and in the early stages of the disease, the administration of purgatives, diluents, and diaphoretics, will seldom fail in producing benefit. These will often serve to bring the pulse to a natural standard; but the abstraction of blood by the lancet, from a vein in the arm, will frequently be required in other instances. It is impossible to state the amount which should be drawn in individual cases, for scarcely any two will be alike, either as regards the character, seat, and violence of the disease, or the constitution and condition of the patient: thus, in inflammation within the cranium, it will be much more correct to abstract a larger quantity than in a case of inflammation of the testicle; in an inflammation in the eye, it might be wiser to take blood more freely than in a similar disease in a lymphatic gland; and in inflammation of the lungs, it would be highly proper to bleed more copiously than in inflammation of the mamma. Again, a young and previously healthy constitution will generally bear the loss of blood better than one in which the energy of youth has become exhausted; and the inhabitants of a crowded city, from locality and other circumstances, are usually deemed less able to bear depletion than those of the rural districts. Different opinions are held on some of these points, however, even amongst the best authorities, and there are few of them which do not afford great scope for speculation. For my own part, when the lancet is deemed necessary, I am inclined to allow the stream to flow until some striking change is produced on the pulse or other symptom, as the pain, or, in the lungs, the difficulty of breathing. When such changes are evinced, then the wound may be closed; in some instances the abstraction of ten or fifteen ounces will suffice; but in others thirty or fifty ounces may flow ere any benefit is derived. It often happens that the practitioner thinks it best to be contented with a certain quantity — perhaps ten or twenty ounces; but if the inflammation be severe or dangerous, and a decided effect is wished from blood-letting, then, as a rule of practice, I should say, that the former plan is preferable to that of judging of the effects of the venesection by the appearances of the blood. It may be hours before the surgeon can again see the patient — probably a day may have elapsed, and should it be found that in the cup occupied by the fluid last drawn, the buffy coat is most distinct, and should it happen, too, that the disease is not in any way ameliorated, then there may be grounds for supposing that much valuable time has been lost, if it is determined again to use the lancet, as in all likelihood it will be. Perhaps, in many instances, the presence or

absence of the buffy coat forms the principal criterion of the state of the disease, although it should not always be depended on; and in numerous examples, I believe, the surgeon will do well to test the immediate efficacy of his practice, by the apparent improvement of the symptoms, resulting from the method of blood-letting, above recommended. The state of the pulse ought not always to be relied upon; for, as I have already mentioned, in some instances it may be smaller, and even slower, than in a state of health; and in certain conditions or peculiarities it may happen, that the heart's action will be so far affected by loss of blood and other causes, as to give that feeling of fulness and strength, which might lead to the supposition of a further depletion being necessary.

Besides these measures, which may be said to constitute the most important parts of the constitutional treatment of inflammation, there are others, which often are of the last consequence, such as opiates, to allay irritation, and stimulants to rouse the depressed and sinking powers of life. The exhibition of camphor, ammonia, and wine, may prove of the utmost value in certain cases, which form, as it were, the exceptions to the general practice of constitutional depletion, which is so universally admitted as being the proper course to pursue in the treatment of this disease. Indeed, in some instances depletion may be carried too far, and unless the practitioner resorts to the use of stimulants, his patient's life will be placed in as great jeopardy by the over-zealous application of the means of cure, as by the original disease.

The diet of the patient may produce great influence for good or evil. It is seldom that authors or teachers neglect to caution against the use of animal food and exciting fluids in the early stages of inflammation, though, in fact, there is but little need to do so; for, so long as the disease is in full vigour, the patient loathes his usual diet, and when he does not, the disease can never be looked upon as of immediate serious importance. It seems to me almost unnecessary to inform the young practitioner that he should not insist on his patient partaking heartily of chop or steak, when he may perceive that he can scarcely admit a morsel into his mouth without experiencing nausea. If the disease has really been formidable, it may be deemed a most favourable symptom when the patient asks for food; and at this period there may be a necessity for caution, as over-exciting food, either from quality or quantity, may greatly retard the progress of cure. It may be requisite, in certain examples, to keep the patient on low diet, not so much for the purpose of curing inflammation, as with a view to prevent its commencement or extension. For example, if a person suffered concussion of the brain from a blow on the head, it would be highly improper to permit full diet, as in such a case, after the first stunning effects have gone off, there may be good reason to dread the occurrence of inflammation; again, if a large joint was wounded, or a large bone severely fractured, a generous stimu-

lating diet might produce those very results which it is the object of the surgeon to obviate, viz., an excess of inflammatory action.

In certain kinds of inflammation, and in certain stages, a full amount of nourishment, both in the way of food and drink, may be productive of the utmost service ; and where digestion and assimilation seem to go on favourably, and whilst the disease seems to improve, it will rarely happen that the practitioner is wrong in permitting their use. In severe local inflammation, such as that of carbuncle, occurring in a debilitated constitution, accustomed perhaps for years to the artificial stimulus of ardent spirits, the latter dare not be omitted ; and if the stomach will bear the additional excitement of a generous and wholesome diet, the system will bear up more vigorously against the depressing effects of disease. Again, in cases of profuse discharge happening at any period of life, nourishing food and a fair proportion of stimulating fluids will be of advantage, provided always that the indulgence does not seem in any way to aggravate the ailments of the patient. At such a period possibly hectic fever may exist, and might be aggravated by an over-liberal allowance. It is, however, impossible to offer set rules as applicable to all kinds of cases, and much must be left to the good sense of the practitioner and discretion of the attendants, or of the patient himself. Among the educated classes, the surgeon has seldom any difficulty in having his wishes and orders fulfilled to the letter; but in the lower ranks it is often necessary to be exceedingly strict and cautious.

The local treatment of inflammation constitutes the peculiar feature of practice, in a large proportion of cases of this disease, which come under the surgeon's care. In many instances the administration of a purge, and some slight modification of diet, such as an intelligent patient might himself adopt, may form all the constitutional treatment required. Local abstraction of blood seems almost always to have a more decided effect on the disease than when a large vein is opened at a distant part ; thus in inflammation of the testicle, of a joint, a bursa, or, in short, any similar local forms of the affection, and whether depending upon a local or constitutional cause, this mode of depletion is, in my opinion, more to be depended upon than the other, although here also there are many exceptions to a general rule. Sometimes, indeed most frequently, it is impossible to reach the actual seat of the disease, as in inflammation within the cranium, the eyes, the ears, spine, hip-joint, and other articulations ; yet in such examples if blood be drawn from the temporal artery or external jugular vein,—from over the mastoid process, the spine, or fleshy part of the hip, more benefit will, in general, result from operations on these parts than by opening a vein at the arm. In severe forms of the disease, both may be combined. In erysipelas, or in severely inflamed wounds or ulcers of the skin, or of certain parts of the mucous membranes, local depletion, in the strictest sense of the term, can be applied, and in such instances the effects are usually very beneficial.

Blood may be abstracted locally, by such means as have already been referred to; and if the part actually affected with inflammation is near or on the surface, I should, in general, prefer leeches, as the method by scarifications, either with or without the cupping-glasses, is usually attended with more pain, and may possibly leave greater marks than those resulting from the leech bites.

Whatever be the means employed for local depletion, warmth is always of service in promoting the flow of blood: whether local bleeding has been resorted to or not, it is seldom that it does not produce a soothing effect on the patient's feelings:—indeed, I believe that it has a specific advantage besides, in encouraging a more general diffusion of blood through all the vessels of the affected part, and also in those immediately around,—at the same time causing the exudation of serum on the surface, and thus, as it were, lessening the quantity of fluid in the seat of disease. Whether these explanations be correct or not, I have no hesitation in recommending warmth as an excellent mode of treating inflammation locally. It should be applied by means of fomentations, by dipping the parts into warm water, by keeping moist cloths over them, or by a poultice. Fomentations are usually applied with a sponge or bit of soft rag. Cloths (surgeons' lint, linen rag, or soft flannel) are usually wrung out of hot water, and their efficacy is greatly enhanced by covering all over with oiled silk or Mackintosh cloth, which has the double effect of preventing evaporation, (thus preserving the warmth,) and keeping the bedclothes dry. These means are often greatly to be preferred to the poultice, although the latter cannot always be dispensed with. In slight inflammation of a finger, for example, if I deemed warmth required, instead of using a poultice, I would wrap the part up in wet lint, and cover it with oiled silk. Moisture and heat are thus more effectually secured than by a poultice, which will soon get cold on the surface, and in a few hours become almost quite dry. On other parts of the body this plan, modified by circumstances, may be resorted to with every advantage, and I cannot speak in terms too laudatory of the "warm-water dressing," as this method is now usually called, which under the influence of many practical surgeons of the day, has in a great measure superseded the more troublesome, and more cumbersome poultice.

It is often customary to use decoctions of chamomile flowers, poppy-heads, solutions of acetate of lead, of opium, or other sedatives, as fomentations. Such adjuncts seem occasionally to allay pain and irritation, but in the majority of cases I believe that warmth and moisture constitute the chief virtues of fomentations. The same fluids have been used to moisten the materials of which poultices have been made, the latter being usually formed of bread, linseed powder, boiled carrot or turnip; and sometimes they seem to enhance the value of the poultice.

Besides the efficacy of warmth as an immediate application to an inflamed part, I believe that when used on the surface, even in deep-

seated inflammation, it is of service in encouraging the flow of blood to the superficial parts, and thus relieving the deep-seated vessels, acting in this way much in the manner of a counter-irritant. In the latter light, too, I look upon the supposed efficacy of bags of heated bran, salt, or sand, which are favourite remedies with some practitioners.

The immediate application of cold has a most decided effect on inflammation, in most instances; but if it does not come into close contact (which is the sense in which the term "immediate" is used above) with the disease, and the greater part of it, too, I am doubtful if it produces the benefit which some seem to imagine. It has a good effect in allaying the heat and pain of a slight burn or scald;—perhaps in such cases, if applied at an early date, it prevents inflammation, but in the severe forms of such injuries its use is inadmissible, or, at all events, very questionable. In certain cases, as, for instance, an inflamed testicle, it seems to diminish the quantity of blood circulating in the superficial vessels, but it probably throws more into the deeper ones, and thus increases the patient's suffering. That such is not always the result, here, as also in other parts, may be admitted, for, were the above argument invariably correct, the utility of cold, in injuries of the head, might be doubted; and though upon the whole I prefer warmth to cold, as a local means of treating inflammation, I would, in many instances, trust greatly to the feelings of a patient, and the seeming effect of the remedy otherwise, in persisting in the use of either one or other.

Cold is seldom used where local bleeding has been resorted to. It is generally applied by means of water, with ice, if convenient, or by some saline combinations in solution.

Counter-irritation is a remedy of great power, I believe, in certain cases and forms of inflammation, but it is often, in my opinion, much abused. In deep-seated disease, as in the spine or hip-joint, after the symptoms of acute action have ceased, the excitement of a new action or disease on the surface, at some distance from that first affected, generally produces benefit. In the treatment of such affections as those alluded to, it is often the custom, after caries has been established, to apply issues on the surface, under the impression that the counter-irritation is of use: I do not, however, suppose that it is of the smallest advantage at this period,—but on this subject I shall be more explicit in my remarks upon caries afterwards.

Counter-irritation is effected in the various ways already referred to. The method of applying it, in most general use, is by the common blistering plaster of Cantharides, or the sinapism of mustard, and when a severe and more lasting effect is wished to be produced, the potential or actual cauteries may be resorted to, or the seton, according to the nature of the case, or the supposed efficacy, or applicability, of one or other of these measures.

Most of the direct applications to inflamed parts may be said

to have a soothing and sedative effect on the disease, and I believe that nothing tends more to a happy result of treatment, than complete repose both of body and mind, and a favourable adjustment of the affected parts. For example, if in inflammation of the leg, resulting from some such slight cause as the pulling out a hair, the patient persists in standing or walking much, and moreover takes no care to prevent the surface being fretted, the disease usually assumes a much more troublesome character than would otherwise have been the case. Here, rest, and the horizontal position of the limb, might have saved much trouble. I shall have so many opportunities afterwards of pointing out the advantages of quietude and of favourable position, in local inflammations, that I need not dwell on these topics at present;—indeed I have referred to them in this place, chiefly for the purpose of stating, that sometimes the reverse of soothing and sedative measures are recommended to inflamed surfaces: thus, blisters and lunar caustic have been used in erysipelas; but my own experience would induce me to eschew such means, although in certain chronic forms of inflammation, as of the conjunctiva, or in callous ulcers of the legs, direct stimulants are certainly of service; the application of sulphate of copper, nitrate of silver, vinum opii, and other such irritants, being useful in either case, whilst in the latter, even blisters have been applied with great advantage.

CHAPTER IX.

EFFUSION OF SERUM AND OF LYMPH.

The general treatment of inflammation may be further illustrated by reference to some of the consequences of this disease, and partly for this purpose, as also to carry out the objects of this introduction, I shall now proceed with the consideration of such of them as shall serve the purposes I have in view.

Pain, heat, and redness, may all be subdued by those local and constitutional measures of treatment which I have lately been describing: even swelling may be prevented, or may subside under the use of cold. Perhaps, however, this symptom of inflammation, after it has once become conspicuous, disappears more slowly than any other. It is certainly, in general, aggravated by warmth and leeches,—by the latter in particular, but unless it increases amazingly, it is not much to be regretted; on the contrary, I believe that diffusion of swelling is a beneficial occurrence, for in instances of inflammation in textures and parts of the body where this cannot happen to any very perceptible extent, the other symptoms of the disease are invariably most distressing, as is well exemplified in

inflammations of the periosteum, bone, eye-ball, ear, and under aponeuroses. But in some instances, and these, too, not of rare occurrence, swelling becomes so remarkable, or is so peculiar in its character, as to require some appropriate treatment, different from that resorted to in ordinary inflammation.

If swelling is dependent merely on enlargement of bloodvessels, it can never require much treatment solely as swelling, although the relief of the over-distended vessels, by the measures already referred to, viz., drawing blood from their immediate vicinity, or by their actual division, may be of great service in checking the disease: but if this condition depends on any of those forms of effusion, which so frequently follow as consequences of inflammation, then the aid of the surgeon may prove of great value.

In some parts of the body swelling constitutes one of the most conspicuous symptoms of inflammation,—as in the eyelids, scrotum, or prepuce. In these situations it is almost invariably the result of effusion of serum into the cellular texture, which, once the active form of the disease has ceased, disappears almost as rapidly as it may have come on. In other parts of the body, too, as in the hands and feet, a similar swelling may exist, the term œdema being that in general use to designate this condition. When a part is in this state, it is always easily recognized from any other kind of swelling, from the dimple which is left after the forcible application of the finger, and probably by the shining and partly translucent appearance of the skin. A similar condition may be present independent of any apparent inflammatory action, as in the swollen state of the body which occasionally follows scarlet fever, or in anasarca resulting from diseased heart or kidneys. From whatever cause it may arise, the surgeon should remember, that unless the part affected (supposing the condition to be entirely local) be supported on a level with the rest of the body, or, at all events, be kept from a very dependent position, the swelling is almost certain to increase: hence the excellent rule of elevating a part affected with inflammation or any action of a somewhat similar kind. Thus, in the scrotum, if this species of enlargement is not attended to, and supposing the patient to be confined to bed, the swelling gets between the legs, or falls so low between the groins, and produces so great distension of the skin, that ulceration, or mortification, may actually occur: again, if in a like condition of the hand or foot, these parts be allowed to lie below the level of the rest of the body, the same results may happen. By suspending the scrotum properly, or keeping the other parts sufficiently high, all such dangers may be avoided; and, indeed, unless position be properly attended to in the treatment of accident or disease, the state of œdema is exceedingly apt to occur,—even a little irregular pressure, from a bandage, or other cause, may occasion the same result. As a proof of the advantage of position in such cases, I may refer to the condition of the face, and particularly the eyelids

in ordinary anasarca: during the night, when the patient is in the horizontal position, these become much swollen, but during the day, when the patient sits up, they assume their natural appearance, owing to the serum gravitating towards the more dependent parts. Here there is little to be done, unless by constitutional means, which I need not particularly refer to; indeed, I allude to the circumstance for the sole purpose of showing the advantage of elevating a part above the rest of the body, (in as far as that can properly be accomplished,) which happens to be in an œdematous condition. Sometimes the swelling of œdema seems so much greater than the skin can bear with impunity, that it is advantageous to make punctures with a lancet to permit the escape of serum. This practice has, with some surgeons, the additional recommendation of permitting the escape of blood, and thus alleviating inflammatory action. In erysipelas, for example, more particularly in the head and face, where it is often attended with great swelling, the plan of puncturing with a lancet has been much followed by some. I have often myself resorted to such treatment, especially in the œdema which attends the severe forms of phymosis and paraphymosis; but position, and the exhibition of a smart saline cathartic, may do much to obviate the necessity for the lancet. In acute forms of this kind of swelling, the last-named means of treatment, and those usually followed for inflammation, may put all to rights again; and in certain cases, where the action seems chronic, friction, or the application of a bandage, may be of service: both, however, must be used with caution, and any irregularity of pressure by the latter means must be avoided, for whatever impedes the venous circulation seems to conduce greatly to effusion of serum, as may be frequently seen in the case of fracture of the upper end of the humerus, where, in adjusting the splints, pads, and bandages, unless the hand and forearm are enveloped in a bandage also, and in addition suspended in a sling, there is every probability of œdema coming on.

In certain forms of inflammation, instead of serous effusion there may be an exudation of lymph, and when this occurs in textures it may also occasion swelling, which is usually designated solid œdema, in consequence of the accompanying hardness, and in contra-distinction to that resulting from the presence of serum. It generally seems to be the effect of more chronic action than that which induces infiltration of serum, although this is by no means always the case, for sometimes the latter seems to be brought about by a slow irritation, whilst, on the other hand, lymph may be poured out within a few hours after the application of an exciting cause. As an illustration of the latter statement, I may refer to the rapid exudation of lymph succeeding to wounds, occurring, as it does, within a few hours after such injuries. Swelling resulting from the effusion of lymph seldom acquires any magnitude, and is rarely such as to demand active surgical interference. In those cases where it is most common, such as in erysipelas, wounds, stumps, fractures, and dislocations, time alone may be trusted

to, as absorption is sure to occur, provided all source of irritation be removed. In some of these cases, however, the disappearance of the swelling may be expedited by stimulants, such as friction with the hand or flesh-brush, or stimulating liniments, douches, and pressure by bandages. In some instances, too, where the swelling and induration seem peculiar to, or dependent upon, a specific condition of the constitution, as in certain kinds of chancre, or in a soft node, the internal and external exhibition of mercury or iodine, singly or combined, has a most beneficial effect apparently, although occasionally it may be doubted, whether, when swellings disappear under the use of these means, the benefit is to be attributed more to their efficacy, than to the time occupied in their application.

Sometimes the lymph effused as the result of inflammation, forms a swelling so permanent, and, at the same time, so troublesome to the patient, that there may be every justification in using the knife for its immediate and effectual removal. The necessity for such a proceeding is by no means unusual on the prepuce, where solid œdema is an almost certain result of long-continued inflammation.

CHAPTER X.

EFFUSION OF PUS.

EFFUSION of pus is a result of inflammation, which often adds greatly to the swelling, and is one of those consequences of this disease, which affords apt illustrations of the treatment of certain conditions of inflammation. This fluid may, like serum, be effused on any surface or on any texture of the body; but, for present purposes it will be best to refer to its formation, only in those where its presence is most interesting to the surgeon.

Although, in general, this consequence of inflammation is a most unfortunate result,—as, for example, in erysipelas, in inflamed glands or joints, and in many other kinds of the disease in different parts of the body,—it is nevertheless earnestly to be desired in some instances. In effusions of serum, or of lymph, where there is little or no breach of continuity, or of surface, absorption may remove all traces of these conditions, and that consequence or termination of inflammation called resolution may ensue; but when pus has been secreted it rarely happens that it is absorbed,—it must be discharged from the body by a breach of surface, and, unlike the favourable cases of resolution, there must always be some mark left, to denote, ever after, that disease and injury have been present. The case, also, will usually be more tedious, and there is greater danger to limb or life, when suppuration occurs. Hence, then, the anxiety of the surgeon to arrest the progress of an inflammation ere suppuration commences.

The occurrence of suppuration often produces alleviation of all the

most distressing symptoms of inflammation, both locally and constitutionally, and, although this may be doubted in some cases, there are certain forms of injury and disease where such a result is most apparent, and where, in consequence, the practitioner from the very first encourages the event. Thus, in lacerated wounds, when there is no possibility of union by the first intention, and in wounds where irritating materials have been left behind, suppuration is not only productive of the benefits above alluded to, but is also a stage in advance towards a cure. It is almost universally admitted that the formation of pus progresses most favourably under warmth, and hence, then, in such cases the surgeon assiduously applies it by one or other of those means already adverted to. Here it may seem strange, that the same means are adopted to encourage suppuration that are considered most efficacious in arresting inflammation; yet, according to the explanations I have given of the supposed efficacy of warmth in this disease, and what I have lately said of the beneficial results of the process, this remedial agent (warmth) may be considered to act favourably in inflammation, whether in one case it arrests its progress, or in another it hastens on the suppurative stage, and thus in a great measure changes the aspect of the disease. Why it should produce these different effects, cannot readily be explained, nor can the most experienced surgeon always be certain which result will ensue.

It is often a point of much interest to determine whether suppuration has actually occurred or not. When it happens on a surface from whence matter is discharged, the physical characters of the secretion are usually sufficiently clear to denote the circumstance: but if it happens in deep-seated parts, there may not be the same facility for discrimination; so, whilst in some instances the event can scarcely be doubted, in others the most experienced practitioner may be at fault. The only characteristic constitutional symptom denoting the first formation of matter, which has been deemed of much consequence, is that of shivering; but it is, in my opinion, less worthy of estimation than some seem to imagine:—it frequently happens in instances of disease where suppuration never ensues; it often occurs even in a state of health, and equally often when it does happen, it may be overlooked. Shivering is a symptom which the surgeon is often deeply interested in, not so much, however, from the dread of suppuration, as that it denotes some peculiar condition of the system fraught with much danger to life,—as, for example, if within the first ten days after a capital amputation, or after lithotomy, a patient is seized with shivering, there is every reason to anticipate a fatal result; and although this may not occur in all such instances, every practical surgeon must bear me out in the formidable estimation I have made of this symptom. But whether it has preceded suppuration or not, the surgeon will seldom be thus satisfied that matter has formed. Swelling is not always a good criterion either, for though in some cases the continued accumulation of matter often produces most perceptible swelling, tumefaction sometimes actually diminishes as matter is formed. The undulatory mo-

tion of the fluid, produced by percussion with the fingers, is one of the surest symptoms of suppuration having occurred: the feeling of fluctuation is well understood by the person who has once placed the fingers of one hand over the collection of matter, and tapped gently on the swelling with those of the other. But some surgeons seem more acute in their perceptions than others; and it is with all more difficult to detect the presence of matter when it is deep-seated and in small quantity, than when superficial and in abundance. Some practitioners trust chiefly to the sense of touch, and the history of the case; occasionally the eye alone suffices with the most experienced; whilst, in other instances where there is doubt, some exploring process may be resorted to, such as those which are described at p. 18.

CHAPTER XI.

ABSCESS.

When there is full assurance that matter is actually present, the plan of treatment may yet be doubtful. The surgeon may have to determine whether he will trust to nature to produce absorption; whether he will resort to such means as are thought conducive to this end; whether he will allow the matter to be discharged spontaneously, or give it an exit himself; and, in the event of resolving on the latter course, what period and what means will be best for that purpose.

There cannot be a doubt that large abscesses have occasionally been absorbed, and every-day experience shows that small collections of pus will disappear, either spontaneously or under the supposed influence of remedies. It would be improper, however, to entertain sanguine hopes of such an event occurring frequently; but, in general, little harm can result from any attempt that may be made to excite the action of the absorbents. Some of those means which I have referred to in treating of the absorption of lymph, may be tried here; perhaps the external use of iodine, of mercurial ointments, singly or combined, may be of most service, whilst sometimes a blister may produce the desired effect. It may as often happen, however, that these either produce no perceptible benefit, or that they actually conduce to the suppurative action. The blister is most apt to have this latter effect; indeed, so great is my conviction on this point, that I order a blister as frequently with the view of inducing an increased secretion of pus, and a consequent approach towards the surface, as from any hope of absorption being excited. When absorption has occurred in my own practice, it has generally been under the use of poultices, which had been applied for the purpose of promoting suppuration, or else of bringing the matter towards the surface; and I have in such instances attributed it more to time and natural results

than to any peculiar action of the poultice, which, as I have already stated, is considered one of the most certain means of producing suppuration.

It is, I imagine, too much the custom to allow matter to be discharged naturally. In most parts of the body, if the suppuration be deep-seated, the matter may extend widely, and do much harm by the separation of textures, ere it can reach the surface; and even when it does so, and is discharged through some small opening, it rarely happens that the interior of the abscess closes entirely;—a discharge continues long afterwards, and ultimately the interference of the surgeon is required. From this it may be seen that I am averse to leaving such cases entirely to nature; occasionally the surgeon cannot do otherwise, and sometimes, even with all his care, matter will burst forth when he does not expect it. If an abscess in the perineum, for example, be left for a day or two, under the supposition that the delay will be advantageous, even though it may be intended to use the knife to open it, the practitioner is often amazed to find that the matter has, in the lapse of four-and-twenty hours, made an exit through the skin or mucous membrane in the vicinity of the anus,—yet it seldom happens in such instances, that the knife is not ultimately required.

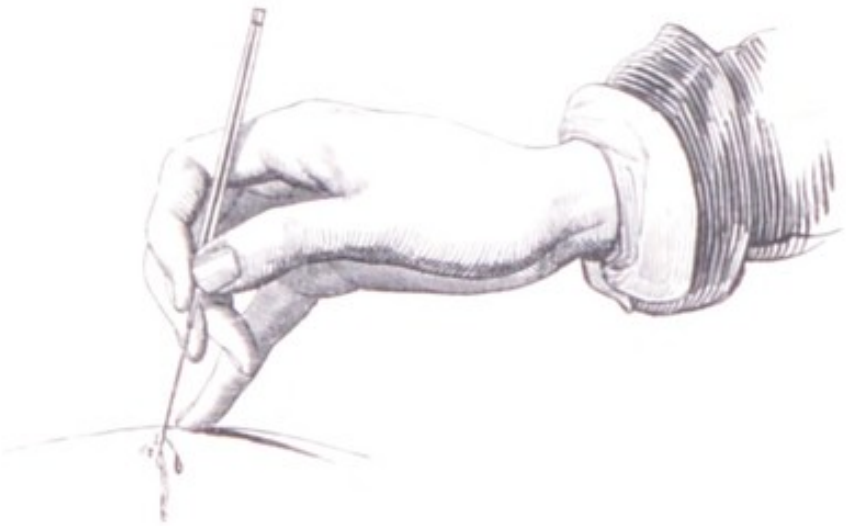
The period for giving exit to matter will vary according to circumstances. Thus, if it be extensively diffused, as in phlegmonous erysipelas, where it may separate the skin from the textures underneath to a most injurious degree, the sooner a free vent to the matter is given, so much the better; and here, too, if the knife be used, there seems an additional advantage, as has been pointed out by Mr. Lawrence, in the loss of blood occasioned by the division of engorged vessels: again, if the pressure of matter seems to produce great pain, or if its continued presence is likely in any way to occasion additional harm, such as by bursting into any cavity, laying bare a portion of bone, or of a large vessel, or if from being under an aponeurosis, there is greater chance of its being diffused beneath that membrane than making its way to the surface, then it should be permitted to escape through an incision made at an early period. However, excepting under these or other equally pressing circumstances, I must declare myself an advocate for delay in opening abscesses. Besides the hope, though it may be but slender, of absorption occurring, I am of opinion that in ordinary abscess, a bubo, for instance, if an opening is not made until the matter has approached near to the surface, the subsequent progress of the case is much more rapid and satisfactory, provided that a proper opening be made. I have seen a good deal of the practice of making early openings, and have invariably observed that more pain was thereby induced, and, I have often fancied, an additional amount of suppuration, whilst the after treatment has been remarkably tedious. I have already, in a preceding page, stated my impression, that in some instances the occurrence of suppuration actually produces an amelioration of many of the distressing accompa-

niments of inflammation ; and if, before the process has gone almost to its full extent, any incision be made into the affected parts, the injury thereby inflicted upon them, will perhaps prevent such benefit as may be expected. That in all instances of suppurative inflammation this is not the case, I most readily admit, and the examples I have cited above, to inculcate the necessity for an early opening, will show that I entertain many exceptions ; but in the case of bubo in the groin, or other such abscess, I am decidedly inclined to delay, until the parts over the matter become much thinner than they may have been at first, or, in other words, until the fluid has come nearer to the surface, and perhaps actually threatens to burst forth.

When an opening is required in cases of suppuration, I give a preference to cutting instruments for the purpose. Excepting in rare and peculiar cases, I deem the caustic potash a cruel and unwarrantable application ; and when the abscess is large, I consider that a scalpel or bistoury should always be used. In a small collection of matter, the point of a needle or pin may make a sufficient opening, or that of a lancet may at all events suffice ; but, as I strongly recommend that a free incision should be made in the generality of these cases, I deem a bistoury the most efficient instrument. In the case of a bubo, containing perhaps an ounce or so of matter, I would probably make a wound an inch long, so as to expose fully the whole interior of the abscess. I would, in general, select the thinnest part of the skin, where the matter is said, in technical language, to point, and make the incision in the longest axis of the swelling, though sometimes I might be induced to deviate from the latter rule, for the purpose of having one end of the opening in such a position as to give free passage to matter afterwards, or possibly for the purpose of cutting parallel with some particular part, or in other instances across such textures as might seem to require division.

If a lancet is used in any of these operations, it may be held in the manner referred to at p. 39 ; and if the bistoury is selected, the atti-

Fig. 51.



tude exhibited at p. 5, may be chosen, but it is by no means a safe one for such purposes; by a sudden plunge, or by a movement of the patient, it may pass too deep; and I therefore prefer that just represented in fig. 51, in which the little finger, resting on the neighbouring surface, is a safeguard against such an occurrence. The point of the instrument should be thrust into the matter, and then carried to the desired extent through the textures, by a movement with the extremities of the thumb and two first fingers. The edge of the knife may be carried in any direction, and consequently some slight deviation from the position of the blade, as here shown, must be attended to.

Fig. 52.

Such an attitude as that in fig. 52, I think good; the forefinger of the left hand, and perhaps the middle also, being placed over the abscess, with a gentle pressure; the back of the knife should be caused to rest against the side of the forefinger, as here represented; the point should then be thrust through the skin and the coverings of the matter divided as far as may be thought sufficient. This attitude I deem best suited to cases where pus is deep-seated, and when, probably, the surgeon has misgivings as to its presence at all. When

the point of the bistoury is supposed to have reached this fluid, the blade may then be gently turned a little on its long axis, when, probably, the pus will spring up along its surface, or a director, as referred to at p. 18, may be pushed down through the wound, the blade remaining and serving as a guide. In opening an abscess, whatever be the instrument used, I invariably prefer puncturing first, and then cutting from within outwards, to the method pursued by some, of making a sort of dissection, by successive incisions through the skin and other textures.

When an abscess is freely opened, as above recommended, the whole surface is exposed to the air, and to the contact of such dressings as may be deemed advisable. Within a few days the whole cavity is covered with red granulations; and these, with the contraction of the sac subsequent to the evacuation, serve to diminish the space, until ultimately, as cicatrization is completed, the part is nearly, if not entirely, on a level with those around. After the opening is made I generally apply slight pressure to squeeze out most of the matter, then push in with the point of a probe a long narrow strip of lint, which I allow to remain for a couple of days, until suppuration is established on the cut surfaces; in the interval I apply a poultice, or the warm-water dressing, as recommended at p. 54, and continue with one or other of these until the granulations seem to fill up the whole space to a level with the surrounding surface: then I make use of simple ointment, thinly spread on lint, and from time to time wash the sore with a solution of sulphate of zinc or of copper (gr. ii. ad ℥i.), until it is healed over. Some little variety may be required occasionally, as will be more fully explained in my observations on the treatment of granulations.

CHAPTER XII.

SINUS.

If a free opening into an abscess be not made, the matter which may still continue to be secreted from the surface, will not readily get vent, may collect in some dependent part of the cavity, burrow under the skin, and probably point elsewhere; or possibly the interior of the abscess will remain much the same as immediately after being opened, the surfaces may rub against each other, a constant secretion being thereby induced, and there may be little alteration for the better, even after the lapse of months. This condition and that termed sinus are nearly alike; the principal difference being, that in the latter there is a kind of canal, much longer than it is broad: indeed, a sinus is most frequently the result of abscess. It is almost invariably the result of suppuration near the anus, constituting fistula in ano, and here the surgeon knows that his utmost skill can seldom prevent the formation of sinus: the abscess will not heal entirely. In other parts of the body it will occur in spite of the utmost care; occasionally it is the result of negligence; and very frequently it arises from too small an opening being made originally.

An abscess in the condition above described, and a sinus, may be treated much in the same way: the cavity must be made to close, and a variety of methods may be resorted to for this purpose; all of them having for their immediate object the inducement of new, and perhaps excited action, under which the grand object of treatment is gained, viz. the complete reunion of the parts.

One of the simplest means of treatment is pressure, which is usually effected by a pad of lint, held in its place over the space or sinus, by straps of sticking plaster, or a roller; the surfaces are then kept steady, perhaps a slight adhesive action is excited, and so union occurs. Stimulating injections will probably accelerate the action. Sometimes these are used by themselves, of considerable strength. Such plans, however, fail but too frequently; often no favourable change being produced, whilst occasionally they are so far deceptive as to cause the orifice to close: but the deeper part remains in its usual condition,—matter still continuing to be secreted, which, after collecting in considerable quantity, will burst through the original opening, or make a new one for itself somewhere in the vicinity. And so affairs may go for months or for years, as is often exemplified in the case of fistula in ano, unless there be some more active interference on the surgeon's part. In almost all such cases the best practice is to lay the part freely open with a probe-pointed bistoury, such as the blade represented in fig. 53. The point should be passed into any

Fig. 53.

of the openings (for there may be more than one), and then the skin should be divided in all directions where there are spaces underneath. The point of the fore-finger of the left hand should be freely used on these occasions, in tracing out wherever the matter may have burrowed, and also in breaking down the loose and flabby adhesions which are occasionally found in different parts of these cavities: it generally answers better than the common probe; and the additional pain, and, I may add, apparent rudeness, will be amply compensated by the more certain cure that will be the result. When a patient is subjected to such a proceeding, it had better be done effectually, once and for ever. I feel assured that the want of success from using the knife on these occasions is from not attending to this circumstance. The most experienced surgeon cannot always be sure in what different directions sinuses may run, unless the finger be used as directed above. Perhaps a single line of incision through the skin may suffice; but, in general, if the space be large, and the necessity for free exposure great, there need be no hesitation about notching the sides of that already made, and thus making a crucial incision. It has occasionally been the custom in modern times, to divide the parts with a strong thread instead of a knife, a relic of ancient practice, which no surgeon of the present day should countenance, being more painful and less certain in its effects than the other; and being, moreover, a kind of return to that barbarous and do-no-better surgery of former years, which inculcated amputation of limbs by a similar process, viz. that of encircling a part with a cord, which should be gradually tightened more and more, until the part should drop off.

Sometimes, in using the knife freely in these proceedings, the bleeding is considerable; but a ligature rarely is required, provided the operator has a moderate share of anatomical knowledge to guide him in making the incisions. The lint, with which the gap should be filled, will usually stop the effusion. Warm dressings, and occasional fomentations should next be resorted to, and the treatment afterwards should in every respect, almost, resemble that required after the opening of an abscess, as already described.

It is not always that an old abscess or sinus can be thus treated,

however, as for instance, the space below the skin may be so ample, that a reasonable surgeon would dread exposing so great a surface, as well as the infliction of a wound sufficiently large to open all the interior; or perhaps the sinus may run where he does not wish to make incisions, as in the face or neck of a young female, or possibly under some large blood-vessel, or other important part. In such instances, if a persistence in the mode by pressure and stimulating injections, above recommended, does not succeed, possibly the introduction of a thread or seton may have the desired effect. Its presence for a few days will induce new inflammatory action, which may end, after the withdrawal of the thread, in the closing of the track. I have sometimes found this plan most serviceable; but it cannot always succeed, and should only, as I think, be resorted to when the knife cannot be applied. The thread, which may be of hemp, silk, or worsted, and of a size proportioned to the calibre of the sinus, may be introduced by means of the common probe, such as seen at p. 17; the thread being attached to the eye, the point of the instrument should be passed through the subcutaneous space, and caused to project where it is desirable to bring it out; an incision should then be made upon it, — a simple puncture will generally suffice to let it pass to the surface, when it should be seized by the fingers, drawn out through the wound, and the thread, which has followed its course, may be left, with ends of equal length hanging out of each aperture.

Although I strongly recommend a free opening with a cutting instrument, in the ordinary treatment of abscesses, there are certain instances when such practice is objectionable, or, at the least, of questionable utility. In large abscesses the system may not bear up against the extensive inflammation and its consequences which must follow the exposure of so large a surface; and it is good practice in such cases to ascertain in how far the cyst or sac of the abscess may be made to diminish by gradually lessening the quantity of fluid. This is the object in view in resorting to such means as are supposed to produce absorption; but, as these are so seldom of service, it may be done by evacuating the contents gradually, and at different periods, through small punctures with the lancet or bistoury, after the manner recommended by Abernethy. If, for example, a lumbar abscess, pointing in the groin or loins, be opened by means of a small oblique puncture, a considerable quantity of the fluid may be allowed to escape, as much perhaps as the natural elasticity of the parts will cause to flow out, and then the little wound be closed so as to heal by the first intention, the patient may, after the lapse of twenty-four hours, when the aperture may be supposed to have permanently healed, be in no respect injuriously affected by the proceeding, but will have probably six or twelve ounces less fluid in the abscess. If similar proceedings be repeated again and again, each one in succession being done before the disease has attained the size it may have had on the occasion immediately preceding, then, at last, the cavity may have dimi-

nished so much, that its whole interior may be freely exposed at once, as in the treatment of abscesses of a smaller kind. This practice is well worthy of commendation; but, like many other really good measures, it does not always succeed: the puncture may not heal, and there will be a continued drain of fluid through it; inflammation may extend from the wound over the whole sac; the nature of the secretion will thus become much altered; possibly a few globules of air, entering through the aperture, may cause putrefaction or other important change; and supposing even that none of these evils have occurred, and that the sac has diminished as desired, a sinus may still remain which will baffle the best skill. However, even in this condition, I think it must be admitted that the patient is in a better state than with a large abscess. Sometimes bad results will follow the first operation; but in general every thing goes on well until the third or fourth: by this time, however, there is less danger than previously. I have very frequently tried this plan, and from experience, then, can speak highly in its favour. Lately, I treated in this way, in King's College Hospital, a very large abscess, situated chiefly in the iliac fossa and upper part of the thigh (see Lancet, Nov. 6, 1841): by repeated openings in the latter region, the matter was entirely evacuated, whilst the sac gradually contracted and ultimately closed. In this instance, the lower part of the abscess opened again after the lapse of several months; but the whole of the large cavity, which must at one time have existed in the iliac fossa, remained permanently obliterated. I refer to this case, chiefly on account of the latter circumstance, as it is by no means unusual for a part of an abscess to open up again, after being supposed to have closed entirely; and these sinuses, as they may be termed, are often more troublesome to deal with than the original disease.

Although I have recommended the free use of the knife in cases of sinus, when other means will not avail, there are certain instances where this practice may not be necessary, or where something additional may be required: thus, a foreign substance,—any extraneous object that may have passed into the body, or a piece of necrosed or carious bone, may be the cause of sinus. In the first of these examples, probably the foreign body may be reached and removed without any particular use of the knife; and, if so, in all probability the sinus will speedily close. If necrosis be the cause, possibly the loose portions of bone may be removed by similar means; perhaps, however, a little additional cutting may be required, and this will be especially necessary in the instance of caries. The description of the operations for these purposes will be found in after parts of this work, and I need not say more at present on such subjects, than to refer to the impossibility of removing in all instances, by such direct surgical or mechanical means, the foreign substances which may, by the continued irritation they keep up, prevent the closure alike of wounds, abscesses, or sinuses.

Sometimes in the treatment of suppuration, several openings should

be made at the same time, to permit a free discharge: thus, in phlegmonous erysipelas, when the matter is likely to be diffused extensively in the subcutaneous cellular texture, such practice is highly advantageous, and there is greater probability of the intervening spaces adhering. Occasionally, when an abscess has arrived at the condition of sinus, it answers well to make a counter-opening, as it is technically named, at some distant part from the original one, where the matter may escape more readily. If the abscess bursts spontaneously, the aperture may not be in the most favourable position for a free discharge, and sometimes the surgeon may find, when he has used the knife, that he has not selected the most dependent position: in other instances the matter may burrow afterwards, and in all such cases a second opening, at a more fitting part of the cavity or sinus, may bring about a speedy cure.

CHAPTER XIII.

EFFUSIONS ON SURFACES. HECTIC.

THE preceding remarks refer only to effusions of pus in the textures of the body. Where matter is secreted from surfaces, the plan of treatment is usually less difficult to decide upon, and less troublesome in its application. In such discharges from the vagina, for example, whether the result of gonorrhœa or otherwise, astringent lotions may probably suffice to check the suppurative action. If there is much active inflammation present, suppuration is often a relief, and therefore at first, instead of checking it, the secretion ought rather to be encouraged by warmth, applied in some of the modes already described; but when the disease has assumed a chronic condition, astringents may be used with propriety; and here, too, there may be need of some alteration in the constitutional treatment. There is often much benefit in a change of air and of diet, which should be generous; and tonics, more especially iron, may be additionally serviceable. In some of the mucous membranes, it is occasionally the custom to use strong astringent applications at the commencement of inflammation, before suppuration has actually occurred, by way of arresting all disease at once: in suppurative ophthalmia, for example, a solution of nitrate of silver, of the strength of ten or twenty grains to the ounce of water, has been used, and with the desired effect too; but the plan is by no means in general use: similar practice is sometimes tried with good effect in the early stages of gonorrhœa in the male; but the danger of bringing on swelled testicle by thus suddenly changing the actions in the urethra, usually deters the practitioner from resorting to it.

Effusions in the serous and synovial surfaces frequently require surgical treatment, as hydrocele, ascites, hydrothorax, or in certain affections of bursæ and articular surfaces. Sometimes these effusions consist of an excess of the natural secretion; at other times, the fluid seems a mixture of serum and lymph, or pus with serum or synovia, and it rarely happens that pure pus is found in any of these cavities, although every good pathologist may occasionally have seen cases of the kind. In dissections of those who have died of acute peritonitis, pure pus is sometimes found as if it had been secreted from the serous surface: in the pleura, too, a similar occurrence may occasionally be noticed; but in general, when there is pure pus, its secretion seems to have been preceded by the exudation of lymph, forming a new lining surface to the original serous membrane, in most respects analogous to that which forms the interior of ordinary abscesses.

The treatment of many of these affections will be particularly considered afterwards. Here, however, I may state, that it is usually conducted according to the methods above described for inflammation and abscess. At first, if the effusion seem the result of acute action, the violence of the disease must be allayed by such local and constitutional remedies as have already been described, and by such specifics as may be known,—as, for example, cathartics and diuretics in ascites, or colchicum in what are usually called rheumatic effusions into joints; then, as the action becomes chronic, such plans as may be supposed to excite absorption may next be used, and should these fail, the propriety of giving vent to the fluid may be taken into consideration. On the latter point there need be little hesitation on some occasions, as in the case of hydrocele, whilst in others, as in hydrothorax, the circumstances of the case should be well weighed, ere the surgeon proceeds to open such a large serous surface.

Long-continued and profuse suppuration is almost certain to end in hectic, and if the surgeon cannot arrest the secretion by removing its cause, changing the action, closing the abscess or sinus, or amputating the diseased part, then he can only trust to those means which a knowledge of practical medicine, or common prudence, may suggest.

CHAPTER XIV.

GRANULATION. CICATRIZATION.

In certain instances of inflammation, as in wounds where union by the first intention does not occur, the term granulation is generally understood to denote that organized condition of the lymph, which is always effused in such cases, ere the open surface closes. When a wound heals by the second intention granulation must occur: it is the partial contraction and glazing over, as it were, of the granulations which constitutes cicatrization, or healing, and no union of an open suppurating sore can occur until these are present, and are disposed to close over. Such sores are frequently the result of abscess. It will happen sometimes, that when an abscess has been opened and completely evacuated, its sides, falling together, coalesce by the first intention, but oftener a suppurating sore remains, on whose surface granulations form, and, as the sore heals, cicatrization occurs,—the two latter terms being in a manner synonymous.

When granulations are healthy, they are disposed to heal spontaneously, and indeed often do so. In some cases the surgeon can scarcely flatter himself that he confers the least benefit, but in others he has it in his power to aid nature materially. The term "healthy" is usually understood as denoting that condition of granulations in which there is an evident tendency to cicatrization: if, when they are in this condition, any different action occurs, the healing process cannot go on at the time, nor until the healthy action is again present; and here it is in the power of the surgeon, in many instances, so to caution his patient against irregularities, to dress the sore, to support the parts, and to give them a good position, that he may exhibit many of the best qualities of his profession.

I need scarcely refer to what the irregularities may be, and will only remind the young surgeon, that the nearer he keeps his patient's constitutional health to what may be deemed the natural standard, in each special case, the greater is the probability that the local affection will be cured. The dressings for such a sore need be few in number, and ought to be of the simplest kind. It is not easy to convince a non-professional party, that the usual applications in these cases have no remarkable specific effects on a sore: hence the popular credulity in nostrums, and the rich harvest for "The poor man's friend." I fear that professional men often take too much credit to themselves, or assume it for their applications, and overlook the remedial powers of nature in such cases, and hence, perhaps, the opposite opinions regarding the effects of certain agents, and the vast variety of remedies in use.

It may be a question with the young practitioner, when granula-

tions are healthy, and how he is to know that they have assumed this condition? When the surface of a sore becomes of a bright red colour, when the surrounding swelling and other marked symptoms of inflammation subside, when the open space diminishes in size, and the circumference seems of a light blue colour, he may feel satisfied that the granulations are in this state. If the sore is now accurately examined with the naked eye, or with a glass, the surface will be observed to be covered by numerous small irregularly rounded points, red with arterial vascularity, which are the granulations. If no retrograde action takes place, such surfaces have invariably a tendency to heal, and will do so, provided the surgeon takes due care of the sore. The continued use of a poultice, or of warm-water dressing, may be sufficient, or, perhaps, of some simple ointment, such as the spermaceti, —these having the sole effect of keeping the surface somewhat moist, and thus preventing the matter which exudes from it becoming hard, and a source of irritation. Often, however, without any perceptible cause, the healing action does not seem to progress, and perhaps the granulations become somewhat pale, larger, and of a gelatinous flabby aspect; at this time a change of application may be of service, a slight stimulus will induce further cicatrization, and at last the desired end will be accomplished. Here, then, the surgeon, as it were, assists nature. The usual stimulants on these occasions are solutions of acetate of lead, of the sulphate of zinc or copper, or of the nitrate of silver,—the latter, or the preparation of copper, being occasionally applied in their solid forms; ointments of the nitrate, or of the red oxide of mercury, of the oxide or carbonate of zinc; and a variety of others in the form of red, black, and blue lotions or washes, which require no particular notice here.

A lotion, when used on these occasions, is applied either cold or lukewarm, and if oiled silk is put over the moistened lint with which the sore is usually covered, it soon acquires the natural temperature of the part. Instead, however, of keeping the surface constantly covered in this manner, the granulations may be only bathed at each dressing, after the lapse of twelve or twenty hours.

I may, perhaps, not be correct in designating all the means above alluded to as stimulants; but, at all events, an occasional change from one of these to some other, produces, in general, a favourable alteration on the sore. Such local applications resemble, in their effects, the action of certain purgatives, to which the bowels become at last, after continued use, so much accustomed, that the peculiar action of the medicine cannot be produced excepting by increased doses, when, probably, a smaller quantity of another remedy may have a powerful effect. So it always is with lotions or ointments, some of which may actually produce pain when first applied, but in the course of a few days may produce no effect at all; although if another application of moderate strength be used, a new action seems to take place in the sore. Hence, then, the advantage of changing dressings from time to time.

The dressings may merely be laid on the surface, and retained by means of a loose bandage, but sometimes it is highly beneficial so to support the neighbouring parts—so to approximate them—that there shall be no drag upon the granulations, and that every facility shall be given to the process of contraction, which takes place in cicatrization. A roller properly applied, or adhesive straps, (which usually act as gentle stimulants, partly from pressure, and partly from the composition of the plaster,) or probably both combined, may produce the desired effect.

Although in most instances it is highly desirable to produce contraction of granulations so that the cicatrix shall be of the smallest possible size, there are certain examples where great precaution should be used, lest the contraction should be such as to cause inconvenience or even deformity. In the cicatrization of severe burns, for example, parts of the body may be unnaturally drawn towards, or fixed against, each other, as is often seen in the hands and fingers, between the arm and chest at the axilla, and between the skin of the chin and that over the upper end of the sternum. I believe that more may be done to prevent these occurrences by proper attention to position at first, than by attempts to improve the state of the parts by subsequent operations. It is well to bear in mind, too, that contraction does not cease as soon as cicatrization has occurred: it will often go on to an amazing extent afterwards, and this may be for good or evil, according to circumstances. To continue the example of burns; if, when cicatrization on the surface seems complete, the patient is allowed to carry the part in such an attitude as he finds most convenient or agreeable, vast deformity may be the result, although the surgeon may have bestowed great attention during the period of granulation. There must be few practitioners of experience not familiar with such examples. Lately a patient was under my care in our hospital, with a large granulating surface in front of the elbow, resulting from a burn: as cicatrization went on, I kept the arm in an extended position, having no fear of a stiff joint; when the process appeared completed, I allowed the patient to keep the extremity in any attitude he chose, and whilst he was out of bed he bore it in a sling with the elbow bent at a right angle: in the course of a few days, the cicatrix became prominent, forming a band between the lower end of the arm, and upper part of the forearm, evidently preventing extension: a little force, however, was sufficient for this; the straight position was again resumed, but it was not until after several similar occurrences that the disposition to contract seemed to cease. But more will be said on these matters in another part of the work.

With regard to attitude, it may be deemed an established rule, that the affected part should always, if possible, be kept on a level with or above the rest of the body. If this be not attended to, the healing process goes on much more slowly, (if it goes on at all,) and hence, then, the advantage of keeping a person in the horizontal position,

who has a sore on the leg. These rules of practice will be more fully illustrated in describing the treatment of injuries and ulcers of the lower extremities, as well as of other parts of the body. I may state, however, that there is a combination of benefit in rest, position, or attitude, and support by straps, rollers, or other convenient apparatus, which is not always taken into due account. For instance, if a person with a healthy sore on the leg, who has been kept to his bed, is allowed to get up and walk about, the sore is almost certain to retrograde, unless some support be given to the tender vessels in the equally tender granulations: they will burst and bleed on the surface, or cause infiltration in the organized lymph, and days or weeks may elapse ere the part resumes its first condition.

CHAPTER XV.

ULCERATION.

The process of ulceration, which is usually deemed a product or consequence of inflammation, is always a source of much vexation to the surgeon, often of great annoyance to the patient, and not unfrequently of the utmost danger. It is one over which the practitioner has but little control; it usually causes much pain and alarm, and occasionally opens important organs, as the stomach, intestines, or large bloodvessels, so as to cause speedy death. The terms ulcer and ulceration seem too often to be confounded with each other, although in the proper application and acceptation of these words, there is really a great difference. Ulcer is a generic term applied in all sorts of sores, more particularly those which are on surfaces, but in many such, ulceration has never at any time been present. A person who has sores on his legs within a few days of healing over, is said to have ulcers, and the term is perfectly understood in some respects, although the difference between these conditions at their commencement, and towards their end, is not always sufficiently appreciated. In their early stages nature seems determined to increase their size, whatever opposition man may offer; parts visible to the eye at first, in a few days disappear by that process termed by Hunter ulcerative absorption: the sores go on increasing in size so long as this process continues, but towards their latter stages nature seems just as determined to heal them up again. At first, ulceration is present; latterly, the process of healthy granulation: there is a sore, or ulcer, it will be observed, but instead of any excavation, such as is seen in ulceration, there is actually an effusion of lymph on the surface,—a kind of addition caused by nature, instead of a loss.

The term ulcer is usually applied to a healthy granulating surface, such as that which is present in a wound healing by the second intention, a stump, for example, treated in the Continental fashion, without bringing the surfaces into apposition at first; yet here, it may be remarked, the process of ulceration will, in all likelihood, never be present at any period, from the infliction of the wound until cicatrization is complete.

In most instances of ulceration there seems to be a deposit of lymph between the affected surface and the parts immediately underneath, and hence, then, when vessels of moderate size are destroyed by this process, there is a security against hemorrhage. Sometimes, however, this effusion does not occur, and then the ulceration is most dangerous; and sometimes the ulcerative absorption removes the lymph that may have been effused: of both of which examples the secondary hemorrhages which occur after amputations and operations for aneurism give too frequent proof.

Ulceration may go on in any texture and in any part of the body. On the skin it is seen in a variety of forms; on the mucous membrane, also; and it occurs in articular surfaces, cartilages, bones, and bloodvessels. Sometimes it is accompanied with a secretion of pus; at other times, absorption alone takes place.

The treatment of this disease will be best exemplified by reference to the diseases of the different textures afterwards described, but it may be stated generally to consist in such measures as are supposed to arrest its progress and bring on a healing action. The general treatment for inflammation, constitutional as well as local, seems most applicable, whether the ulcerative process is going on externally or internally. When all the symptoms of inflammation are well marked, as most frequently they are, abstraction of blood, locally in particular, fomentations, counter-irritation, and other remedies already referred to, may be of service; and where the disease seems to be of a specific nature, as in poisoned wounds or sores, from syphilis or other causes, the destruction of the affected surface with caustic, and the internal exhibition of mercury, or other medicines, may bring about a more healthy condition.

CHAPTER XVI.

GANGRENE. MORTIFICATION.

THE conditions of gangrene and mortification, whether these be the result of inflammation or otherwise, usually demand much care and attention on the part of the surgeon. Generally when mortification or sphacelus, for the terms seem synonymous, has actually occurred, the principal objects of treatment are to protect the remaining parts from further destruction, and to relieve the system of that portion which has become dead, as in this condition it can only be a source of irritation and continued disease. The part which has lost its vitality may be a portion of skin, mucous membrane, tendon, vessel, bone, or other individual texture, singly and only to a small extent, or several may be involved, or all the textures in a member may be in this condition at one and the same time. The term "slough" is in general use to denote the death of a portion of the soft parts; that of "exfoliation" or "sequestrum" is commonly applied to a dead portion of bone. In gangrene, where the parts still possess a certain degree of vitality, the general object of treatment is, if possible, to restore the healthy actions, and thus avert the occurrence of mortification, which is a result very likely to follow this state.

In many instances of inflammation, the disease runs a regular course—from a mild form to one more severe, which then assumes the condition of gangrene, and ultimately that of mortification. In other instances it is difficult to discover any marks of severe inflammation, previous to either one or other of these events; and, indeed, in some kinds of mortification it is impossible to say that this affection has been present at any period, as in that which occurs in old age, or in certain examples of disease of the heart; even in some other cases, of deep interest to the surgeon,—the ligature of a main artery perhaps, it may be doubted, (perhaps even not so by some,) whether inflammation has ever been present in the affected part.

In the treatment of gangrene, then, it must be of great consequence to ascertain the cause. Sometimes this may be done, at other times it cannot, although in general there will be some marked cause,—a severe compound fracture, for example, or a violent attack of erysipelas, and such a one also as from the first may be set down as likely to bring on this condition. For the sake of illustration, I shall take an example of a fracture of the lower ends of the bones of the leg, perhaps compound, with great contusion and laceration; in such a case the certain result is inflammation, and that too of a high degree, in consequence of the severity of the injury: here all the symptoms of this disease will be well marked; pain, heat, redness, and swelling, will all be conspicuous. If gangrene threatens, the swelling will probably attract most attention; perhaps the pain and

feeling of heat may then be less, and, in all likelihood, instead of the swelling being a bright red, the surface will assume a bluish colour; it will perhaps, too, feel to the surgeon colder than it may have been, and the cuticle may be elevated at various points by effusions of serum, technically named bullæ, phlyctenæ, or vesicles. At such a time, if the part is touched by the fingers, it will feel tense and crepitating, for now there will be air in the soft textures. In such a case the constitutional symptoms are probably of less moment than the local, as indicating the extent of the mischief. At first there will be the usual constitutional symptoms of severe local inflammation; latterly the pulse will sink, and become irregular; the skin will be pale, cold, and clammy; the countenance will assume an anxious haggard appearance; there may be vomiting, hickup, and delirium. Under such circumstances there need scarcely be a doubt that gangrene is present, and it is usually to such a case that the terms acute, humid, and traumatic gangrene are applied. Sometimes, however, when no such injury or evident cause of derangement is present, the leg and constitution will assume similar conditions; after ligature of the femoral or iliac artery, for instance; yet, as I have already hinted, in such a case it may be doubted if inflammation has ever been present. The condition may be equally acute, the limb equally humid; and though it may in justice be attributed to the wound and obstruction of the artery (the latter without doubt), yet it cannot with propriety be termed traumatic. It is not my object here, however, to argue such points, but by way of practical contrast I shall now sketch another form of disease. A person may have disease of the heart, dropsy, and anasarca, or possibly none of these affections may be observable; the points of the fingers or toes may assume a blue colour, will be painful, cold, and perhaps slightly swollen, yet the practitioner cannot entertain the idea that inflammation is present; by and by the points of one or more of these members will become of a darker colour, at first of a leaden aspect, then of a darker grey or ash colour, and ultimately of a brownish black; all heat will cease, excepting that derived from contiguous sources, and to all appearance, as in reality, the part will have become dead, and at the same time shrivelled up. Such a case has lately occurred in King's College Hospital, under the care of my colleague, Dr. Todd, apparently resulting from disease of the heart. I shall take another example, one perhaps of more interest to the surgeon: a person receives a deep wound above the wrist, on the ulnar side of the fore part of the limb; the artery is divided, and afterwards secured by the surgeon when he dresses the wound; in the course of a few days the little finger is discovered to be cold, leaden-coloured, and destitute of sensation, and in a few days more vitality ceases. Such examples as these are, in contra-distinction to the case of injury of the leg, first taken for illustration, termed dry gangrene, or, properly speaking, dry mortification; but it is often difficult to draw a clear distinction between the two kinds. Dry gangrene,—senile gangrene, as it has been called,—is generally seen

in advanced years, the result in all probability of deficient circulation; but it may be seen at any period of life, as is also the case with the humid form of the disease; and it will be observed that any kind of gangrene, or rather mortification, if allowed to remain sufficiently long on the body, is sure to become dry.

From what I have stated, it may be observed that the cause of the disease is often, in a great measure, beyond the influence of the practitioner; but in many instances, and where the inexperienced might least suppose it, he has great facilities in obviating the worst results. Thus, if in the treatment of fracture of the lower extremity the heel is allowed to rest on a hard mattress, the pressure on the skin, by the weight of the limb and foot, may produce mortification,—a slough as large as half-a-crown may form. If the surgeon is on his guard, and, at the first alarm, so adjusts the pads and splints as to take off pressure from the part, no such event will occur. Again, if in severe inflammation of the scrotum, accompanied with copious effusion of serum, as is almost certain, the part be not well suspended, and kept rather above the level of the pelvis, a slough in the skin is not unlikely to occur, and the same thing may happen in extensive œdema of the lower extremities. Here, too, the surgeon may, by attention to position, do much to avert the occurrence of this disease.

Severe cold is well known as a cause of gangrene and mortification, more especially if warmth be applied too suddenly. The experience of Larrey in Russia, on the latter point, gave ample additional proof of this well-known fact; and hence, then, the propriety of restoring warmth to the parts gradually, by friction and otherwise. Intense heat is a frequent source of these conditions. Sometimes a bandage may be too tight around a limb, when it will produce swelling in the part below, and, if not attended to, even partial death; the tightness of the orifice of the prepuce in paraphymosis may produce this, although I believe it does so more rarely than some apprehend; and the stricture in or about the neck of a hernial sac is a fertile source of these affections. If a tourniquet is kept long upon a limb, as is sometimes done in hemorrhages, œdematous swelling is sure to come on, and mortification would be a certain result were the constriction kept on.

The above are all palpable examples, where a little surgical skill may be of service, but other instances are less controllable. In the example of gangrene, resulting from severe inflammatory action, as in the kind termed traumatic, there is less probability of arresting the progress of the case towards mortification. All such measures as are likely to subdue inflammation must be actively resorted to: here some will pin their faith upon cold applications, whilst others will be equally sanguine in the efficacy of warmth. For my own part, I would place most reliance on such measures as I have already recommended for the treatment of the acute forms of inflammation, more particularly if the affection was very prominent on the skin. Above all, I would resort to incisions, chiefly on account of the relief to tension which they

would produce, by giving exit to blood, serum, air, and matter; for in some cases both the latter may be present. This last mode of treatment will not arrest the disease in all instances, but it may produce wonderful effects in some. If proper cases for its adoption be selected, such as where there is great swelling and tension, (as in severe forms of erysipelas in which gangrenous inflammation occurs,) I cannot imagine that incisions will at any time do harm. The practice may appear harsh, and so indeed it is; but it should be remembered that it is applied to save the vitality of a portion of the body, the death of which, whether large or small, may probably involve the life of the patient. An excellent example of the advantages of this kind of practice is afforded in the instance where the urethra gives way behind a stricture; here the urine gets rapidly into the cellular texture of the scrotum: high inflammation succeeds, and, if the surgeon does not interfere properly, gangrene and mortification are the inevitable results. But if a free exit to the urine be allowed, through one or more incisions into the swollen and already perhaps dangerously inflamed parts, the irritating cause is, as it were, removed, and the formidable event is averted, or at any rate more limited in extent; and here, too, it must be observed, that the cause of the disease could be got rid of in no other way.

When the vital powers are deficient from external causes, as in the case of frost-bite, these may be gradually restored by judicious means; and in instances arising from the obstruction of a main artery, as after ligature, in which case there may be sudden alternations of temperature, attention to the latter circumstances may be of service.

When mortification arises spontaneously, or from some apparent internal cause, over which the surgeon has no control, he cannot expect to avert the disease, but he may, nevertheless, be of service to the sufferer; for here, as in other instances, after sphacelus has actually taken place, he may apply his skill with excellent effect: indeed, it may be truly said, that, in many cases, the efficient treatment only begins after this period.

In the early stages, any constitutional treatment, further than what may be required for the particular form of fever present, will have but little influence over the local disease. Instead of the high symptomatic fever, which is usually present in the ordinary kinds of severe local inflammation, there may be a depressed state of the system, for which stimulants may be highly useful,—as camphor, ammonia, wine, or spirits; and these, if the patient's stomach will bear them, will seldom prove amiss, after sphacelation has actually taken place. The free use of opium, by itself or combined with calomel, will often be of much service in alleviating the extreme suffering from local pain, which latter is often most distressing to witness, particularly in those instances occurring in advanced years, from disease of the heart or bloodvessels. At one time the Peruvian bark was deemed a specific for most forms of this affection; but so far as I know, no faith is now placed either in it or quinine, further than as an

excellent form of tonic in the latter stages of treatment when the patient is convalescent.

When a part of the body has in reality become dead, the first object of local treatment is to promote its separation from the living, a process which is usually performed by nature, by that kind of action which Hunter named Disjunctive Absorption. The more rapidly the separation is effected the better; for, in general, the stench is most offensive; thus forming an additional inducement to get rid of the putrid mass. Excepting in particular cases, the surgeon should never attempt to hasten this process by mechanical means. The inexperienced will often wonder why the knife or other cutting instrument is not used on these occasions; but unless it be to divide the skin over a slough of cellular texture, or the soft and hard parts around a dead portion of bone, so as to allow of either being lifted away by the surgeon, or thrown from the surface by nature, such a plan should seldom be resorted to. At first there may be some difficulty in appreciating the extent of the disease; and, latterly, when its limits have in a manner been defined by the chink, fissure, or line of separation, ("demarcation" is the technical word,) which forms between the dead and living tissues, there seems no good reason for interfering with the natural process, as the after-part of the cure is not expedited thereby. Sometimes, when a slough has become very loosely connected to the adjacent textures, a portion of it may be cut away with scissors, but on no account should the living parts be touched on such occasions. If these be cut, the wound will give pain, and must go through various stages of inflammation, ere it arrives at the condition of the surrounding surface, where separation at various points may have previously occurred. Often, I believe, it is best to trust the process almost entirely to nature, and merely to apply some simple ointment, poultice, or soothing fomentation; but sometimes there is an advantage in local stimulants, as the disjunctive absorption seems to be accelerated by them. Among the soothing remedies, warm water, warm decoction of poppies, of hemlock, solutions of acetate of lead with or without opium, bread poultices made with one or other of these fluids, the linseed poultice, the hemlock poultice, and such like, are usually resorted to; and as stimulants, a vast number of means have been used, varying in quality from the moderate excitement of a mixture of a resinous tincture with water, to the destructive agency of the potential or actual cautery.

In general, I imagine, that gentle stimulants only should be used. It ought to be remembered that their influence is intended for the living parts only: if too much excitement is produced by strong stimuli, possibly gangrene may be encouraged, and, at all events, more pain is occasioned by their use than the circumstances warrant. No harm can result from the application of caustics or the heated iron, provided the living parts are not touched by them; the stimulus of their qualities conveyed to these parts, through the medium of the slough, may induce favourable excitement in the living textures; but

when they touch the latter, they will kill, and thus produce only further mischief. It is good practice, on many occasions to rub the surface of a sloughing, ill-conditioned, languid ulcer, freely with caustic, or even with the heated iron; but here, be it remarked, there is a slough already present, or it is intended to convert the surface into one by this direct and killing measure, for in the latter case the application seems to have the effect of causing nature to bring the disease to a crisis, as it were, and no longer to leave all the parts in a half-dead state, the surface being thus killed outright, and the adjacent vessels excited to a more healthy action. It is customary in the instance of carbuncle to cut freely into the gangrenous and mortified textures, but the object of doing so is apparently not understood by some. The incision in such cases should never penetrate beyond the actual gangrene and sphacelus: it should, however, be close upon those parts where the separation is expected to take place; for, under these circumstances, the stimulating applications influence the living tissues much more readily, than when conveyed through the whole thickness of a slough.

Stimulants in these cases are most commonly applied through the medium of poultices and lotions. A bread and water poultice, with a little tincture of myrrh, oil of turpentine, port wine, or such irritating fluids, poured over its surface, may suffice, or the common fermenting poultice may be used with benefit. Sometimes resinous ointment, by itself, or mixed with turpentine, is spread over the surface of such poultices. At the periods of dressing great care is taken to wash away all foul discharges, and no fluid answers better for such purpose, I think, than a mixture of tincture of myrrh and water, of the strength of half a drachm, or a drachm to the ounce, or according to the stimulus supposed to be necessary. Of late years it has been much the custom to use solutions of chlorine for such purposes; chiefly, however, to correct the offensive smell of the slough.

By such means, and by time, a slough will at last become entirely detached, and may then be lifted away, or if it be left by a few shreds only, these may be cut across with the scissors, and when the large mass has been removed, the small remaining portions of these shreds may be left to separate afterwards. The surface, at the period of the removal of a slough, is usually covered by healthy granulations inclined to heal over, and no particular treatment is required further than that already referred to in the chapter devoted to granulation and cicatrization.

Perhaps the most troublesome cases of partial mortification, which the surgeon has to deal with, are those which occur over the sacrum, in persons who are long confined to bed from fevers, chronic diseases, or fractures. As pressure seems in all such cases to be the immediate cause of the affection, the exposed parts, such as the skin on the back of the pelvis, over the prominences of the scapulæ, the great trochanters, and the heels, should be defended by soap plasters, and when, unfortunately, sloughing occurs, (or ulceration, for the treatment of either

case should be nearly alike,) poultices will, besides their other good qualities, act as soft cushions for the injured parts, and if a water bed (Dr. Arnott's) can be procured, it will be found of the utmost utility.

CHAPTER XVII.

QUESTION OF AMPUTATION IN GANGRENE AND MORTIFICATION.

THE above remarks are applicable chiefly to instances of partial affection of some region: but it will happen sometimes that the gangrene seems so extensive, in either the upper or lower extremity, or that mortification has committed such ravages, as to preclude the hope of saving the limb, or even the life of the individual, if such a source of irritation is allowed to remain. The surgeon will seldom do his duty properly here, if he leave the case so much to nature, as in the instance of a partial slough; for, although there is ample experience to prove that a portion of a hand or foot, fore-arm or leg, may drop off, or that either member may be separated at its articulation with the trunk, by the disjunctive absorption, it is equally certain that the work is done in a tedious, painful, and unsatisfactory manner. Months may elapse ere a part is entirely separated; and when this has at last occurred, months more may pass over ere the sore cicatrizes. There cannot be a doubt, that the surgeon is justified, in many of these cases, in performing amputation, and the only difficulty in some of them is to determine on the proper period for such a proceeding.

In the instance of spreading gangrene, as has already been stated, it is difficult, if not impossible, to say where the disease is to end,—where there is to be a separation between the dead and living parts,—and hence it has been the prevalent custom to wait until a line of demarcation has formed, though, from the examples of Larrey, Lawrence, and some other modern surgeons, the practice of operating at an early period has been strongly advocated. Although educated in these latter doctrines, and strongly prepossessed in their favour, I feel bound to say, that, after having acted upon them repeatedly, and seen others do the same, the success has been very different from what I anticipated. I have in my recollection six cases in which I amputated during spreading gangrene, four times in the thigh, (one of them being for a simple fracture of the leg, another for compound; both close upon the ankle; the third following spontaneous obstruction of a popliteal aneurism, and the fourth after ligature of the femoral artery for a similar disease); one in the leg for severe lacerated wound of the foot, and the sixth at the shoulder-joint for extensive injury of the arm. None of these succeeded; and though I might possibly in future resort to similar practice, I must say, that I should feel

greatly inclined to wait for a line of demarcation; and, that even here, I should not be very sanguine as to the result. Numerous cases might be brought forward, however, to prove the success of such practice, yet I believe that, in many instances, the surgeon will best show his judgment, by amputating, in severe injuries, before sufficient time has elapsed for gangrene to come on, or by waiting, in the event of such an occurrence, until it is seen how far, and to what degree, the affection is likely to proceed, and in addition, to what extent the constitution sympathises with the local disease. The latter circumstance is, indeed, often remarkable; but whether it is from the wound or the gangrene, it is difficult to say. I once saw an amputation in the leg performed by a surgeon of great experience, for a severe compound fracture: the calf of the leg, when the incisions were made, was in a slightly suspicious condition, but not sufficient to deter from selecting this part for the operation: unequivocal gangrene, however, attacked the stump, and within eight-and-forty hours amputation was performed in the thigh: again the disease appeared in the stump, and at the same time in the skin over one of the scapulæ, where there was no suspicion even, that the slightest injury had been inflicted. Although I am satisfied that the operator did what the best rules of surgery dictated in this case, it is nevertheless exceedingly probable, that if delay had been given, in hopes of a line of demarcation forming, the condition of the shoulder would have been sufficient to have deterred from an operation at all.

It will often happen, both in spreading gangrene and in mortification, that the surgeon does not feel warranted in resorting to amputation; yet, such is the tenacity of life in some individuals in the latter affection, that a large portion of an extremity may be converted, after the lapse of weeks or months, into a shrivelled, dry, and black mass, attached to the body only by means of bone, which undergoes disjunctive absorption more slowly than the soft textures. In such a case it will be but charity to assist nature with the saw, by applying it close to the living part, where, if no dead bone be left, granulations will spring up, and a tolerable, nay often an excellent, stump will be the result. It may sometimes be a question in such cases, whether it will be best to cut in the line of demarcation, or perform a regular amputation a little higher up: the latter should certainly be preferred in some instances, although, as a general rule, particularly in those advanced in life and of debilitated constitution, I believe it will be best to follow the indications of nature, and confine the manipulations to the parts where separation is already in progress.

CHAPTER XVIII.

HOSPITAL GANGRENE. PHAGEDÆNIC GANGRENE.

SUCH a disease as that once familiarly known under the name of Hospital Gangrene is now rarely seen, although, from time to time, both in hospitals and in private, cases are met with, which resemble in many respects those of former years, when the disease committed such ravages among our soldiers and sailors, and when, in civil hospitals also, so great was its prevalence and liability to attack all open surfaces, that it became altogether impossible to calculate with any degree of certainty on the results of surgical practice. It rarely happens now-a-days that a slight abrasion of the skin, or the wound of an amputation, is attacked with sudden and severe inflammation which speedily assumes a gangrenous character, and then rapidly ceases in mortification; yet such cases do occasionally occur, although not with the frequency of former times, when, as was said of the Hôtel Dieu, a student might learn how to perform amputation by seeing it done on the living body, but could never learn how to treat the stump from the same field of observation, as the patients operated on invariably died of this destructive malady.

The term Phagedænic Gangrene is frequently used for this disease, too. Often there seems to be a mixture of erysipelas, gangrene, mortification, and ulceration, in the same case, as exemplified thus: on a slight sore on the glans penis, for instance, the proportionably slight inflammation which is present, suddenly becomes more active; the surrounding redness assumes a darker hue; then it becomes blue and gangrenous, and the parts thus affected are converted into a slough, underneath which the process of ulceration goes on so rapidly, that as the slough becomes loose, the space behind is evidently larger than under ordinary circumstances: moreover, on the comparatively more healthy surface left after the detachment of the slough, similar actions may again speedily ensue, and thus, in the course of a very few days, according to the extent of the attack, one half of the glans or one half of the penis, or more, may be destroyed. Sometimes the patient's constitution seems but little affected; generally the pulse is rapid and full at first, but feeble as the case makes progress; the mouth dry, tongue foul, and indeed there are most of the symptoms of that kind of fever which usually attends severe local inflammation, particularly great prostration of strength. In hospital practice I have seen many such cases; but the patients have generally been admitted with the malady upon them: neither the air of the hospital, nor any other supposed contagious influence about such establishments, having been the cause of the disease. Occasionally, however, I have known instances where sores and wounds have assumed similar aspects spontaneously in the hospital. During one season in Edin-

burgh, some years ago, without any apparent cause, many sores in the hospital became affected with actions which, in some respects, resembled those of Hospital Gangrene. Healthy-looking ulcers suddenly lost their red colour, and became of an ashy hue,—the granulations having seemingly lost all vitality: then several patches sloughed, whilst ulceration extended and widened the breach of surface.

There are few remedies, either external or internal, which have not been made use of in these phagedænic sores, but their effects have been very equivocal. As local applications, caustics seem to have been productive of most benefit; the arsenical solution, acetic, muriatic, and nitric acids, have all been used, mixed with water in the form of lotions, or applied undiluted to the surface: nitrate of silver, caustic potash, corrosive sublimate, even the actual cautery, have been had recourse to: again and again have they, individually, been applied to the same sore, until at last the granulations have assumed a healthy aspect: during the same period many of these remedies, in appropriate doses, have been used internally; cinchona and other tonics have been given, mercury has been tried also, though it has been deemed a dangerous medicine in such cases, as being likely to encourage the sloughing; change of food, change of air, and generally all such means as common prudence, combined with professional knowledge, might dictate, have been recommended and adopted;—sometimes with the apparent effect of arresting the disease; often, however, with no good result,—the sloughing and ulceration still extending, until the constitution has sunk under the continued irritation, or probably sudden death has ensued, from the opening of a large artery. In many instances, when the disease has ceased, I have often thought that time, and the natural changes in the system, have produced as much good as any immediate means that may have been used; nevertheless, I should not consider any one justified in leaving such cases alone to nature: a judicious practitioner may often see opportunities of being of service, were it in no other way than cleanliness regarding the dressings, or in the exhibition of stimulants to support the sinking powers of life. I believe that there are few instances in which both constitutional and local means of treatment will not be had recourse to, and the latter must at all times be more or less in requisition. It is long since Mr. Blackadder proved the disease to be of a local nature at first; and, as in more modern times, the opinion seems to gain ground, that this and many other external affections are of a like character, the propriety of destroying the affected surface at an early period should be carefully kept in view. When the disease has seemingly changed its destructive character, and when healthy granulations cover the surface, the same kind of treatment as that required for healthy sores arising from other causes, (such as have already been described,) should be resorted to.

CHAPTER XIX.

ERYSIPELAS.

THERE are few inflammations in which the surgeon is more interested than in those exhibited in the different forms of erysipelas. Whether the disease occurs spontaneously, or follows operations, or accidental injuries, there may be the like need for his services.

The treatment of this disease,—whether it occurs in the form of erythema, with merely a blush of red on the surface,—in that of a more active inflammation of the skin, as in common erysipelas,—or in that termed phlegmonous, where suppuration in the subcutaneous cellular texture and sloughing always occur, may be conducted with advantage, according to the mode of practice which I have inculcated as applicable to the ordinary kinds of inflammation. At first the usual means to evacuate the bowels, and cause moisture of the skin, should be exhibited: often, more especially when the disease is spontaneous, and where the patient seems bilious, an emetic will be of service: sometimes opiates may be of advantage, and it rarely happens that blue pill and opium will not be beneficial. In some instances stimulants may be deemed requisite at an early period of the disease, although they are generally of greater service in the shape of tonics and generous diet, towards the latter stages of treatment.

Constitutional treatment, in some shape or other, is invariably of service, but local measures are probably most essential. I have myself little faith in those which are said by some to check the progress of the disease in a sudden, specific, and mysterious manner,—such as the free use of nitrate of silver, applied either on the inflamed surface, by way of dispelling the affection at once, or in the vicinity to check its progress, and prevent it extending further on the surface than a line marked out by the caustic; neither do I place reliance on blisters over the affected parts, nor on pressure by bandages or otherwise. It cannot be denied that erythema and simple erysipelas have disappeared under the use of such means, but it does not follow that the cure is to be attributed to them; doubtless in many instances the circumstance has been overlooked, that these conditions, so soon as they are developed, have a natural tendency to disappear, and it is probably in such cases that the marvellous effects of these measures have been evinced. Treat two cases, or any equal numbers of a similar affection, one with nitrate of silver, another with such remedies as I have recommended for inflammation, and in all probability the results will be nearly alike under either method of treatment; in the one, however, there will be no affectation of suddenly arresting the progress of the disease, which must of necessity run a certain course, whilst with the other there is an assumption of power on the part of the surgeon, which, in reality, he does not possess. I have similar objections to

the use of flour or chalk, or smearing the part with mercurial ointment; the two former are said to have a cooling effect, and moreover they absorb the moisture, which is exuded in the form of cuticular bullæ or vesicles, in many cases of erysipelas; and the latter, with most equivocal merits, has the disadvantage of being a most filthy mode of treatment. I imagine that the heating influence of flour may probably be greater than the cooling, and I can see little benefit in the absorbing effect of this material, of chalk, or of any other similar remedy. When fluid is actually present, and when such means are used, a dirty cake is generally formed on the surface, which, if not soon removed, often proves a source of irritation; the secretion forming a vesicle becomes semi-purulent, and thus the supposed remedy becomes an evil. In slight excoriations of surface, slight inflammations from certain apparent sources of irritation, such as may be noticed in very fat children, or even grown-up parties, or from urine coming constantly in contact with the skin during any period of life, I have no particular objection to such remedies, although I believe that in all such cases attention to cleanliness, and a proper change of dressings, may be equally conducive to good; but in erysipelas they are often, I imagine, worse than useless.

In erythema, which term implies the mildest form of this disease, I believe all that need, in general, be done locally is to apply warm fomentations, which, with the ordinary treatment for other simple kinds of inflammation, will keep the surface comfortable, until, in the course of a few days, the affection subsides. It may happen, however, that the disease may assume a more severe character, or may actually be so from the commencement, but even then I would recommend the above local treatment, and, in addition, such a number of leeches to be applied, as the extent of the disease might seem to demand, or the age of the patient, and his condition generally, might appear to warrant. In instances requiring leeches, I should consider the disease as simple erysipelas,—that is, a more severe form of inflammation in the skin; and in some such examples, if the swelling were considerable, as it occasionally is on the head and neck, I should deem punctures with a lancet of advantage in permitting the escape of both blood and serum.

In the most severe forms of the disease, when from the pain and other symptoms of acute inflammation there was every reason to apprehend the formation of matter, I should first, perhaps, endeavour to mitigate the violence of the action, by the use of a greater number of leeches; and in the event of not succeeding in this way, I should not hesitate to make one or more incisions, according to the extent of the disease, through the skin, so as to give free vent to blood and serum, and also to matter, should it happen to have already formed. Possibly, however, the suppurative action may not have occurred, but notwithstanding, the wounds will be productive of great benefit; and should the secretion of pus ensue, the fluid will have ready egress through one or other of the openings.

I believe that the advantages of the practice of making incisions, so strongly advocated by Mr. Hutchison, and by Mr. Lawrence, have been much overrated, and that at all events the method has been shamefully abused, having been resorted to in many instances when it was not required; but, on the other hand, I am equally confident that if, in many examples, this mode of treatment had been adopted, the disease would have made less fearful ravages than have been too often observed to follow its course. Without at all wishing to detract from the modern assumption, that surgery implies much more than the "work of the hand" alone, I cannot but say, that I have seen many instances, where it would have been of the greatest consequence, if the practitioner had made more use of his fingers over the seat of the disease, than at the patient's wrist. I have known all the attention devoted to a supposed scientific examination of the pulse and tongue, with probably some careful inquiries about shivering, when if the fingers had once been applied over the seat of the disease, such unequivocal proof of the formation of matter would have been observed by any medical man, however inexperienced, as might at once have dictated the proper line of treatment.

It is characteristic of the suppurative inflammation which occurs in the early stages of severe erysipelas, that the matter is not surrounded by an effusion of lymph, such as happens in the cellular tissue in common abscess, but, on the contrary, the fluid seems to permeate in all directions, without restraint, further than is offered by the natural firmness of individual textures, and so it will become extensively diffused under the skin, or under an aponeurosis, before it will burst through either of these textures. It is in such instances that incisions are productive of so much good. In general, division of the skin is sufficient; but where the matter lies under a fascia, the knife must be carried to the requisite depth. One, two, or more incisions from two to three inches in length, in such situations as to give most ready egress to the matter, both at the time and afterwards, should be made, and such wounds I should in general prefer to the long incisions of Mr. Lawrence, or the lancet punctures of Sir W. Dobson.

After evacuation of the matter, the treatment should be such as has already been described for abscess, granulation, and cicatrization; poultices, lotions, ointments, and bandages will all, in succession, be of service; and possibly, too, there may be sloughing both of skin and cellular substance, when the practice in regard to mortification must be kept in remembrance. In the severe forms of diffuse suppuration, the system will require powerful support from generous food and stimulating liquids. It will often happen that the stomach will nauseate such food as is usually deemed nourishing, and then the chief reliance must be on soups, spirits, wines, and malt liquors.

Sometimes the original disease causes such havoc in all the textures of a limb, as to render amputation the only feasible course, and this is particularly apt to occur, when the disease comes on in compound fracture; for here, besides extensive suppuration in all the textures

around, the ends of the fragments are often so denuded of periosteum, that they are certain to die.

In some, I might almost say in many, instances of simple erysipelas, when, throughout the whole active progress of the inflammation, there have been no symptoms of suppuration, the presence of matter is detected when it is least expected ; and this will occur, too, when the disease has, to all appearance, ceased ; there may be one abscess or several, but it seldom happens that beyond a few drachms or ounces of pus collect ; and moreover, unlike the example of the phlegmonous form of the disease, the matter is usually surrounded by condensed cellular substance, as in the case of common abscess ; indeed, I consider that for several weeks after an attack of simple erysipelas, the textures, particularly the subcutaneous cellular tissue, are extremely liable to suppuration. These abscesses should be treated according to the method already described for simple collections of matter.

There are few injuries or diseases of the body or of its textures, regions, or members, to which the foregoing methods of treatment are not more or less applicable. The diseases of the skin which fall under the province of surgery, such as pimple, pustule, boil, carbuncle, and ulcers ; the effects of heat, as exemplified in scalds and burns ; those of cold, as chilblain and frost-bite, may all be treated according to the rules inculcated in the preceding pages ; nor does it require much additional skill to apply them to those of the mucous membrane, blood-vessels, nerves, muscles, tendons, bones, sheaths, bursæ, and joints. As it is not within the intended scope of this work, to name or describe the nature and treatment of all the diseases to which these textures are liable, I shall not profess to do so ; but notwithstanding it will be afterwards found in treating of the injuries and diseases of the different regions, that few subjects of much interest to the surgeon, such as he may meet with in ordinary practice in this country, have been overlooked.

CHAPTER XX.

HEMORRHAGE.

To save constant repetition afterwards, to serve the purposes of this introduction, and to illustrate the general mode of treatment of certain injuries and diseases, I shall now refer to such subjects as seem to me to require separate consideration at the present stage of my progress.

The directions which I have already given as to the manner of arresting hemorrhage, leave but little further to be said on this subject. It will be remarked, however, that my observations are chiefly with reference to arterial hemorrhage, and that, too, occurring during operations, or immediately after the infliction of wounds; but the surgeon has other kinds of bleeding to deal with, and his assistance is required at other and equally important times. Although hemorrhage from arteries is that which is most to be dreaded, it cannot be doubted that the wound or rupture of a large vein may be equally prejudicial, and therefore the surgeon, in all cutting operations, is as anxious to avoid such vessels as any other important textures. In operations for aneurism, or for the removal of tumours, he carefully protects the large veins, for the purpose of preventing hemorrhage, and other unfortunate results which may follow their injury; but such veins must often be wounded, or even cut across; as, for example, in venesection, the treatment of varix, in operations about the neck, and in amputation. It rarely happens that bleeding from these veins is at all troublesome to arrest, unless it be from vessels of the first magnitude. In venesection at the elbow, for instance, or in the external jugular, the removal of the obstruction to the circulation, on that part of the vessel nearer the heart than the wound, is usually sufficient to obviate the further escape of blood, and at all events a slight pressure with a pad and bandage will have the desired effect; and so it will have, too, in wounds of larger veins than are interfered with on these occasions, as is exemplified in rupture of varicose veins on the leg, or when the surgeon divides them with the knife; for in such instances a slight pressure, combined with the horizontal position, is sufficient to restrain the flow of blood, even when the vessels have become enormously distended.

Perhaps the most troublesome of all venous hemorrhage is that which occurs during operations at the root of the neck, (as on the large arteries,) and in amputations near the trunk. In the former case, unless some very large vessel is wounded, the blood ceases to flow from the aperture, as soon as the struggles of the patient subside, and the respirations become more natural. It seldom happens that more than a little temporary pressure with the point of the finger, or in any other convenient mode, is required; when the finger cannot readily be applied, a curved copper spatula may suffice, or the forceps

with a catch may be used, or even ligatures may be applied. In the latter case the threads may be drawn with such a tightness only as to prevent the blood from flowing, as it is deemed by some the best plan to remove them, as soon as the chief part of the operation has been accomplished. In some cases the surgeon finds it necessary to allow the ligatures to remain, or to replace them, in the event of the hemorrhage continuing; but this measure should not be resorted to, unless the bleeding cannot be restrained otherwise. It must be remembered that, in this situation, the hemorrhage may be equally troublesome, from either end of the vein; and on the external jugular, for example, a ligature may be required both on the upper and lower side of the wound.

Venous hemorrhage during amputation, is commonly most conspicuous when the fingers are used instead of the tourniquet, to arrest the circulation; as the main vessels are then alone compressed, the smaller arteries, given off above, convey a large quantity of blood to the part of the limb below the pressure, and it is apt to run from the corresponding veins into the lower part of the larger tubes, and so escape through their divided extremities. The valves in the veins in a great measure prevent this; yet it often happens; but it usually ceases as soon as the fingers are removed. Sometimes it is not desirable to raise the fingers until the large arteries have been secured with ligatures; and in such a case, whilst they are being applied, the best manner of proceeding is for an assistant to place the point of his finger over the bleeding orifice. At the shoulder, in the leg immediately below the knee, and above the middle of the thigh, the large veins are apt to be troublesome, during the taking up of the arteries; but I have seldom known an instance where the bleeding did not cease when all pressure was taken off above, and when the flaps were approximated and the stump laid in a proper position. In some instances, as in removing the great toe with its metatarsal bone, I have found it difficult to secure the bleeding arteries in the usual manner; and in consequence of the hemorrhage appearing partly venous, I have stuffed the wound with lint, and applied a bandage over all with good effect; but this course prevents union by the first intention, and should not, therefore, be resorted to unless the necessity be urgent.

In amputations and in all other operations involving the division of veins, it is seldom requisite to apply more than moderate pressure to stop the flow of blood from the divided ends. Formerly it was the custom to secure the vein and artery in the same ligature, but such a plan is now obsolete, excepting in rare cases, when the surgeon can scarcely do otherwise. For the last twenty or thirty years he has, in securing the main artery of a limb, taken especial care to exclude the accompanying vein, and assuredly this general practice, for many good reasons, should never be deviated from; for, although I consider that recent experience in the treatment of varicose veins, as well as many common occurrences in surgery, go far to show that

there is really no such great danger in interfering with veins, as was supposed by those who reasoned on the few fatal results of ligature of the internal saphena, practised by Home and others, as it is rarely necessary to use a ligature to a vein, there is no occasion for inflicting an additional and worse kind of wound upon it, by means of the thread.

For oozings of blood either from veins or arteries, it is customary to trust to local astringents and styptics of various kinds. Cold air, solutions of spirits of wine, of tinctures, of turpentine, of various salts, such as the acetate of lead, sulphate of alum, of zinc, or of copper, nitrate of silver, caustic potash, even the actual cautery, have all been used for this purpose. From time to time pretended specifics have been used, also; but with these, as was the case with the famous styptic of Brossard, the agaric, pressure seems invariably to be the main agent; and doubtless it would, if properly applied in a severe hemorrhage, be equally efficient without the aid of the mysterious and empirical supposed styptic. Cold air, or cold water, will generally prove successful in ordinary cases, and the cautery will arrest bleeding from very large vessels; but unless these run in bone, or cannot be commanded in any other way, it is now-a-days seldom used for such purposes. Any of the other means enumerated above, used undiluted or otherwise, will prove styptical in all ordinary oozings. Sometimes they are merely allowed to come in contact with the surface; on other occasions they are combined with pressure, the latter being applied by means of sponge or lint, kept on by the hand or by a bandage. In all instances, the surgeon should bear in mind, the favourable influence of keeping the bleeding part above the level of the heart if possible, nor should he forget the remarkable effects of the acetate of lead when used internally in such cases, as well as the peculiar influence of digitalis over the heart's action.

In many instances the surgeon is obliged to trust to one or other of these means; but, I need scarcely repeat, that when ligatures can be used with propriety, they should generally be preferred.

Secondary hemorrhage is often more alarming, and more uncontrollable, than that which occurs during the performance of operations, or as the immediate effect of injuries. This kind of bleeding usually happens after amputations, and operations for aneurism, about the period when the ligature separates from the principal artery. It may ensue in consequence of the adhesive process not having taken place in the vessel at the seat of ligature, or it may be the result of unhealthy inflammation, or of ulceration in the wound, causing the vessel to open after having been closed by the proper effusion of lymph. The bleeding which occurs in ulceration and sloughing, such as occasionally happens at the ham, groin, and neck, (although it may be for the first time, *i. e.* primary,) is somewhat analogous, as there is a similar unhealthy action—a similar deficiency of adhesion.

When the vessel is small, some ordinary styptic may suffice to arrest the hemorrhage, particularly if combined with pressure; but

if it be large, these means are not to be trusted to ; the ligature will alone give assurance of safety.

The pressure should be applied directly on the bleeding point, by graduated compresses and bandages; and it will be of advantage, too, if pressure be put on the main artery, or arteries leading to the aperture, as on the humeral, radial, and ulnar, in wounds deep in the hand, or in puncture of the humeral during venesection. In some parts of the body, as at the root of the neck, the surgeon cannot do otherwise than trust to pressure, and often has he the fatal proof of its inadequacy. When the stream is profuse, he may, on certain occasions, as in a stump, at once see the propriety of resorting to other measures. Perhaps there may be difficulty in deciding on the proper part for the application of a ligature. The occurrence may, in general, be taken as sufficient proof, that there has been little disposition towards the adhesive process, and that, at all events, ulceration, and other unhealthy actions, are going forward in the seat of hemorrhage: in such a case, then, it will be advisable to place a ligature on the principal vessel of the limb, at a considerable distance from the orifice;—in a stump in the leg, for example, the femoral artery should be tied in the middle, or upper third, of the thigh. The impetuosity of the current is thus stemmed: much less pressure will check the further flow of blood from the orifice (if, indeed, there be any): more healthy action may go on in and around the bleeding vessel, and adhesion, granulation, and cicatrization, may at last close up the parts. In such a case, there may be secondary hemorrhage from the seat of the ligature, and in this event the best skill may be of little avail. The observations on secondary hemorrhage after ligature of the superficial femoral artery, which will be found in a future part of the work, may serve to guide the surgeon under such difficult circumstances.

CHAPTER XXI.

WOUNDS.

THE treatment of wounds constitutes a large proportion of surgical practice, and although much of the after part of this work is devoted to the consideration of particular kinds of such injuries, I deem it proper, in this stage of my task, to make some general observations upon them.

Some wounds are so extensive, so complicated, so peculiar, and so hazardous to life, if the injured part is allowed to remain on the body, that amputation is the proper course of proceeding: severe compound fractures and dislocations, extensive gun-shot injuries, lacerations by machinery, and other such examples, often demand this operation; in which event, the wound left on the body, though perhaps comparatively of great size, is always of a less formidable character. It is in the condition of a simple incised wound, which is the most favourable of all that the surgeon has to deal with. Such are the wounds which he himself usually inflicts in the performance of cutting operations; but as the use of the knife forms so small a share of the treatment of any injury or disease,—being, perhaps, the work of a few seconds or minutes only, whilst the after practice may last for weeks or months,—it is highly incumbent on the young surgeon to study the science and art of treating and dressing such injuries.

Whether a wound be punctured, contused, lacerated, poisoned, or gun-shot, it is usually a good object to bring it as nearly into the condition of a simple incised one as circumstances will permit. It is evident that this cannot be effected in all these instances; nevertheless, much may be done by a judicious practitioner to forward this object. Thus, in a puncture, a portion of the sharp point with which it has been inflicted may have been left in the part, and, if this were allowed to remain, it would be almost certain to retard the cure. Again, in contusions and lacerations, there may be great effusion of blood in the surrounding tissues, or there may be foreign substances driven into them. In poisoned wounds there is a peculiar source of irritation, and in those termed gun-shot (which usually include the injuries of pistol, musket, or cannon-balls, and other missiles projected by explosions of gunpowder), if foreign bodies remain in contact with the textures, the result is almost invariably more troublesome, than when the track is left comparatively clear.

Sometimes it is improper, or impossible, to remove foreign materials, at the commencement of treatment. In gun-shot injury, for instance, a large portion of the wound may be deprived of life, and can only separate by sloughing; or the most skilful surgeon may not be able to remove a foreign body which may be in the part. Then, in effu-

sions of blood, it would in general be improper to make an incision for its escape: this should be done only when it has become evident that it is a source of irritation, and that it is not likely to be absorbed. In sprains and slight contusions, the ecchymosis (or, in other words, the effusion of blood) invariably disappears. In simple fractures and dislocations the extravasation is always absorbed in the progress of time, as it is also in the instance of thrombus, which occurs during venesection when the orifice in the skin is not kept directly over that in the vein.

Inflammation is the inevitable consequence of all wounds, however trivial, or whatever their magnitude. Sometimes the action following a puncture with a needle or a lancet is so imperceptible,—the ordinary symptoms of inflammation being scarcely appreciable, that some have disputed this point. In a wound healing by the first intention, that in venesection, for instance, the process which Hunter named "adhesive inflammation," has been asserted by John Bell and others, to be different from that of inflammation. The difference, however, seems to me to be more in degree than in quality. Adhesive inflammation is, perhaps, the mildest of all forms of this disease, and the nearer the approach to it in a case of wound, so much the better is it, in general, for the success of the treatment. The immediate removal of every cause of irritation, in so far as this may be possible, is, therefore, an excellent general rule of practice. Some foreign substances, which must of necessity be left, as ligatures and stitches, are known to produce a very small additional amount of irritation, which is, however, amply compensated for by their own merits; but in the case of a poisoned wound, such as the bite of a poisonous snake, or of a rabid dog, when its mysterious influence on the system is too often ungovernable, the surgeon cannot too speedily resort to such measures as may destroy the poison ere it enters the system. Hence the advantage of an early application of the caustic, cautery, or even excision of the bitten part. But as some of these doctrines are more fully illustrated elsewhere, I need not dwell on generalities here.

In some incised wounds, and, indeed, in all of any other kind, with but few exceptions, the chief object to be kept in view is to procure union by the first intention. To forward this desirable occurrence, the wound must be cleared as completely as possible of all extraneous matter. A soft sponge and warm water must be used, to wipe away blood, and every other material likely to prevent the surfaces coming accurately in contact. Such a number of ligatures having been applied as may be thought advisable, in the manner and according to the views, already described, their ends being left out at some convenient part of the wound, the surfaces must be carefully approximated, and held together by means of stitches, straps, and bandages, as may be deemed most convenient. The method of treating a wound for the purpose of encouraging early union, has been, in part, referred to already, in my observations on stitches, and will be still further illustrated, in describing the treatment of stumps immediately after ampu-

tation. When ligatures are left in a wound, of course union cannot occur where they are placed; but in general, as soon as they are detached, the spaces or sinuses through which they have passed speedily heal. If all circumstances are favourable, union may occur throughout the whole track (saving where the ligatures are) in the course of twenty-four hours or less; and in eight-and-forty hours, when it may be thought advisable to remove the stitches and first dressings, the bond will be tolerably firm, but certainly seldom such as to save the necessity for further support. In some cases, when there is no drag on the parts, and, consequently, no disposition to separation, (as in the wound of venesection,) a bandage is not requisite after the first four-and-twenty hours; but when the wound is considerably larger, and the edges heavier, a further degree of support is demanded, else the tender adhesions will be certain to give way.

In most instances, when it is said that union by the first intention has occurred, there is usually some little point on the surface where it does not happen, (as where the threads hang out,) and that same point will seldom heal under the lapse of three or four weeks: but this need not be considered a drawback, for there are few instances where a wound can be exposed to the least violence within that period; in a stump, for example, whether of the finger or of the thigh, where early union may have taken place, no freedom can be taken with it,—no artificial limb can be applied for weeks, aye, even for months, in consequence of the tenderness of the parts; and here, then, it really signifies less than some seem to imagine, when a small portion of the wound remains open for three or for six weeks. In stating this, I by no means wish the young practitioner to suppose, that he should be careless on such a matter, but it may be satisfactory for him to know, that when surgeons talk of union by the first intention having occurred throughout a wound, such little troublesome points often remain, which the most consummate skill will not cause to heal until nature seems inclined, and this will not be until the open part has gone through the process of suppuration and reached that of healthy granulation, when, as already stated, the sore will heal, as it were, spontaneously.

The above remarks apply only to such wounds as are exposed to the atmosphere. When there is air between surfaces, I believe it is impossible that union of this kind can occur, and in external wounds, I imagine that it only happens in those instances where the surfaces are so accurately approximated that the air is excluded. On the contrary, if the surfaces have never been exposed, the most severe wounds will often unite without the occurrence of suppuration;—as those of the soft parts in simple dislocations and fractures, where the union, though in some respects different from that usually spoken of as that by the first intention, is, nevertheless, in most features remarkably similar.

But the best examples which I can give of the favourable union of parts, are those which have been afforded in modern times by the operations termed "subcutaneous." When Lorenz, Sartorius, and

Delpech, divided the tendo Achillis for club-foot, a large opening was made in the skin, and the tendon was freely exposed to the air, but the wounds healed so slowly that the operation was deemed of little value, until Stromeyer showed the advantages of the subcutaneous incision. Since then, extensive use of the knife has been made, so as to divide broad tendons and muscles, (the latissimus dorsi, for example, and the rhomboideus major,) but the instrument has been so narrow, and has caused such a small puncture in the skin, that air has not been admitted, and the whole track has united without a single unpleasant symptom. One object in such cases has been to permit the retraction of the divided ends: the parts cut, therefore, cannot be said to have united by the first intention, but the whole gap left between the retracted extremities has done so: at all events, there has been no suppuration, nor has there been any granulation, in the ordinary acceptation of that term.

Whether a wound is, or has been, exposed to the air or not, I deem it essential to the process of immediate union, that the parts be kept in perfect quietude. If the surfaces are allowed to rub upon each other in the least degree, the process is certain to be prevented, in which case, the wound can only heal by suppuration and granulation. The only exception to this general rule, which I can at present remember, is in the instance of simple fracture, when, after the lapse of six or eight weeks, the ends of the fragments have not united: in such a case, a little motion may really be of service to induce that excitement which seems to be wanting; but even here, perhaps, after new action has thus been produced, perfect quietude is again necessary to allow the healing process to go on favourably.

If a wound does not close in the manner above referred to, it must do so by that of suppuration, granulation, and cicatrization, and ought to be treated according to the methods recommended for these processes. When immediate union is not expected, the best plan is to foment and poultice, to encourage suppuration; for, as I have previously stated, I believe that this event will, in some degree, alleviate the patient's sufferings. Possibly there may be such a degree of inflammation as to render leeches advisable: sometimes it may be of a gangrenous character: often it is erysipelatous—as in severe punctured wounds, or those received in dissections, when high action ensues, and the directions already given for the treatment of these different conditions will save repetition in this place.

CHAPTER XXII.

DISLOCATIONS AND FRACTURES.

So much will be afterwards said on the subject of dislocations, when each individual kind is referred to, that but few general observations are here required regarding them.

A simple dislocation may be looked upon as a severe contused and lacerated wound, which, however, (the parts not being exposed to the air,) has all the tendency to heal kindly; but if the dislocation be compound,—if, in other words, the injured joint be exposed to the air,—then high inflammation is likely to result, which is almost certain to end in suppuration. That this does not always occur is fully proved, by the occasional successful results of compound dislocations of such joints as the knee and shoulder, and even when suppuration ensues, there is ample proof that there may be a possibility of saving both limb and life, as exemplified in compound dislocations of the ankle.

In a simple dislocation it should be remembered, that so long as the displaced end of the bone is allowed to remain in its unnatural situation, it acts in some degree as a foreign body, and, therefore, the sooner it is replaced so much the better. But this is not the chief and only reason for an early interference. If inflammation has already set in, the patient suffers much more than he would do if reduction was set about at once; and, moreover, in consequence of the swollen condition of the soft parts, there must be greater difficulty in accomplishing the proceeding. There are few surgeons who would not at once attempt reduction, and I should scarcely here refer to the subject, were it not that I believe there are some who incline to delay. Doubtless, after the lapse of some time, and after the use of leeches and fomentations, or perhaps cold lotions, the inflammatory swelling which follows a dislocation will in a great measure subside, but assuredly each day which passes, with the joint in its distorted condition, only adds to the pain and difficulty afterwards. In all instances, then, unless there be some good reason to the contrary, I recommend an early attempt at reduction. If this be accomplished, one great cause of inflammation will be removed, and it seldom happens that there is any occasion for adopting means to subdue that slight inflammatory action, which must, of necessity, result from an injury of this kind.

The constitutional means which may be resorted to, to facilitate reduction, and the most distant period of time at which it should be considered advisable to attempt the proceeding, will be noticed in reference to the shoulder and hip, and proper occasions will be taken to point out how extension and counter-extension are to be applied,

whether by the hands alone, or by the aid of different kinds of apparatus.

The above remarks are almost equally applicable to fractures. Whether such injuries be simple or compound, each must be deemed a lacerated and contused wound, which must be followed by considerable, if not severe, inflammation. So long as the fragments are not strictly in apposition, the greater will be the amount of local irritation. It is, I believe, a common practice with some, to wait until the inflammatory swelling has in a great measure subsided, ere any attempt is made to set the fragments in their proper place. Others, at an early period, place the fragments and the whole limb in the position in which it is intended that they shall lie during the cure, but make no attempt to fix the parts by means of splints and bandages, until inflammation and swelling have, in some degree, gone off. I believe that the latter plan is absolutely necessary in certain instances, and that the former may occasionally be deemed advisable; but, as a general rule, I feel satisfied that it is best not only to set the fracture (as is the technical term), but to apply such apparatus as may be deemed requisite, as soon after the surgeon sees the case as circumstances will permit. The admirable practical remarks of Mr. Pott, and of Sir James Earle, on this subject, seem to be overlooked by some practitioners of the present day, but the advantages of an early re-adjustment of parts must be so apparent, that it is scarcely necessary to quote such high authorities to enforce the practice.

The smallest deviation of the fragments from their natural position, must be productive of greater irritation than when the broken surfaces are accurately opposed, and, therefore, with few exceptions, they should be so placed at the earliest possible date. I have no doubt that if all fractures were set within an hour of their occurrence, the subsequent inflammation and swelling would be less severe than they usually are; but the surgeon, who is to be responsible for a case, may not see it for some days after the accident, and it is in such instances, perhaps, that there may be doubt as to the propriety of immediate adjustment. In fracture of the patella, for example, as will be afterwards stated more particularly, the fragments are usually separated from each other by the fluid which collects in the joint, and it is not until absorption takes place, that approximation can with propriety be accomplished. In the upper third of the thigh, too, the swelling from effused blood and inflammation is occasionally so great, that attempts to extend the limb are productive of little or no benefit. In such examples, however, by proper attention, the fragments may be at last placed in excellent position.

In dislocation, as soon as reduction is accomplished, the need for the surgeon has almost ceased,—the act of reduction seems the chief part of his duty, and, moreover, it may be said that, in general, it is the only occasion on which any active interference on his part is required. Not so, however, in fractures: the proper adjustment of the fragments only, as it were, begins the treatment, and, for weeks after,

the surgeon has to give careful attention to their position, and to see that the bandages, splints, and other apparatus, are properly applied. It often happens that after the first dressing there is no further occasion for the surgeon's interference; but he acts unwisely who gives a case no further notice until the time comes for taking off the coverings; for, besides the frequent necessity for loosening or tightening bandages, averting undue pressure on particular points, ascertaining that no unusual inflammation is going on, no vesication on the surface, no suppuration within, it is incumbent on him, also, to observe, that no displacement occurs during the movements of the patient, or otherwise, so that in such an event, he may take the earliest opportunity of putting the parts right again.

I am convinced that success in the treatment of fractures, depends much more on these attentions, than on any marked superiority in particular forms and kinds of splints and bandages. Out of the many cases treated in our public hospitals, there are few examples met with of marked deformity; yet it is doubtful if the apparatus used in such cases is altogether alike in any two establishments; and the results are often equally good in the instance when no splint or bandage is made use of, as when the most complicated instruments are had recourse to. These results, then, in my opinion, are chiefly to be attributed to the skill and care of the surgeon,—skill in the original setting and adjustment, and care in the after management.

With few exceptions, it will rarely be necessary to use leeches, or other such means, to subdue the inflammation which follows simple fracture; — rest and good position being chiefly to be relied on. When great injury has been inflicted, it may be well to use some precautions lest the inflammation should run on to suppuration. Leeches and fomentations may possibly be deemed advisable; but, in general, cloths wetted with cold water, or a cooling lotion, may be preferred. If suppuration ensues, the matter should be evacuated at an early period: if it is not already in contact with one or both fragments, it may speedily be so, and caries or necrosis may be the result.

In compound fractures, the treatment must be varied according to circumstances. At first, the fragments must be set as in the case of simple fracture, with the exception that the wound on the surface must not be covered in a permanent manner,—the splints and bandages being so placed as to permit the application of any dressings that may be deemed necessary. If the wound in the skin is slight, an attempt may be made to effect union by the first intention, and if this succeeds, the case must afterwards be treated exactly in the same manner as a simple fracture. If, however, the wound suppurates, which it is almost certain to do in a large proportion of cases, the application of poultices and warm-water dressings, as in the treatment of suppuration under other circumstances, must be resorted to, and when the matter does not appear to have free egress, more convenient openings should be made. The diffusion or infiltration of

pus, which often occurs in such cases, is thereby rendered less likely, and a few incisions at first (that is, when suppuration has occurred, or when the inflammation is high—perhaps of a gangrenous character), judiciously made, may probably avert the necessity for amputation, which is the occasional result of compound fracture. Whatever course of treatment may be necessary for inflammation and its consequences, the strictest care should be taken to keep the fragments in good position, and perfectly quiet.

The question of amputation in compound fracture is frequently one of great interest, and it will be often canvassed in the after parts of this work. In all instances when a limb is injured beyond the hope of recovery, there seems little doubt among the present race of surgeons, that immediate or primary amputation should be performed; the statistics collected by Mr. Guthrie, and still more recently by Mr. Rutherford Alcock, give decided proof in favour of this practice. The chief difficulty in such injuries seems to consist in determining which are the cases where attempts may reasonably be made to save both limb and life, and whether in saving the former such a useful member will be preserved as to warrant the risk to which the latter may be subjected. In all instances of doubt I should lean to that decision which might save mutilation, whenever I imagined that the future circumstances of the patient afforded a fair chance of recovery; but assuredly I should neither consider it a matter of gratulation, nor an illustration of judicious practice, that the surgeon had refused to amputate, for the sake of preserving a limb, which at best could only be deemed an eyesore and an incumbrance. I trust it will be afterwards found in these pages, that I am no advocate for interference by means of operations when other measures may suffice, and more especially when that interference implies the loss of an important member; for I imagine that as much good judgment may be displayed by patiently watching the efforts of nature, as by an officious meddling; but, on the other hand, I cannot admire or sanction that kind of surgery which inculcates the saving of a limb at all hazards, merely for the sake of avoiding amputation;—hazards, too, which involve the life of the patient, and the probability of an ultimate necessity for this operation.

More than thirty years since a method of treating fractures without splints was recommended by M. Sauter, of Constance, and Dr. Mayor, of Lausanne, and a mode of swinging broken bones was also recommended; but although both plans are occasionally followed in the present day, and although I think well of the practice of suspending fractures of the leg, I cannot give it a preference, nor omit this opportunity of referring to the objections (stated in an after part of this volume) to treating fractures without splints, which seem to me so apparent, that I wonder how such a mode could ever have had its advocates. There is no deficiency of evidence that fragments will unite without the aid of splints, nor is there proof wanting to show that occasionally they will not unite, however carefully any kind of

apparatus is applied; but I think that it cannot be doubted for an instant, that a broken limb is in a much safer condition when properly put up in splints than when left altogether unprotected. I must refer, however, to my remarks on the treatment of fracture of the leg for further illustration on this subject.

It may be observed that, in my notices of fractures of different bones, I make no particular allusions to separation of the epiphyses, diastasis, as the accident is called,—a kind of injury which is occasionally met with in the young subject; and the reason for this is, that I know of no difference of treatment which such cases may require, whilst every anatomist must be aware that a solution of continuity is more likely to occur in such situations than elsewhere. If they deserve especial comment, it is probably that crepitus will be less distinct, and also with reference to the proximity of the injury to a joint; but on the latter point, the principles of treatment for ordinary fractures are equally applicable, whilst if the symptoms of fracture are so obscure as to make crepitus essential to the diagnosis, it is evident that if there be a fracture at all, it must certainly be one of a most simple character.

CHAPTER XXIII.

FALSE JOINTS.

WHATEVER care be taken with fractures, it will sometimes happen that the fragments do not unite by means of bone. In such cases there is either a total absence of that vascular action which produces callus, or whatever amount of it there may be, there is no disposition towards union and consolidation of the parts which have been separated. Under such circumstances a false joint is said to have formed.

Occasionally there is a very evident cause for non-union, whilst in some instances the utmost skill cannot divine any other than that which is the usual resource of our ignorance, viz., a peculiarity of constitution. I have seen one instance where I imagine the chief cause of non-union was the constant interference of the surgeon, who, in his anxiety to afford all the skill in his power, used to take down the splints, and put them up again every second or third day, so that the parts really had not that rest which is of such essential service in the early stage of treatment. I hope it will not be supposed that this is the kind of attention which I recommend in a preceding page; for when once all the parts and apparatus are properly adjusted, there should be no further interference, unless there is an absolute necessity.

In examples where the cause can be ascertained, the surgeon may not have the remedy in his power, or at all events he can but wait, in

hopes of a more favourable action coming on, as in the case of a compound fracture where necrosis has ensued, when he must allow time for the separation of the dead portion. In one constitution, consolidation will take place much more rapidly than in another; but we cannot calculate with certainty on the period that may be required for this event, either on the score of constitution or age, excepting in the latter case, when fracture occurs under puberty or in early infancy, for then we know that the formation of callus goes on more rapidly than at any other period of life. I have treated several examples of fracture which had taken place during birth, and have remarked how speedily the fragments have become firm. I have seen one instance to the contrary, however, where a false joint in the leg was formed in early life, which at first caused lameness and deformity, and ultimately, as the patient's weight increased, necessitated amputation.

In certain parts of the body, and under certain circumstances, a false joint is almost sure to be the result of fracture, and is in some degree desirable, as, for instance, in fracture of the neck of the thigh-bone, where it is seldom expected that bony union will ensue; moreover, such a result in this situation, and in advanced years, when the accident occurs most frequently, is as good as need be desired; but there are few other parts of the extremities where false joint is attended with so little trouble or inconvenience. A case has been referred to by Mr. Marshall where a recruit passed the ordinary examination as to his physical condition, who had a false joint in the fore-arm. I have myself seen one instance where a similar state caused but little inconvenience; but, in general, if the fragments remain disunited in the leg, thigh, or upper arm, there must be such a loss of power as to induce the patient to submit to any reasonable proceeding on the part of the surgeon, to bring about consolidation.

My opinion regarding false joints, whether resulting from fractures or dislocations, will be found at greater length in future pages, where I shall speak of particular cases; meantime I may here state, that in the treatment of non-union, I would resort to almost any reasonable measure before I would cut down to the parts, as was done by White. After the lapse of six, eight, or ten weeks, I would resort to friction of the ends of the fragments against each other, gentle or active, according to circumstances, and after exciting increased action in this way, I would again, for a time (ten or fifteen days), keep the parts still, as in the first stage of the treatment. If this did not suffice, then I would allow the patient to move about a little, desiring him, if the fracture was in the arm or fore-arm, to use the limb as he might feel inclined, and if in the lower extremity, permitting him to rest upon the part at will. Here, perhaps, I might resort to the starch bandage, and should success be still wanting, I would next use a blister or a seton. I have, on several occasions, seen this last method resorted to, and have remarked the difficulty of passing the thread between the fragments, as was originally done by Dr. Physick: but I do not consider it absolutely necessary that it should be between them, as I

believe it may answer equally well when in the proximity, for the desired inflammation may be produced in this way with as much certainty, perhaps, and often with greater safety, than when the thread is carried through the fissure. In the leg or fore-arm, it may not be very easy to avoid important vessels or nerves. The thread must be passed with a needle of a size proportioned to the thickness of the limb, and if the common seton needle be used, its sharp sides may possibly cut what should be avoided. I have seen the radial artery wounded in this way. If a probe is preferred, as I have already recommended for passing an ordinary issue seton, the bistoury, which must be in requisition in such a proceeding, may do harm. I have seen the surgeon, unable, or unwilling, from judicious caution, to pass a needle or probe between the disunited fragments of the tibia, leave the latter instrument sticking in the fissure, and the proceeding was attended with all the benefit that could have been expected from the cord, had it been carried between the fragments.

I would only cut down to the fragments as a last resource, and, on doing so, be regulated by circumstances, whether I should merely scrape the exposed surfaces, or actually cut portions of them away with the saw. In the leg or fore-arm, I should resort to the latter plan with great reluctance, more especially if only one bone was at fault. A case will be afterwards related, where, in consequence of a portion of the tibia having been removed at the period of reducing a compound fracture, no new bone was produced, and, the fibula afterwards proving insufficient to support the weight of the patient's body, amputation was ultimately performed. The best part for resection is in the arm, and it would only be the most urgent necessity that would make me attempt such an operation in the thigh. There is a preparation in the museum at King's College, exhibiting an instance where such a proceeding might have been of the most essential service: a loose portion of bone is seen lying crosswise between the two chief fragments, so as to keep them from coming into contact. Here if an incision had been made, the fragment might have been very readily removed, and, doubtless, with a successful result.

It must be kept in view, that when resection is performed, the fracture is converted into a compound one, and the hazard is, therefore, considerable, more particularly in the thigh, where this species of fracture is so very dangerous.

In false joints, as in most other abnormal conditions, resulting from injury or disease, with which the surgeon has to do, it is well to ascertain in how far constitutional remedies may be of service. A case, remarkably illustrative of this observation, once occurred to me in The Royal Infirmary of Edinburgh. A man, about fifty years of age, came under my care for a simple transverse fracture in the middle of the thigh, and, after the lapse of three weeks, when all swelling from effused blood had gone off, and the muscles and other soft parts had diminished considerably in size, the ends of the fragments could be felt rubbing against each other, as if the surfaces had already

become, in some measure, smooth. From the flaccid state of the muscles, and apparent deficiency of vascular action, I was apprehensive of the result, more especially as the patient seemed to fall off in health daily. Nutritive food had no good effect, and I was at a loss what to do. Although assured by the patient that he had been temperate, I, from his looks, suspected the reverse, and ordered him a reasonable quantity of whiskey during the day. The change seemed marvellous! within a week, his countenance brightened up wonderfully from its previous sickly and languid aspect, swelling took place around the seat of fracture, and in little more than a month from the time that I first commenced the use of the spirit, a most excellent cure was accomplished. Had I not resorted to this most vulgar mode of treatment, I verily believe that this person would have died, and that, too, without the smallest reparative local action.

CHAPTER XXIV.

ANEURISM.

THE operations for aneurism, most commonly in use, will be carefully described in future pages; but the disease requires some separate notice at my present progress.

The symptoms of aneurism are generally so distinct, that there is seldom any difficulty in detecting the disease. A tumour, in the course of a large artery, pulsating synchronously with that vessel, diminishing in size, when the blood is prevented from passing into it, by pressure either upon it or upon the vessel nearer the heart, and accompanied by a peculiar sound, usually now-a-days termed "bruit de soufflet," which is recognised by applying the ear directly over the swelling, or through the medium of the stethoscope, can scarcely be mistaken for any other disease. But some of these symptoms are occasionally indistinct, and others not altogether to be relied upon. Tumour or swelling may depend on other affections, and pulsatory motion may be very indistinct, from the presence of fibrin, or it may be communicated by a contiguous artery. The "bruit," above referred to, is not esteemed by Mr. Porter and other recent authorities, as altogether infallible, and I have myself seen instances when it did not serve to clear up existing doubts. I have seen a most experienced and judicious surgeon cut through the parietes of the abdomen, with the intention of tying the external iliac artery, for a supposed aneurismal tumour situated immediately above Poupart's ligament, which, however, in the progress of the operation, turned out to be a malignant affection of the lymphatic glands; and I have known the same excellent practitioner, for a tumour which baffled the diagnostic skill of many seniors around him, place a ligature on the main artery, under the supposition that the

disease was aneurism, when it was ultimately proved that he was correct. Such instances, it must be admitted, are rare; but fortunately, it is seldom that the symptoms are so very obscure, although on all occasions it behoves the surgeon to be cautious in his diagnosis. To mistake another disease for aneurism is assuredly a serious matter; but not so bad as the converse. Most surgeons of experience must have met with cases of aneurism at the root of the neck, wherein some ignorant non-professional parties have been advising the use of poultices, and ultimately of the lancet. I have myself known many instances of the kind, in which happily, however, the latter advice had not been complied with.

Many of the usual pathological distinctions between different kinds of aneurism seem to me of little value practically. Thus, it matters not to the surgeon, whether a popliteal aneurism be true, false, or mixed. If the disease arises spontaneously, which it almost invariably does here, I know of no difference in practice more applicable to one case than another, provided always that circumstances are favourable otherwise for an operation. The most experienced cannot tell when an aneurismal sac is formed by dilatation of all the tunics, or merely condensed cellular texture; nor can he be sure in what instances there has first been a dilatation of all the tunics, and then a rupture of the two internal, and further distention of the external. If, however, the aneurismal swelling be the immediate result of a wound, he may then be sure that, if it is circumscribed, it must be by the surrounding cellular texture, and not by any dilatation of tunics. Unless the malady be the result of a wound, or of ulceration, (a case of extreme rarity,) it is impossible to form a correct idea of the state of the tunics, excepting with reference to the age of the individual; and, therefore, however interesting these points may be to the pathologist who examines such tumours after their removal, or after death, I repeat that the supposed condition of the tunics of an artery in spontaneous aneurism, ought not in any way to influence the practice of the surgeon, in so far as selecting an operation for its cure is concerned.

The distinctions between aneurism in one vessel,—common aneurism, as it may be called, and that dilatation of numerous small vessels which constitutes aneurism by anastomosis, are, however, sufficiently important to demand separate consideration, and the latter disease will be particularly referred to in the next chapter. Meantime, I wish it understood, that my present remarks are intended for that form of tumour which is connected with a single large artery.

The operation which Anel performed,—tying the humeral artery for the cure of aneurism at the bend of the elbow, has often been quoted to show that Hunter was not original in placing a ligature on the main artery leading to the disease, at a point nearer the heart; but the grand difference between the cases in which the operations were performed by these parties, does not seem to have been appreciated, or, at all events, clearly pointed out, by all who have discussed

the question of priority. Hunter operated in a case of spontaneous aneurism, Anel in one where the vessel had been wounded. In the former case, there was every reason to suppose that the vascular texture was not in a state of health, as evinced by the spontaneous dilatation or bursting of the artery; in the latter, the puncture with the lancet had evidently occasioned the disease, and there was no reason to deem the vessel, immediately above and below the wound, otherwise than healthy. Anel did his operation in an instance where most of our best authorities would still perform the old operation. Hunter tied the femoral artery at a distance from the popliteal aneurism, to avoid the acknowledged disadvantages and dangers of the operations previously performed in similar cases. In punctures of the humeral artery during venesection, there is sufficient evidence to prove, that if ligatures be placed above and below the seat of injury, the vessel will close permanently; and, before Hunter's operation, there was no lack of testimony as to the formidable results of all preceding operations.

But such questions do not require to be argued at the present day and I may, therefore, proceed to state generally, that in spontaneous aneurism, when it occurs in any part of the body, where it properly comes under the care of the surgeon, and when an operation for its cure is resolved upon, the ligature is usually applied at some considerable distance from the disease; on the other hand, if it is the result of injury, deligation may be resorted to, as close to the orifice in the vessel as may be found convenient. Thus, in the humeral artery, when injured during venesection, a ligature is applied immediately above the wound, and, to prevent bleeding from the lower orifice, which may take place in consequence of free anastomosis, another is applied immediately below: the aneurism is actually cut into, and the blood or fibrin turned out. In the spontaneous aneurism, however, the tumour is untouched,—left entirely to nature.

The practice in these different cases will be more fully illustrated afterwards, and it should be here observed that there may be exceptions to some of these general rules. As, for example, in an aneurism of the femoral artery resulting from a wound, the surgeon would act more wisely in placing a ligature upon the vessel at a point nearer the heart, and leaving the tumour untouched, than by cutting down to the seat of injury. Here the recurrent circulation is not so much to be dreaded as in the arm, and there is every probability of the cure going on as it would in a case of spontaneous disease. I wish it to be remembered that the practice here recommended has reference to aneurism, and not to a wound of the vessel, with the blood flowing from the surface, for in such a case I might, perhaps, prefer exposing the seat of injury, as recommended in after parts of this work.

As it is not my present object to detail all that has been done or may be done in the treatment of surgical disease, I need here only state, that for external aneurism, the only certain remedy which the surgeon possesses, is ligature of the vessel with which the disease is connected. Pressure has sometimes proved successful, and in all

eligible situations there need be no hesitation in giving it a trial, although it would be wrong to be sanguine as to the favourable issue. It may be applied over the tumour, on the artery leading to the disease, or partly on both. I know of no other remedy on which the smallest reliance should be placed: the different proposals of causing coagulation, or deposits of fibrin, by means of cold, passing threads through the tumour, or heated wires into it, and by other methods, are all in my opinion of the most futile character; and the trials that have been made of them on the living body, should be considered valuable, chiefly on account of the assurance which they have given, that their success has not been such as to encourage repetition. Success, in a single instance, with one or other of such plans, may possibly occur; but I should deem it unjustifiable, in most examples, to tamper, either with the disease or the patient's credulity, in persisting in their use, or even applying them at all.

In internal aneurisms which are beyond the reach of surgical art, there is, of course, every propriety in resorting to a trial of one or all of those methods, which have been proposed for the purpose of encouraging a spontaneous cure; but as it is not my present object to speak particularly of what is usually termed the medical treatment, I need not refer to such modes of practice, further than to add the testimony of my own limited experience to the vast amount of evidence already obtained, that, however laudable it may be to resort to such treatment in cases which are so fatal in their character, we possess no remedy which seems to have the smallest specific influence on the disease; at all events such an influence as to lead to a certain cure.

In the practice of surgery, the application of a ligature to the vessel with which the disease is connected, has a powerful and specific effect; and although the operation for its accomplishment is not without danger, both at the time and subsequently, it possesses such advantages over all other modes of practice, that the surgeon who, when other circumstances are favourable, hesitates to adopt or recommend it, may with justice have either his skill or his sincerity called in question.

The immediate effect of a ligature is to check the flow of blood through the disease, either entirely, or to such an extent as shall permit the contents of the sac to consolidate, by impeding the influence of the heart's action. In aneurisms at certain parts of the body, it cannot be doubted that after the main vessel has been obstructed by operation, circulation still goes on, though with diminished force and quantity. Sometimes this is quite appreciable; as, for example, in the popliteal artery, where pulsation often can be felt after obstruction of the femoral; the same has occurred, too, in an inguinal aneurism after ligature of the external iliac; at other times the surgeon cannot feel pulsation, although a very considerable current of blood may be passing along, as is proved by what sometimes happens after ligature of the subclavian artery for wounds and aneurisms of the axillary. A case will be referred to afterwards where such an operation failed,—bleeding continued; a similar case has lately been described in The Lancet,—

the collateral vessels kept up the hemorrhage; and, indeed, in my opinion, complete obstruction through the main vessel, at the seat of injury or disease, does not occur in all instances of such operations, and is not absolutely necessary for the cure of aneurism. It is on such views that Mr. Wardrop has proposed his operation of impeding the circulation through the subclavian artery or through the carotid, in aneurism of the innominata, by placing the ligature on the vessel on the distal side of the tumour, being a modification of the original proposal of Brasdor, who imagined that obstructing the vessel beyond the disease might have the desired effect.

The operations of Brasdor and of Wardrop are resorted to only in cases where all other modes of treatment are unavailable, more especially when Hunter's cannot be put into practice, such as in aneurism at the root of the neck. All experience goes to show that those proposed by the two first-named authorities can be undertaken only as a last resource, and one, also, on which no great reliance can be placed; whereas Hunter's operation may be resorted to with every probability of success; but here, it must be remembered that no one would recommend the former when the latter is applicable;—in other words, the instance where Hunter's operation is practicable, is not altogether so desperate, as when either of the others alone holds out a ray of hope. It may be said that Brasdor's and Wardrop's operation, the latter in particular, has been more successful in aneurism at the root of the neck than Hunter's;—ligature of the innominata for aneurism beyond having never entirely succeeded, whilst deligation of the subclavian for aneurism of the innominata has actually, in some instances, been followed with every good result that could be anticipated. But more will be said on these interesting subjects when I come to the head and neck; meantime I shall limit my observations to Hunter's operation.

The usual circumstances which induce the surgeon to hasten an operation of any kind whatsoever, or to wait until a more favourable opportunity, will always influence him in selecting a proper period for such a momentous one as ligature of a main artery. I do not apply such a high-sounding term to the mere manual proceeding, for that is of minor consideration in comparison with the effects which may be produced on the patient; a pupil from the dissecting-rooms may place a ligature on the femoral, subclavian, or other large vessel with as much precision as the most experienced operator, but the most skilful surgeon cannot foretell what may be the result; and it is in this light that the proceeding must be deemed momentous. Experience has taught that it is wrong to wait, after an operation has been determined upon, in the hope that by allowing time for the collateral vessels to enlarge, there will thus be less chance of mortification occurring immediately afterwards. This doctrine formerly prevailed with reference to the popliteal and axillary aneurisms, and the tumours were occasionally allowed to attain an immense size; now, however, it is the practice to operate in such cases at an early date,

mortification being rarely dreaded, and being moreover as likely to happen in the one instance as the other, perhaps most so when the tumour has attained a great size. Instances, however, are not wanting to prove, that when the swelling is very small, there is no immediate hurry; I have myself watched one, of undoubted character, on the axillary artery, for several years, and could observe no perceptible increase in its size; and examples where spontaneous cures have occurred within a certain period, might also be adduced to sanction the advice against precipitancy. I have seen a case of popliteal aneurism, where all the symptoms were distinct, and where an operation was contemplated within a brief period, in which, before the time agreed upon had arrived, all pulsation in the tumour had ceased, and the disease underwent a spontaneous cure. But I believe the general rule of operating at an early period to be a good one, and would not delay, when such a proceeding was deemed necessary, excepting for some other and better reasons than those above referred to.

Two aneurisms, one in the ham and the other in the groin, on the same limb, have been cured by one operation on the external iliac artery; and the disease has been successfully treated by the Hunterian operation, first in one limb and then in the other, as has occurred in the practice of Sir W. Newbigging. In such cases, I deem it almost as unnecessary to inform the young surgeon that he may operate, as to remind him of the impropriety of tampering with an external disease, whilst there is an incurable internal affection present. It may be well, however, to keep this circumstance in view, that when aneurism has come on spontaneously in one part of the body, it may possibly have done so in another; and therefore in all external cases of this disease, a strict investigation should be made as to the condition of the large internal vessels. I need not here allude to all the circumstances that may argue for or against an operation, but I cannot help referring to one case which has come under my notice. Mr. Watson, my former colleague in The Royal Infirmary of Edinburgh, had a case of popliteal aneurism in a female six months gone with child; an operation was determined on, but circumstances occurred to prevent it. In the meantime, the late Professor Hamilton's opinion was taken as to the propriety of operating on a female in this condition, and he advised against it. The patient returned to the country, and in due time was delivered. In the interval the disease had greatly increased in size; on childbed the limb became additionally swollen, the limits of the tumour became less distinct, and death occurring ten days afterwards, afforded Mr. Watson an opportunity of ascertaining by dissection, that the aneurism (in his opinion) had burst into the knee-joint and surrounding textures during delivery. Although the advice for delay under the peculiar circumstances came from such a high obstetrical authority, and admitting, as I do, that all formidable operations should, if possible, be avoided at such periods, I think it may fairly be doubted whether in this case it would not have been better to have operated at the earliest

date at which the patient sought advice. Were a similar case to occur to me, I should feel inclined to proceed at once, although it must be admitted that many circumstances might lead a judicious surgeon to delay.

The individual operations for aneurism will be particularly described afterwards; but, to save frequent repetition, I may here state, that the incisions through the integuments over a large artery should always, if there is no reason to the contrary, be very free, and that those in the vicinity of the vessel should be limited, and so cautiously made as to disturb it in the smallest possible degree. The old practice of carrying the finger under an artery, is now out of date, and the same may be said of that of passing a couple of threads or more around the vessel at different points;—a precaution which was erroneously supposed to guard against secondary hemorrhage. Among surgeons of the present day, the general custom seems to be that of only exposing such an extent of the vessel as to make sure of its identity, and to permit of the introduction around it, of such a needle as that delineated at p. 29, and such a ligature as that described at p. 25. The treatment of the wound must be conducted according to the ordinary principles of surgery, and the most probable after-events will be specially referred to, when each individual operation is under consideration.

The same kind of practice with reference to the ligature, which I have inculcated in previous pages, should be adhered to in the operation for aneurism. The thread should be drawn sufficiently tight to prevent it from slipping from its place on the artery, or the knot from loosening. In tying a ligature in this operation, as well as in amputations and other large wounds, I imagine that, if these two objects be kept in view, it signifies little about the particular effects on the arterial tunics; that is, whether the two innermost be divided or not. I believe it will scarcely be possible to sink the noose sufficiently deep in the artery, without dividing the inner and middle coats, and am also of opinion that the adhesive inflammation is much more certain after such an injury than when the tunics have been merely laid in apposition; but it cannot be doubted that adhesion and obliteration will occur under either circumstance, and the nicest perception in him who draws the noose, will not, on all occasions, indicate the exact amount of laceration of these tunics.

The proposal of using temporary ligatures, that is, allowing the thread to remain on the vessel any period from a few hours up to fifty or more, although successful in the practice of Travers, Roberts, and others, seems to possess no decided advantage, whilst there are strong and obvious reasons against it; and the same may be said of gut, wire, and other materials not referred to previously, which have been proposed as ligatures in operations for aneurism.

The practice with regard to aneurismal varix and varicose aneurism, may be partly ascertained from observations in some preceding pages, but will be more particularly referred to in the surgery of the upper extremity.

CHAPTER XXV.

ANEURISM BY ANASTOMOSIS.

ANEURISM by anastomosis is, in most respects, so essentially different from the other kinds of aneurism, that the treatment requires some separate notice, more especially in this part of my work, as it is a disease which may occur in any part of the body, and the general principles of treatment are, under ordinary circumstances, alike applicable to all.

The peculiar characters of this disease seem to have been first clearly pointed out by John Bell, whose descriptions of it are so accurate that little of importance has been added since his time. He imagined, that it consisted of enlarged arteries and veins, communicating freely by cells of the cellular tissue; but most pathologists of the present day agree, that what he considered cells, are merely dilated and tortuous vessels, inosculating directly with each other, and my own investigations lead me to acquiesce in the latter view. Some years since, I had occasion to amputate the foot for a large aneurism by anastomosis: on injecting it afterwards, the fluid (rather a coarse one) passed rapidly from the arteries into the veins, by direct continuity, and the dissection, which was made by my assistant at the time, Mr. Stephen Stanley, now of the Royal Navy, showed several large points of communication. The preparation is in the Museum at King's College.

Mr. Bell, in his descriptions, makes allusion to the resemblance which the disease has to the erectile tissues, such as the penis and gills of the turkey-cock. He gave it the name of Aneurism from Anastomosis; but recently, from the example of Dupuytren and others, it has often been called the Morbid Erectile Tissue. The terms nævus, and subcutaneous nævus, have often been used of late years, too, but I fear with some degree of confusion. I know of little or no physical difference between the disease described by Mr. Bell, and that spoken of by Mr. Wardrop, under the name of subcutaneous nævus, but between the latter and the nævus maternus there are important distinctions, and it is a pity, I think, that these two terms should, in some degree, have been confounded, and applied, as they often are, to one and the same disease: the mother's mark being, in reality, only a red or bluish appearance, occasioned by a peculiar arrangement, perhaps even enlargement, of the vessels of the skin, showing no tendency to increase, and being in nowise dangerous, or even troublesome; whilst the subcutaneous nævus has all the symptoms, properties, and dangers of the disease originally described by Mr. Bell, under the title of Aneurism from Anastomosis.

This disease may be treated by local measures, or by a mode similar to the Hunterian operation. In the first of these methods,

the object being to remove the tumour by excision, by sloughing, or to alter its condition by exciting inflammation: in the second, the force of the current of blood is taken off, diminution of the swelling succeeds, coagulation perhaps occurs, adhesion, and obliteration.

In certain instances, local treatment cannot be adopted, as when the disease occurs in the orbit, antrum, or other deep-seated parts; and in such cases, ligature of the common carotid, or other large vessel, whose branches lead directly to the disease, is the only resource. Fortunately, such operations have often proved successful, and therefore there is some encouragement to adopt them, although I should, on most occasions, when practicable, be inclined to prefer local measures only.

If it is not wished to make free use of the knife, a variety of plans are at the command of the surgeon, with which he may attempt a cure—the immediate object of all of them being inflammation. This process may be excited by pressure, vaccination, by caustic, by heated wires, by needles, setons, single threads, or by subcutaneous incisions.

Pressure may be, in some cases, applied both on the tumour and on the vessels leading to it, as on the scalp, for instance, but it can seldom be done with great effect. On children, who are most frequently the subjects of practice for this disease, it is difficult to keep bandages and hard pads properly applied, and it does not often happen that the tumours are so situated that the plan can be available. Unless there be bone immediately below the mass, sufficient pressure cannot be applied. This method has first the effect of preventing the blood from circulating in the enlarged vessels, and then producing inflammatory action. Of the method by means of plaster of Paris I have no experience.

The method by vaccination is rarely put into practice, for although the disease is often congenital, it is seldom that any operation is thought of or required, before or at the usual age for this proceeding; moreover, it is only in instances where the tumour is very small, that such a mode could have sufficient effect.

Caustic potash has been used with good effect; but unless the tumour be very small, and the caustic freely applied at first, or often repeated, it is, in my opinion, inferior to some other modes of treatment, although it is backed with the recommendation of Mr. Wardrop.

The practice of pushing heated wires or needles into such tumours, will cause sloughing and inflammation. Professor Pattison has succeeded in this way, and speaks highly in its favour.

I have frequently obliterated small vascular points by passing a needle through the disease, and twisting a thread around it as in making the twisted suture. On these occasions, I have sometimes withdrawn the needle in the course of eight-and-forty hours, in other instances, allowed it to remain longer, and in some, to separate by ulceration.

A seton, carried through the centre of such diseases, has been known to excite high inflammation and obliteration. A needle should be used for the purpose, and the thread should be sufficiently large to fill up the track of the wound, otherwise troublesome hemorrhage might be the result. In some instances, when I have tried this plan, I have subsequently, in the same tumour, observed that two or three single threads, passed through different parts of the disease, by means of a common sewing needle, have had a more decided influence than the large single cord composing the seton.

Two or three subcutaneous incisions will have the double effect of destroying some of the enlarged vessels, and exciting inflammation afterwards. The blood which escapes in these instances will press upon the vessels forming the tumour, and being in a manner infiltrated amongst them, may cause more extensive inflammation.

It has been recommended to push the nozzle of a small syringe into the mass, and thus introduce a quantity of irritating fluid, such as tincture of iodine, so as to excite the desired amount of inflammation: —but there is scarcely an end to the various methods by which this process may be excited.

Of all these plans, after having repeatedly tried most of them, I am inclined to give the preference to the needle and twisted thread. If the tumour is small, one will suffice, but more may be used. In the event of not succeeding, or possibly, even at first, I should resort to the use of two or more single threads. By either of these methods there is every probability of success, and there is less pain and trouble than with some of the others. Moreover, the scars on the surface will be less observable than when other measures, such as the caustic or cautery, have been used.

The fearful account which John Bell gave of certain attempts to remove these tumours by the knife, had, probably, a strong effect in preventing any interference with them in this way; and, indeed, unless the surgeon can make sure of the limits of the disease, he will seldom be justified in adopting such a course; for although an energetic practitioner may arrest the bleeding, which is the immediate and certain result of cutting into such tumours, and dividing so many enlarged vessels at the same time, there may be a greater quantity of blood lost than prudence would deem right. I have seen a free incision made into a large tumour of this kind on the forehead; and although the bleeding was copious for an instant, the surgeon was so well prepared with proper pads and bandages, that comparatively little blood was lost. Here the operator had previously assured himself that the bone was sound behind; and as the head was fully developed and the patient far beyond infant years, there was no difficulty in keeping up efficient pressure.

If the limits of the disease are well defined, there need be little dread of bleeding, for incisions in the healthy parts around will not give rise to greater trouble than under other circumstances. The

principal objection to this plan is the size of the wound, and consequent scar; and, moreover, there are few instances in which it is admissible.

To avoid the danger of bleeding, it has often been the custom to encircle these tumours with a stout thread, which is drawn sufficiently tight to cause strangulation and sloughing. The usual practice has been to push a needle through the centre of the disease, and thus convey a double ligature across, one being tied around the root of one half of the tumour, the other round the opposite half, both including skin as well as disease. This mode is very efficient, but painful, and liable to objection from the size of the scar, which must be the result; besides, if the base of the tumour is broad, complete strangulation may not be effected at once, and new threads must be introduced.

A method by incision of the skin and the ligature has been most successfully resorted to by Mr. Liston. By convenient incisions the skin has been elevated from the circumference of the tumour; needles and threads have then been introduced, and the diseased mass has been treated in the manner above described. This plan has the advantage of preserving a larger portion of skin, and also of allowing the noose to be drawn more closely in contact with the disease, which is thus effectually compressed at once. The surgeon's judgment must indicate the proper incisions and flaps to be made on such occasions. If the tumour is prominent, and the disease involves part of the skin, the knife should be so carried as not to interfere with it; but generally towards the circumference of such growths it is perfectly healthy, and can be raised without much danger of cutting into the mass. The needles used in such operations may be similar to those represented at p. 29, or to that seen at p. 30, which, being set in a handle, enables the surgeon to use it with greater force and precision. Common ligature thread is not strong enough to permit a sufficiently firm noose being drawn, and small whip-cord will be found more advantageous. Instead of one needle only being used to carry across a double ligature, another, armed in a similar manner, may be run at right angles with the first; and thus, by four threads being present, more complete strangulation may be effected. Such a method I have often resorted to in removing hemorrhoidal tumours with ligatures.

Of all these different methods I give the preference to the latter wherever it is practicable, and when it is desirable to get rid of the tumour at once. Instances occasionally occur, however, where even this method cannot be resorted to with propriety. Some years ago I treated a case of this disease in a lad about the age of puberty. The tumour was situated on the outside of the thigh, midway between the trochanter and the external condyle; it was but slightly prominent; and although its diameter in all directions seemed three or four inches at least, its exact limits could not be made out. On all sides large pulsating vessels could be felt passing into it, and there was every

reason to suppose that the affection was deeper than the aponeurosis. It had been present from infancy, but had only lately come near to the surface, where several small ulcers had formed, from which the blood flowed copiously on any unusual effort being made. Being unable to commence any active occupation, the patient was willing to submit to whatever plan of treatment might be advised. Excision seemed out of the question, incision equally so; and the breadth, flatness, and supposed depth of the affected mass, precluded any attempt to cause the part to slough away with ligatures. The parts were not favourable for pressure, and vaccination or caustics seemed insufficient for the bulk of the disease. I used a variety of needles in the manner already described, and with some good effect. Still, however, the formidable part of the disease remained. I then passed several large cords, as setons, and these, too, had a favourable influence, but the affection was far from being cured. Ultimately finding that these measures excited far less inflammatory action than might have been expected, I introduced, by means of long slender needles, a variety of single threads in all directions. More severe action than ever ensued, and when the swelling thus produced had subsided, the tumour was smaller, and firmer than it had ever been; there was less distinct pulsation in it, and a thrill, which was perceptible previously, could not now be detected. When the various apertures on the surface had firmly cicatrized, I allowed the boy to move about as he thought proper; and after watching him for more than a year, I could perceive no indication of the disease being likely to trouble him further. Several small vascular points were still visible on the surface, but these caused no uneasiness; and, I believe, had the patient been anxious, might have been advantageously treated in a similar manner. As it was, the lad, from having been unable to walk without dread and danger of bleeding, now considered himself equal to any fatigue, and called to show himself, previous to entering on the active duties of a sailor.

Aneurism by anastomosis is most frequently seen in the skin and subcutaneous cellular texture, more especially about the head and neck; but it may be seen in any region, deep-seated or superficial, affecting only a portion of a limb or the whole textures. A finger or toe may be the seat of the disease, or the entire thickness of the leg may be affected.

Of late years a disease named Aneurism of Bone has been a good deal spoken of; and my friend Dr. Handyside, of Edinburgh, has written an excellent treatise on the subject. I have often thought that it is no other than aneurism by anastomosis, modified in some of its symptoms and its condition by the peculiar texture in which it is situated. It has hitherto been observed chiefly in the cancellated texture of the upper part of the tibia; and as it is evident, that few of the local measures referred to in the preceding pages could be of any service in such a situation, unless ligature of the femoral artery checked the disease, amputation would be the only re-

source. If the surgeon thought of scooping out the disease, as he would a caries, in the manner which will be described with reference to the last-named condition in the tibia, I would recommend that both he and the patient should be prepared for the necessity, which might immediately ensue, of amputating the limb above the knee. The disease has been found to extend so deep in the interior of the bone, and also to cause such expansion and swelling, as to be far beyond reach from such local measures. Ligature of the femoral has been known to be successful; and judging from the favourable issue of deligation of the carotid for similar tumours (as I suppose them) on the head, by Travers, Dalrymple, and many subsequent operators, out of whom I may single Dr. Mussey, of America, and Professor Kuhl, of Leipzig, who have even tied both carotids for such a disease on the scalp, I imagine that it would be the most judicious practice to try such a method, before resorting to others, which more immediately implicate the safety of the limb. A most interesting case, in the lower part of the femur, supposed to be of this kind, is related by Mr. Hargreaves, of Burnley, in The Medical Gazette for 3rd June, 1842. The femoral artery was tied, and apparently with good effect, when, unfortunately, the patient died from an attack of purpura before the efficacy of the operation could be considered as fairly tested.

CHAPTER XXVI.

TUMOURS.

The term Tumour is in general use amongst surgeons, to indicate swelling on any part of the body, under almost any circumstances: thus, a swelling in the scrotum, from whatever cause it may arise, whether from enlargement of the testicle, hydrocele, or hernia, is usually called by the name of tumour: effusion into the synovial capsule of the knee-joint is often thus designated, too, as well as the different forms of white-swelling. Enlarged tonsils, enlarged thyroid gland, enlarged prostate, local enlargement of veins (varices), are also spoken of under this general title. Strictly, the term is applied to instances of adventitious formations of a prominently local character, which may or may not resemble the natural textures of the part or of the body. For example, if a person grows very fat, although the whole body is thus augmented in size, we do not apply the term tumour; but if there is an extraordinary secretion of this fluid in a particular region of the body, constituting a distinct swelling, separated from the surrounding fat and cellular texture by a distinct capsule of the latter tissue, we apply the term tumour,—fatty or adipose tumour, in consequence of its resemblance to common fat. Again, in the same tissue, a growth may form, which has no resem-

blance either to it or to any other healthy texture, whilst in other instances there may be a degree of resemblance to some normal tissue, as in the medullary tumour, which, however, may be met with in muscle, bone, or any other texture.

However laudable it may be to endeavour to give precision to the word tumour, I doubt if surgeons will ever give up the terms of tumour of hernia, tumour of hydrocele, tumour of hydrocephalus, tumour of abscess, and such like. Dr. Warren, one of the latest authorities on the subject, has been content to leave the term as he found it; and, indeed, except among excessive sticklers for remarkable precision of language,—who are not on that account, however, to be considered the most precise or intelligent practitioners,—I have never seen any difficulties as to what condition the name of tumour was or was not applicable.

Tumours vary in size, shape, position, and organization, to an endless extent. The size may be so small as to be scarcely appreciable, or so large as to equal the aggregate of one half of the body or more. The shape is exceedingly variable,—round, flat, oblong, pyriform, and so forth; they may occupy any part or texture, on the surface of the body, or deep-seated; and their organization and physical appearances are such, that even the most experienced pathologist frequently meets with examples which he may not have observed before.

Sometimes tumours are of a solid fleshy character throughout, such as were described by Mr. Abernethy under the title sarcomatous; at other times they consist of a bag or cyst, which contains fluid,—the encysted species of the same author: occasionally there is a sort of combination of the two, for there may be one cyst or more, in a tumour whose general character is sarcomatous, and in another case a cyst may ultimately assume the appearance of a more solid growth. Indeed, according to Dr. Baron, and also certain modern doctrines founded on microscopic researches, there are grounds for supposing, that even the most solid tumours are originally formed of cysts,—hydatids,—cytoblasts, as they have recently been named.

For practical purposes, the arrangement of tumours into those which are malignant, and those which are not so—benign, as they are called—is perhaps the most useful. I here use the term malignant, as it is generally applied to such diseases as scirrhus, medullary sarcoma, and melanosis. These are maladies which, if not interfered with by the surgeon, are certain to get worse,—to contaminate the system, (if, indeed, they are not already local effects of constitutional disease,) and to be the direct cause of death. The non-malignant, or benign tumour, is exemplified in what Abernethy called the simple sarcoma, or the adipose sarcoma, the cystic sarcoma, and the painful subcutaneous tubercle, described by Mr. William Wood: the different forms of encysted tumour also come under this title, whether the cyst contains a thin fluid like serum, or a thick curdy material, whether it be wen, ganglion, meliceris, atheroma, or steatoma.

The opinion that such a disease as scirrhus is entirely of a local

character in its early stages, seems to gain additional advocates in the present day. Dr. William Budd, of Bristol, has ably endeavoured to prove this in a paper which was read before the British Medical Association, and afterwards published in the Lancet for May 1842. Surgeons (even some of those inclined to deem it hereditary, and therefore constitutional) may be said always to have acted on such an opinion, and, as soon as the real character of the disease has been recognised, have resorted to an operation for its removal, under the impression, that if in reality local and excised at an early period, there is less chance of the system being contaminated, or, in other words, a similar disease showing itself in another and probably a distant part of the body.

It is often an important and difficult question to determine when tumours are malignant or the reverse; and the most experienced cannot always do so on the living subject. When the tumour is removed there is less difficulty, for there are few who cannot recognise the differences between the two kinds. The scirrhous, medullary, and melanotic growths can be detected at a glance: the fatty and encysted as readily, and the distinctions between them and those first named can, with equal facility, be made out. There are certain tumours, however, especially some of those in the bones, whose particular characters as to malignancy, or otherwise, cannot so easily be appreciated, even when removed from the body, and often in such cases the most accomplished pathologist must be content to watch the issue. If there is no return of the growth, he concludes that in all probability the disease has not been malignant, and *vice versâ*.

The symptoms do not always indicate the characters now under consideration. For instance, pain is not a test of malignancy; for the most painful of all, perhaps, is the painful subcutaneous tubercle, which, however, is not malignant; whilst, on the other hand, medullary sarcoma, one of the most malignant of all growths, is not characterised by remarkable pain. The peculiar prickling lancinating pain of scirrhus is often a good test of the disease; but frequently such tumours are met with, in which this symptom is by no means conspicuous. Rapid growth is probably a more certain test of malignancy; but many exceptions to this may be met with also. I am most inclined to take as good criteria, the apparent effect which tumours have upon the constitution, and the extent of their connexions with the neighbouring parts. If a patient, after a growth has existed for some time, gradually loses flesh, becomes pale and languid, has constant uneasiness (if not pain) in and around the part, I consider these good grounds for suspicion that the affection is malignant; and if, in addition, the local disease has no distinct limits, (in other words, if the exact line of separation between the sound and affected parts cannot be made out,) if the tumour be in a manner fixed, if the skin over it does not appear healthy, however much it may be stretched, and does not glide over the swelling, and if the latter does not move readily on the subjacent parts, — if,

added to these, the whole or a great part of the thickness of a limb, or wherever the disease may be, seems to be more or less involved, there need be little doubt that the disease is malignant. Some objections to these general characters will at once be perceived, —as, for example, a tumour of bone cannot be moved like one of the soft parts; and, in certain instances, there are additional characters which indicate peculiar diseases, as the ulceration, in the latter stages of scirrhus, or the bleeding growth in fungus hæmatodes.

My own experience coincides entirely with that of every unprejudiced observer, that when malignant growths are removed with the knife their return is but too likely; nevertheless, as excision gives the only chance of security—a point on which most parties seem to agree—an operation should always be resorted to, provided the knife can be carried beyond the supposed limits of the disease; and, moreover, I deem it one of the duties of the practitioner, to urge the patient to submit to such a proceeding. Many imagine that one time will be as good as another for such a purpose, and most will be pleased to put off the evil day; but if our professional education does not tell us how to cure such diseases by less harsh measures, it enables us, at all events, to foresee the threatened danger, and to warn the patient of it at an early period.

When the growth is supposed to be non-malignant, there is less imperative necessity for interference. Thus in a fatty tumour, or one of an encysted character, the decision may be almost allowed to rest with the patient. The latter form is frequently met with on the scalp, and the fatty often acquires an immense size, so as to produce marked disfiguration, and perhaps inconvenience, both from its bulk and weight. If, however, the patient is willing to put up with such conditions, it is not incumbent on the surgeon to press an operation, as he would in an instance of malignant affection.

In all instances of a doubtful nature, if the circumstances are otherwise favourable, I believe that the surgeon best does his duty who recommends an operation. In inculcating this practice, I by no means wish it understood, that the knife is to be the immediate expedient; on the contrary, in the early stages of tumours, whenever such measures can be resorted to as may be supposed to cause absorption, they should have a fair trial; but when such plans fail, as they will almost invariably do, and if there is reason to suppose that the further continuance of the disease will be detrimental to health, I deem the practitioner highly culpable who still tampers with it, and persists in placing faith in either local applications or constitutional remedies.

Under the supposition that the vessels in a part where tumour first begins are preternaturally excited, it is customary to apply leeches in the neighbourhood; counter-irritation is afterwards resorted to, on similar views to those which lead to the employment of such a remedy in deep-seated inflammation. The plan of tying one or more of the enlarged arteries leading to the disease, as in the case of bronchocele,

and thereby directly cutting off some of its channels of supply, has also been put into execution, probably on similar principles.

The various local means which have been used on these occasions are much the same as those already referred to in describing the treatment of inflammation and some of its consequences, and I need not therefore enumerate them again. Iodine is the remedy in which most faith has been placed for the last fifteen or twenty years; but I am free to confess, and I deem it my duty to do so, that I have never in one single instance seen an organized adventitious growth removed by it. I have already stated my conviction, that large swellings of serum, lymph, blood, and pus, may gradually disappear,—be absorbed, as we say in common language,—and I firmly believe that on many occasions iodine, used internally, but particularly externally, produces more decided effects in some of these instances, than any other means we know of. Hydrocele, hydrophthalmia, effusions into joints, cysts (though rarely), enlargements of glands, such as the lymphatic or the thyroid, even gelatinous alterations of synovial membranes, will all disappear under the use of iodine; but I think I may challenge any one to produce a single case where an exostosis, a scirrhus, a medullary sarcoma, or a fatty tumour, has been removed by its influence. I am myself a great admirer of iodine in its different forms, and I often wonder whether the remedy has not suffered in character from the overweening confidence of some of the zealous advocates for its supposed extraordinary powers; and in numerous instances where improvement has taken place during its use, I fear, that as in the case of many other so-called specifics, there has been too little note taken of those changes, both local and constitutional, which are the results of time and other circumstances.

Operations for the removal of tumours may be amongst the most simple in surgery, or amongst the most difficult and dangerous which the surgeon is ever called on to perform. The smallest possible amount of skill or manual dexterity may suffice in one instance, whilst in another, anatomical knowledge, facility in the use of instruments, judgment to plan, and courage to execute, all the steps of the operation, are indispensably necessary.

Encysted tumours may be operated on in a variety of modes. If of that kind commonly known under the name of ganglion (most frequently seen about the wrist and ankle), and if the cyst is not dense and strong, a little pressure with the fingers, a smart blow with the knuckle, or with a book or other solid substance, will cause it to burst; the fluid will be extravasated in the surrounding cellular texture, and then absorbed; some inflammation will be excited, partly by the injury of the cyst, and partly, perhaps, from the extravasation; adhesion and obliteration of the sac will occur, and so the disease will be got rid of, and in the course of time no vestige of the sac will remain. Sometimes the sac cannot be burst, and then a needle may be pushed into it at one or more points, or a subcutaneous incision may be made to allow the fluid to escape into the surrounding texture.

In either of these modes it may be well to scratch the interior of the sac, so as to induce inflammation; and whether these plans are followed, or the tumour is burst, a pad and bandage should be applied to keep the surfaces of the cyst in apposition. I have occasionally, in large collections of fluid in the sheaths of the tendons about the wrist, successfully introduced a single thread, much in the manner recommended for the treatment of aneurism by anastomosis. Sometimes tincture of iodine has been thrown into these cysts, and numerous other methods have been followed, all of them with the view of exciting inflammation within. These cysts often require to be freely laid open with the knife, and treated as we would an abscess, after incision: the house-maid's knee and miner's elbow, which, in their inflamed state are in some measure like the cases under consideration, may be treated as above recommended; but the sac, especially over the patella, is often so thick, that it is better to dissect it away entirely; indeed, in most instances, with the sac in this condition, it is the best mode of procedure. In cutting out such tumours, the sac may either be laid open, and then partly torn and partly cut away with the knife or scissors, or it may be removed entire. One or other of the latter modes is required for the treatment of wens, for which excision is deemed necessary; and in all such instances when the contents of the sac are supposed to be of a nature that absorption will not likely occur, it is best at once to make use of the knife. When encysted tumours are of considerable size, it may be proper to remove an elliptical portion of skin, and whenever an operation is undertaken, the whole of the sac should be carefully removed, if it is possible to do so with propriety. When the cyst seems loosely attached to the neighbouring textures, I believe that it will generally be best to open it, turn out the contents, and then with well-pointed forceps (see p. 7) to seize the membrane, and tear it out; if, however, there is much dissection required, I imagine it is best to keep it entire, and even when it is accidentally punctured, I would recommend a thread to be cast round the opening to prevent escape of the contents, which, if not confined in this way, might prove more troublesome than blood, by obscuring the course of the knife.

For the excision of solid tumours, the surgeon must be guided by their shape, size, situation, and connexion, in forming his plans. Rules will be afterwards given as applicable to special cases, and at present I may refer to the description of the proceedings for the removal of the mamma, as containing a variety of instructions which may serve for operations on tumours in other parts of the body. In general it is necessary to cut all the connexions; for, with the exception of certain kinds of cysts above alluded to, and the example of the adipose tumour, both of which may be torn out after the skin has been divided, the knife cannot be dispensed with. The last-named growth is usually so loosely attached, that there is seldom any trouble in separating it with the handle of the knife, or with the fingers. It should at all times be an object with the surgeon in such proceedings,

so to plan his external incision as to leave the smallest possible amount of scar afterwards, and, in cutting the deeper parts, to avoid important organs as much as circumstances will permit. He should not, however, so limit his incisions through the skin as to hamper himself in future stages; and in removing malignant growths, he ought to bear in mind, that it is better to sacrifice a considerable portion of the surrounding healthy parts, than to leave the slightest vestige of disease in the wound,—the operation here being done to save life.

The method of removing tumours by ligatures, caustics, or cautery, is, in general, very objectionable. In some instances of malignant nature, or where it is deemed unsafe to carry the knife beyond certain limits, such measures are occasionally resorted to; but the practice cannot be recommended excepting under peculiar circumstances. A strong escharotic, such as the corrosive sublimate, usually, I believe, forms the principal ingredient in some nostrums which are said to cure cancer and other "incurable" diseases: the material, (generally in the form of a paste,) converts the tumour, or diseased surface, into a slough, and sometimes the malady is thus rooted out, by a hap-hazard proceeding, to which no rational medical man would consider himself justified in submitting his patient. I have known more than a single example of this kind, where a large portion of the integuments of one side of the chest has been destroyed in this way: —cancer, mamma, and all, have dropped off as a slough, and the large sore has ultimately healed. It is notorious, however, that death has often been the result of such empirical practice, and I doubt if any surgeon would dare to treat an extensive disease in this manner. One case I deem worthy of notice here: a man had a tumour of malignant aspect in his cheek; an eminent and highly qualified surgeon removed it with the knife; the disease returned,—was again operated on by the same hand, and once more appeared; the patient, unwilling to subject himself to another cutting operation, allowed an escharotic to be applied by a non-professional party, which effected a complete cure. I believe that in this instance the operator had been too sparing in his incisions. I once operated in a similar example for the third time, and succeeded in completely removing the affection. Sloughing sometimes occurs spontaneously, and performs a cure where the surgeon's calm judgment has been against interference: I know of two instances of supposed malignant disease in the upper jaw, where the whole parts have sloughed spontaneously, and perfect cures have followed.

CHAPTER XXVII.

AMPUTATION.

It will be afterwards found, that, in describing the mode of amputating in different parts of the extremities, I have almost invariably recommended the flap operation, as it is called; that is, by preserving the principal part of the future covering of the exposed bone or bones, from one or two sides of the limb, by the single flap or the double, according to circumstances. Since 1679, when Lowdham first proposed this operation, there has been great controversy as to its merits, and those of the mode by circular incisions. Previous to the last twenty years, although the operation may be said to be entirely British in its origin, the circular method seems, with few exceptions, to have been universally followed by surgeons of this country. Of late, the proceeding by flaps has again been introduced, more especially among those who have been educated in Edinburgh within the above-named period. The influence and example of Messrs. Liston, Lizars, and Syme, must have induced thousands to follow this plan. Sir George Ballingall also, if I remember aright, invariably performed the flap operation during the time he officiated as acting surgeon in The Royal Infirmary, although it appears, from his valuable work on Military Surgery, that he does not assent to all the advantages that have been claimed for this mode, nor acquiesce in the abuse which has been heaped on the circular incisions. His successors followed in the same course, and, like other pupils of the school, I myself imitated the practice of my seniors, in by far the greater number of amputations which I performed in Edinburgh. I believe I am correct in stating, that during a period of twelve years, the circular operation was never performed in The Edinburgh Hospital until it was again done by myself, during the latter part of my service in that institution. I find, from the statistical tables of the establishment, drawn up by my respected friend, Professor Reid, of St. Andrew's, that in two years (from July 1839 to July 1841) sixty-nine amputations on the extremities were performed, and it will therefore not be unreasonable to suppose, that upwards of four hundred similar operations were performed in the above twelve years. When the operations in private, during the same period, by the flap method also, are added to this number, it may readily be perceived how widely the example must have spread. Having, with few exceptions, witnessed all those done in public, and seen and been engaged in a reasonable proportion of private cases, it could scarcely be otherwise than that I should, in my own practice, follow the flap incision; more especially when I contrasted those done by the above-named gentlemen and others of less note, with the occasional circular operations which, from time to time, I witnessed elsewhere, and when, in

addition, I compared the stumps made by the two methods, and consequently by different practitioners.

I feel that my personal experience with the circular operation has not been such as to entitle me to give an impartial opinion regarding the two modes. I must say, however, that in so far as results are concerned, I place far less importance on some of the distinctions between these operations, than has been done by certain authorities on the subject.

If rapidity of execution is to be taken as the test of superiority, then I imagine that the flap operation must be allowed the preference; but in the hands of a good surgeon, the difference of time required for the efficient performance of either, seems to me of so little consequence, that such a calculation should not be taken into account. I once heard a surgeon of very considerable experience argue, that if the cutting part of an amputation were well done in twenty or thirty minutes, the performance was as creditable to the operator as if it were done in one, three, or five; but I think there must be few who will entertain such a doctrine: had he pleaded for a few seconds, or minutes at most, no one could have deemed him unreasonable. It has been stated by Roux, in the account of his journey to London in 1814, that he witnessed, in one of the London hospitals, a circular amputation, in which "nearly twenty minutes had been employed in only the separation of the limb;" I feel assured that he could have seen nothing of the kind during his brief visit in 1841. Such a mode of proceeding ought not to be taken into account in discussing the question of rapidity in the two operations, for I imagine that the same individual who thus ingeniously expended "nearly twenty minutes" in using the knife and saw, would also contrive, in some way or other, to occupy a similar period in performing the flap operation. I cannot but think that the same hand which rapidly and safely completes the flap incision would, with almost equal facility, if equally well trained, accomplish the circular. On this point, I can speak from my own very limited trial of the circular, which I have accomplished, in the manner described below, in nearly the same space of time that I should have taken for the flap operation in the same limbs, although, from the want of a like amount of practice as with the flap, I have felt more awkward in the accomplishment of my design, and perhaps, also, from certain circumstances to be referred to afterwards, a little more difficulty. A surgeon of the present day who takes more than from thirty seconds to three minutes (excepting under peculiar circumstances) for the performance of an amputation, whether flap or circular, ought not, in my opinion, to be taken as an authority on the subject. I would, therefore, set aside the question of time in such an argument as that to which I now allude.

The comparative extent of cut surfaces in the respective operations seems to me of trifling import;—a few inches more or less, provided always that a good stump is left, will never, in my opinion, determine the issue of an amputation. The bleeding during such a proceeding

is greatly, perhaps entirely, under the control of the surgeon. If he cuts in parts where the vessels have been long in a state of chronic enlargement, he may be certain that more will require ligatures than under other circumstances; and in such a case, also, if the tourniquet is not used, the loss of blood must of necessity be greater, and this will happen in either mode of operation. It has been asserted by Sir George Ballingall, and others, that the vessels retract more completely in the circular operation; yet in a valuable essay on the comparative merits of the two modes (with statistical tables strongly advocating the flap, by Dr. Machardy, who witnessed a circular amputation done by myself, it was stated, that the blood dripping on the floor seemed like the noise of rain falling on a cupola. In the case alluded to, there certainly was copious hemorrhage and numerous ligatures were required, but in reference to the above statement I may here remark, that the only instance (exclusive of cases of gangrene) in which I have seen a single ligature alone required in the thigh, was a circular operation. It must be admitted, however, that if the bleeding is more copious in the flaps, it is easier to get at the deep part of the wound, than in the hollow cone of the circular incision. When "nine" ligatures have already been applied to the flaps of a stump, it may be considered a serious matter if "eleven" more are required; but I cannot suppose the necessity here (for such a case is referred to by Sir George Ballingall) was occasioned by the mode of incision: had a circular wound been made in the same textures, I have no doubt, that the bleeding would also have been troublesome, and even admitting that a few ligatures less might have been required than in the other method, I fancy that the result of the operation would not have been influenced thereby. Two or three ligatures, more or less, can never make any material difference in the results of an amputation.

It has been asserted in most controversies on this question, that in the circular operation the skin alone is left to cover the end of the bone, whereas in the flap method there is a cushion of muscular fibres preserved, which afterwards protects that part, and lessens the chance of injury from pressure. The nature of the covering, however, depends greatly on the manner in which the operation is performed. In the circular, if the skin is freely dissected upwards before the other soft parts are divided, the end of the stump can be formed only by this texture; but if the incisions are so managed as to leave a sloping surface from the edge of the divided bone to that of the skin, and if a sufficiency of soft parts be left, the covering of the bone may thus be as thick (as muscular) as by the flap operation. In the leg, one side of the stump, when formed by the circular proceeding, must always be formed of skin only; but in the thigh, arm, and upper part of the fore-arm it is quite possible to preserve the parts in the manner above referred to. It is worthy of remark, that the muscularity of the calf of the leg has been made an objection to the flap operation in this situation, and that pains have been taken by some of the greatest

advocates for this operation,—those who insist on the necessity for a thick covering,—to make the incisions in such a manner as to preserve the skin only. Mr. Liston has recommended that in this situation "two semilunar flaps had better be made, one from the anterior aspect of the limb, the other from the posterior, the muscles being cut short in the ham." In very muscular subjects the large posterior flap which is usually made here, is almost certain to project considerably beyond the skin; I have noticed a similar thing with the deltoid muscle after amputation at the shoulder joint: the occurrence retards the cure; but in the course of some additional time, perhaps a month or more, the stump differs little from one where no such protrusion has ever happened. In either of these cases, and whether the operation has been by flap or by circular wound, the stumps are at last so much alike in certain parts of the body, that it is occasionally difficult, after the lapse of years, to say whether an amputation has been by one mode or the other: at all events, when such distinction can be drawn from the shape of the cicatrices, it is evident that the end of the bone is covered by much the same thickness of soft parts, in one instance as in the other. If there has been a full fleshy stump shortly after the operation, all muscular fibre has at last disappeared, and the skin, with a substance resembling condensed cellular texture, alone covers the bone. This substance, undoubtedly, gives great protection to the end of the bone, and its presence is absolutely necessary, I should almost say, to constitute what may be deemed a good and useful stump: therefore, whether the circular or flap incision is resorted to, I would always endeavour to preserve more than the skin for a covering.

The rugged and uneven surfaces which are usually made by the circular incision form an objection to this operation also, as they may possibly not come accurately into apposition, and thus union by the first intention may be prevented; but it is so difficult to calculate on the contraction of muscles in such operations, that I doubt if any accurate data can be collected on these matters. Non-union, suppuration, and granulation may happen from one operation as well as the other; and whether union by the first intention has been obtained or not, I believe that most surgeons of experience will join with me in opinion, that more trouble will result from some little point of the wound where union has not occurred, than from any want of it resulting from the irregularity of surface above referred to. I feel bound to state that I have seen adhesion by the first intention follow as perfectly after the circular operation as after the flap; and, in addition, I have seen as good stumps from the one as the other.

It is impossible to argue that non-union, suppuration, protrusion of bone, exfoliation, tumours on the ends of nerves, and so forth, have not followed the circular operation,—all these evils must be admitted; but the same results have occurred from the method by flap. It is, indeed, difficult to imagine why the circular incisions should cause all the above troublesome results, whilst the flap method should avoid them: for my part, I shall not feel convinced on the subject, until I

see that such is really the case,—until I see a certain number of amputations by these two methods, done by the same surgeon, or by two who are equally competent, and find all the evils on one side, and the advantages on the other. It seems to me that some such proof as this is still wanting for the surgeons of the present day. It is not to be overlooked that some of the most distinguished in the profession have almost invariably performed the circular operation, and surely all the stumps formed by these gentlemen were not so bad as the advocates for the flap would lead us to suppose. I believe I am correct in stating that, even in the present day, more amputations are done by the circular than by the other mode; and, fifteen or twenty years back, I imagine that not one surgeon in fifty ever thought of performing any other operation than the circular. I know of excellent practitioners in large practice, who have never seen the flap, and can vouch for the excellence of the stumps made by these gentlemen.

If a circular operation is improperly performed, the whole catalogue of evils may result; but the same may ensue from the method by flap. I do not here speak from conjecture, for I have seen as thorough protrusion of bone after a flap operation as after a circular. If, in the latter, the incisions are made directly down to the bone, no adequate provision being made for covering its cut end, or if the operator has failed in doing so, then there is no calculating what may follow: if, by the other operation the flaps are not well made,—too short, and selected from improper parts of the limb,—the same evils may ensue. In short, in so far as my experience goes, the evils resulting from one operation may be as great as from the other, according to the manner in which each is performed, the nature of the coverings, the condition of the parts, or of the constitution; and all, too, must be the result of a badly-performed operation by either mode. The latter circumstance constitutes, I believe, the main part of the difference between the two, as a circular operation is much more likely to be ill done than one by flap,—it is, in fact, a more difficult proceeding, or at all events there is greater chance of a mistake occurring in the one than in the other.

With these views, then, it may seem strange why I should not have operated almost as frequently by the one method as the other; but the latter part of the above observations probably tells the cause. Sir George Ballingall, after nearly thirteen years' experience in military hospitals, and more than fifteen in civil institutions,—who, as has already been stated, during his period of operating in the Royal Infirmary of Edinburgh, performed the flap operation invariably (I think) whilst I had an opportunity of observing,—who may, notwithstanding, be considered less prejudiced than some other authorities, thus writes: "The flap operation is a seductive one, and I can speak from my own experience when I say, that it is an operation which one is unwilling to relinquish after having once experienced the comparative facility of its execution." The last part of this sentence implies, in

my estimation, a most important distinction between the two proceedings, and has probably had the greatest influence in determining my own line of practice; and here, then, let it be remarked, that I speak with reference to the performance of the respective operations, not their results.

Any one who has had opportunities of contrasting the two modes, must have been struck with the apparent advantages in the execution of the one over the other: the facility of selecting a flap from any convenient side, the comparative ease with which it may be cut, the greater certainty of preserving a sufficiency of soft parts, the readiness with which the bone can be exposed for the application of the saw, are all, in my opinion, important advantages in favour of the flap operation. In the thigh, for example, it is easier to tranfix, and cut a flap on each side, three or four inches long, than to preserve a covering of similar length, by circular incisions: in the latter, I imagine, that the soft parts cannot be so easily drawn up, and if considerable force is not used in this stage of the proceeding, even a practised surgeon may find that the bone, when cut, is too much on a level with the rest of the surface. In the flap operation the slightest force,—little more than the mere lifting of the flaps, will suffice for retraction.

The limited extent of this work forbids me to enter further on these matters at the present time. I trust it may be considered, that I have dealt fairly with the circular operation; I deem it inferior to the other, as regards its execution; but I think that it remains to be proved, (not by assertion, but by actual experience in the manner alluded to in a former page,) whether, when equal skill and pains are bestowed, and the same mode of dressing is applied to each, the results are so very different, as some modern authorities would lead us to believe.

The flap operation seems by universal consent to be superior to the circular, when amputation is required at an articulation, although, as will afterwards be found, it has been proposed to amputate at the hip-joint even by the circular method.

The individual flap operations will be described in future pages; but to save repetition, I shall here introduce a description of a circular amputation, which may enable either a student or practitioner to apply the method to any part of the body he may think fit. The knife, saw, and other appurtenances, may be the same as for a flap operation. The kind of knife I have used in my own practice is represented in the figure on the next page, and it seems to me as efficient for the purpose as the clumsy instruments generally used by those who always practise the circular incision. The fingers of an assistant are usually sufficient for the purpose of retracting flaps; but here some additional means are almost indispensable. A piece of stout linen cloth, four or six inches in breadth, and about eighteen in length, split lengthwise about nine inches, into two or three ends, in accordance with the number of bones in the seat of operation, will answer all the purposes of the leather or metal retractors used in

former times: three ends being required for two bones, as in the forearm or leg,—two being sufficient for the arm or thigh.

When all preliminary arrangements such as are required for the flap operation are completed, an assistant should grasp the limb with both hands, and draw the skin upwards, both for the purpose of preserving a portion of it, and also to render the surface tense, or the surgeon may do so with his left hand, whilst with the right he places the knife in the position represented in the accompanying drawing (fig. 54): to do so, he requires to stoop, and bend the hand well backwards. Holding the instrument lightly between the fingers, as here exhibited, or grasping it firmly in the closed palm, he sinks the edge through the skin, draws it deliberately round under the limb, and then over it, gradually changing the bend of the wrist, until the hand is as much bent forwards as it previously was in the opposite direction, and thus completes a circular wound. Whatever be the extent of natural

Fig. 54.

retraction, the integuments should next be drawn upwards by an assistant, encircling the limb with the forefingers and thumbs of both hands; and to facilitate the upward movement, the convex edge of the knife may be applied whenever the attachments seem to require division. Again, the knife should be made to sweep round the limb, as in the first part of the operation, being kept close to the surface of the

retracted integuments, and passed half an inch or more through aponeurosis and superficial muscular fibres; now the assistant should place his fingers and thumbs deeper in the wound, and apply more force, so as to retract both skin and the parts last divided; for the third time, the instrument should encircle the limb, so as to divide every texture down to the bone; here the retractor should be put on in such a way as to cover the greater part of the wound, and then drawn forcibly upwards: it may be pulled an inch or more above the part where the knife has first touched the periosteum, when muscular fibres will appear in the centre, still adhering to the bone; these must be divided close up to the cloth, either with another circular sweep, or by applying the point of the knife; and if on the application of a little more retractile force, any additional fibres appear, they must also be divided in the same way, and then the saw must be applied at the highest part where the bone is exposed.

A variety of circumstances may influence the extent and facility of retraction; but to preserve a sufficient covering by the operation just described, I consider it always requisite to apply a good deal of force, —certainly much more than is required for the retraction of flaps. Sometimes the fingers alone will suffice, but in general the retractor will be found more efficient.

By the operation as thus described, there will be a sloping surface, from the edge of the skin up to the bone; the wound will represent a "conical cavity," as described by Alanson, and, provided the retraction has been sufficient, a "fleshy" stump will be formed. I do not deem it at all necessary to place the knife obliquely, nor to use it in the manner described by the celebrated authority last named. The cutting instrument may, in all the circular incisions, be held at right angles with the bone, and the retraction, first with the fingers and then with the linen band, seems to me to obviate the stumbling-block which commentators on Alanson's operation have always brought forward against the plan proposed by him. It is evident that Alanson could not have applied the saw at the apex of the cone without drawing the parts upwards; he must have done so, although he does not clearly state the circumstance, and it is somewhat singular that even in the second edition of his work, when he adverts to the misunderstanding that had arisen about his operation, he should not have pointed out that the "conical cavity" was not made from hard incompressible materials, but from those of a soft flexible nature, such as could be caused by pressure to assume almost any form or shape for the time being. Perhaps he did not think it requisite to notice such an apparent circumstance; but I cannot divest myself of the idea that some have supposed, that in order to form the cone, a kind of process is required, such as might be necessary to make a similar figure in a bit of wood, or other equally incompressible substance. By the forcible retraction, the length of the cone is made scarcely appreciable; but as soon as the pressure is taken off, it becomes apparent.

I am convinced that if the circular incision is made through skin,

muscles, and all, at one and the same sweep, it will be impossible to cut the bone sufficiently high; and if the integument be much everted, or actually dissected upwards, as was described by Sir Charles Bell, and then the muscles be cut right down to the bone by a second incision, as was recommended by Sharp, I imagine that there is too great a probability of the covering being formed by skin only; thus giving rise to one of the most valid objections to the circular operation.

It has often appeared to me, that there has been an objectionable formality enjoined regarding amputations, which has thrown great difficulty in the way of the young surgeon, who has as yet been unable to shape his own course from personal experience. Instead of leading him to suppose that one, two, or three circular incisions constitute the only correct operation,—instead of wishing him to imagine that in the proceedings above described, he must limit himself to three, or at most four circular sweeps, I should say, that he may, if he sees fit, apply the knife again and again in the same manner. I do not think this necessary, however; and if it be done, the whole of the operation must be considerably retarded. If, nevertheless, such a mode be practised, the rugged surface of the wound, which some have objected to, will be less apparent. I shall have occasion afterwards to advert to the needlessness of dogmatic statements regarding other operations besides amputations, such as about standing on one or other side of the limb, applying the saw, and so forth; but here I cannot omit alluding to a mode of teaching, which seems to me equally objectionable to that above referred to, which, whilst one good authority inculcates the necessity for the circular mode of operation where two bones are present, another, equally estimable, characterises the proceeding as being "altogether inadmissible" in such a situation; meanwhile the student may go from hospital to hospital, and see excellent stumps formed by either mode.

It is difficult to say, on such an occasion as this, what should be the length of the coverings. Measurements by inches may do very well on the dead subject, or other inanimate material, but they are unsafe to trust to on the living body. The muscles and other textures will retract much more in one person than in another, and a limited length of soft parts, which might make an excellent stump in one limb, might leave the bone projecting in another. As a general rule, it is safe practice to leave the covering rather too long, than what might be deemed the exact and proper length; but on these points more will be said hereafter, when the individual operations are considered.

Whether an amputation is done by flap or circular incision, it is almost the invariable practice among British surgeons of the present day to promote union by the first intention; and for this purpose, as soon as the bleeding has been arrested by the application of ligatures and otherwise, the surfaces of the wound are brought into apposition, and retained thus by means of stitches, straps, and bandages. It is the custom of some to allow several hours to pass, ere the edges or

surfaces are finally adjusted; and this is done with the intention of making sure that all bleeding has actually ceased, and also under the conviction, that union is not retarded by keeping the surfaces so long from each other. If the edges of such a wound are brought together immediately after the operation, and probably whilst the patient is faint from the shock, there is a chance of some vessel beginning to bleed after he has got warm in bed; and on this account it may be necessary to undo all the dressings. In general, however, if proper care be taken to apply a sufficient number of ligatures at the time of the operation, there will be no further trouble; and I do not hesitate to recommend that, as a common rule, the wound of an amputation should be dressed whilst the patient is on the operating table. I have tried both ways, and have always remarked the additional distress which any interference with the wound, four, six, or eight hours afterwards, has occasioned.

In a circular operation, when the cut surfaces are laid together, the line of junction may be transverse, vertical, or oblique, at the will or taste of the surgeon. I know of no rule which should regulate this circumstance, for I hold it absurd to make a deliberate provision for the after-flow of matter; and, indeed, a stump may be in so many different positions during the progress of treatment, that what may at one time be the most dependent part, may be the reverse in the course of a few minutes, hours, or days. In the flap operation, the line of junction can only be as the flaps are formed. In either proceeding, the ends of the ligatures should be brought out at the points nearest the vessels on which they are placed: if there be no great distance between two or three of them, they may be brought out at the same point; but I consider it improper to cause a thread to traverse a large extent of wound. It is often the custom to cast a knot on the ligature on the main artery, so that it may be known when separation takes place.

The dressing of a stump must be conducted on the principles inculcated in previous pages; but I hope it will not be deemed supererogatory if I here give an outline of the course which I would in general recommend. Supposing that immediate union is desired, the main features of treatment and dressing should be to keep the surfaces quiet and in accurate apposition. The latter object I think is best attained by means of stitches, straps, and bandages; the former by proper position of the stump, and such other means, local and constitutional, as may be thought essential to allay irritation.

But, to be more precise, I shall instance an example of a stump in the thigh. Here, after the requisite number of ligatures have been applied, the wound must be carefully cleansed with the sponge, and, the surfaces being placed in apposition, six, eight, or ten stitches should be used to keep them together: four, six, or eight strips of adhesive plaster, each about eight inches long, should then be applied in the intervals between the sutures; then a narrow bit of lint, spread with spermaceti ointment, should be laid along the whole length of

the wound ; lastly, a roller should be applied, with a very moderate tightness around the limb from the pelvis downwards, and to give additional steadiness it may be brought several times across the end of the stump. In eight and forty hours, or about the seventy-second at most, the roller should be undone, the strip of lint taken off, the stitches cut out, the straps removed and fresh ones applied, with lint and ointment also, and a clean roller again put round the parts. The dressings must be removed once at least every twenty-four hours for the next ten or fifteen days. At this time, probably, all the ligatures may have separated ; and now, perhaps, if any part of the wound gapes, or there is any disposition in the flaps to go awry, a little more pressure may be used both with straps and bandages. Any part of the wound which remains open, will in all probability be a healthy granulating surface, which has a tendency to heal of its own accord. Sometimes stimulating lotions or ointments, such as those used on granulating sores, may be of service. For fifteen or twenty days the patient must be kept in bed : when all the ligatures have separated, and some few days after when the wound has nearly closed, he may be allowed to get up. In thirty or forty days, provided everything has gone on well, the stump will be completely healed,—no further dressing will be required, unless, perhaps, the daily application of the roller, which I think it well to continue for some considerable time afterwards, both as giving a good support to the newly-formed adhesions, and also as being useful in keeping the stump of a good shape.

Many modifications of the above proceedings will be required, from circumstances which it would be useless, if not impossible, to enumerate here. Much of what may be deemed good practice must depend on the good sense of the surgeon. The custom of covering the end of a stump with thick dressings is, in my opinion, highly objectionable, and is a relic of old, ignorant, and barbarous surgery, which ought to be done away with entirely ; indeed, when the parts show no disposition to separate, I do not on all occasions deem it requisite to apply even the somewhat loose bandage which I have above recommended. I have seen a stump of the thigh, by the circular operation too, admirably treated without any covering at all, excepting a narrow slip of lint applied over the stitches ; and I may refer to the stump of the leg, afterwards represented in one of the drawings, which I think must be allowed to be a good one, which was treated for three weeks, with the exception of the first eight and forty hours, without any bandage or support whatever. Commonly, however, I think a bandage highly serviceable, more especially towards the latter part of the treatment, when it may be used with great effect in giving the stump a proper shape.

The straps which I generally use are of the ordinary adhesive plaster. Mr. Liston has greatly extolled a solution of isinglass in spirits of wine, spread upon oiled silk, or gold-beater's leaf ; and Mr. Torbock, of Sunderland, writes to me in high praise of portions of caoutchouc web, cut in the usual shape of straps. The principal ad-

vantage of either of these materials is, that the usual discharges from a wound do not affect them, as they do the common adhesive strap, and the caoutchouc is said to possess the advantage of elasticity, whereby it expands with the swelling incidental to a wound, and contracts again as it subsides. I feel inclined, however, after using both, to give the preference to the ordinary and older-fashioned adhesive straps, of which perhaps not the least advantage is, that the necessity for their frequent repetition ensures a greater degree of care towards the stump.

When union by the first intention does not take place, or if this is not expected, as in some instances when it is advisable to stuff the wound with lint to check hemorrhage, the treatment must be such as to encourage suppuration and granulation; and if care be taken, as the latter process is going on, to keep the soft parts properly supported by straps and bandages, the wound may ultimately heal so perfectly, that it may be difficult for a stranger to say whether it has healed by immediate union or by granulation.

Most of the casualties likely to follow an amputation are treated of in different parts of this volume, and such as are not particularly referred to, are usually of a nature requiring no especial notice here, as I imagine that a slight acquaintance with the principles of surgery will enable even the youngest practitioner to treat each case according to the combined dictates of skill and prudence.

PART II.

OF THE SUPERIOR EXTREMITY.

CHAPTER I.

DISSECTIONS.

One of the fingers may be dissected, and the surgical anatomy, as well as the operations, usually performed on each, may thereby be understood. Supposing the dissection to be performed on the middle one, an incision may be made along the middle of its posterior surface, from a little above its articulation with the metacarpal bone to the root of the nail, when the skin should be dissected off each side, as far as can be conveniently done, with the finger lying on its palmar surface. The skin will be observed to be thin, and but loosely connected by cellular texture with the parts beneath. No vessel or nerve of consequence will be seen. The extensor tendon will now be displayed, forming a kind of aponeurosis on the surface of the first and second phalanx, ere it is attached to the proximal extremity of the third. On each side of the first phalanx, the tendons of the lumbricales and interossei will be seen joining the extensor tendon, and thus strengthening the aponeurosis over this bone. The fibres will be less distinct behind the joints than towards each side; being observed to diverge a little above and join again below. Over the articulation with the metacarpal bone, the tendon is of a rounded form, and less firmly connected with the parts below than when on the finger. Though the fore and little finger are each supplied with two extensor tendons, the above remarks, in a surgical point of view, apply equally to them. The nail should next be examined: the skin should be dissected off its root, and from each side, to display its attachments: it should then be torn off, so as to ascertain the firmness and display the nature of its connexions. The tendon, or aponeurotic sheath above referred to, may now be dissected off from one side to the other, when the bone, covered with periosteum, will be exposed. A thin layer of cellular membrane will be observed, covering the loose portion of synovial capsule constituting the posterior part of each articulation.

The anterior surface of the same finger may now be examined. The hand being placed supine, an incision should be made through

the skin along the mesial line, from a little above the root of the finger to the apex. This texture, which will be found thicker and firmer than that on the posterior surface, should be laid on each side so as to meet the dissection already made, and thus it will be raised from the whole circumference of the finger. In this dissection the knife is carried through firm cellular substance, which is not easily divided, and considerable care is necessary to preserve the digital arteries and nerves, which will be found lying on each margin of the surface. With some care and picking, the parts will now present the following appearance:—an artery and nerve will be seen on each margin, and some dense transverse fibres will yet prevent the flexor tendons being distinctly observed. These fibres constitute the sheath of the flexor tendons. They may now be cut through along the mesial line, when they will be found remarkably firm in front of each phalanx, but nearly deficient over the joints. The tendons will now be exposed, and, if raised a little, it will be observed how completely they have been bound down by these transverse fibres upon the surface of each bone, which will present a slight concavity in its transverse direction. The vessels, sheath, and tendons may now be cut away, and each joint examined. It will be most convenient at present to limit the attention to the two joints in the finger itself, reserving the articulation between the first phalanx and metacarpal bone for after consideration. The examination of one joint will suffice. On each side a firm fibrous structure will be found, extending between the ends of the bones, constituting the lateral ligaments; in front, a dense semicartilaginous texture will be observed; and behind, the synovial membrane,—loose when the finger is extended, and stretched when bent. The lateral ligaments will be observed to be closely connected with the outside of this membrane. The joint may now be cut into, and the articular surfaces carefully inspected. These will be remarked to be so fitted to each other, as not to allow, when in apposition with the finger extended, the edge of a bistoury to be carried between them without coming in contact with two points on the proximal, and one on the distal phalanx.

The thumb may next be dissected according to the above directions, and, saving the difference in size and absence of a phalanx, the parts will vary but little in appearance.

The back of the hand may now be examined. An incision should be carried through the skin across the posterior surface of the wrist from one margin to the other; another should be made from the middle of this one, down the hand, to join the upper part of that made on the middle finger. A flap should next be laid towards each margin of the hand, and, in doing this, the skin must be cut across over the knuckles of the three fingers which have not yet been dissected. In raising the skin, several veins of some magnitude will be seen in the loose subjacent cellular texture, and also twigs of nerves, branches of the radial and ulnar, running towards the fingers, where they are so small as in all probability to have escaped notice in the dissection

above described. The extensor tendons will now be observed; still, however, bound down by transverse fibrous bands. No artery of large size will be displayed in this dissection, unless it be the radial, passing through the space between the extensors of the thumb.

The hand may now be turned, and an incision made across the fore part of the wrist, joining at each extremity that already made on the back. The knife must next be drawn from the middle of this one along the palm of the hand, to join that previously made for the display of the finger, and the skin, which is here thin but dense, is next to be carried to each margin of the hand, taking care to cut it across at the roots of the fingers, so as to meet the dissection already effected. A short incision had better be made, from that across the wrist to the root of the thumb, so as to allow its ball to be uncovered with facility; and thus by raising the skin from the latter part, the hand will be divested of integument. The palmar aponeurosis will now be brought into view. This structure, which is scarcely discernible over the ball of the thumb and the fleshy mass on the ulnar side of the hand, will be seen connected with the front of the annular ligament, and spreading out in the hollow of the palm, until it is lost, partly in the cellular texture at the fore and lateral aspect of the root of each finger, and partly in the tendinous covering of the side and posterior surface of the first phalanx.

No structure of surgical importance lies between the skin and this membrane, and the dissection may be, therefore, immediately carried deeper; this may be done by cutting the fascia across at its narrowest part, viz., at the annular ligament, and carrying it towards the roots of the fingers, where it may be left attached by its numerous slender connexions. It will now be found to have been in close contact with the superficial palmar arch, which will have been brought partially into view. To render the latter more distinct, the ulnar artery had better be cleared as it passes over the annular ligament; a few transverse fibres run across it in this situation, and, lower down, particularly towards the deeper parts of the palm, or nearest to the tendons, the arch and its branches will be found surrounded by loose cellular and adipose tissue. In displaying these vessels, care must be taken to preserve the branches of the ulnar and median nerves, as well as the flexor tendons.

A little dissection may now be made on the radial margin of the wrist and hand, so as to clear the radial artery where it passes under the extensors of the thumb, to get between the metacarpal bones of the thumb and forefinger; and, by cutting through part of the abductor indicis muscle, the branches of this vessel, which chiefly supply the thumb and forefinger, and that which joins the deep palmar branch of the ulnar, may be made apparent.

In this stage of the dissection the parts will appear thus: the ulnar artery passing across the palm, forming the superficial palmar arch, giving off the branches, which, singly and subdivided, supply each margin of the fingers, with the exception of the radial side of the index,

which, with the thumb, will be observed to be supplied with branches from the radial; the ulnar nerve, passing over the annular ligament on the ulnar side of the artery, sending branches to the little finger and one side of the ring finger; the median nerve dividing at the lower margin of the annular ligament into branches which run to the thumb, fore, and middle, and radial side of the ring finger; and the flexor tendons. The further examination of the hand may be postponed until the forearm has been dissected.

The palm of the hand being placed downwards, an incision should be carried from a little above the external condyle of the humerus, down the middle of the posterior surface of the forearm, to join the centre of the cut across the wrist. The skin may then be dissected to each side. To reflect it sufficiently above, it may be necessary to extend the incision a little further up the arm, or to make a transverse one. In raising this tissue, notice must be taken of the veins lying in the subcutaneous cellular membrane, which will be seen passing upwards and obliquely over the margin of the arm to join those on the anterior surface. These being of little surgical importance, with the fat and cellular membrane, may all be raised at the same time with the skin, so as to expose the aponeurosis. This part should next be examined. By cutting it through from its upper third down to the wrist, and dissecting it to each side, an idea of its strength and connexions may be formed; and, by carrying the incision down to the back of the hand, the annular ligament may also be examined with a similar view. The muscles and tendons will now be observed to have been closely invested and bound down by this membrane. With the point of the finger or the handle of the scalpel these may next be separated from each other, as far up as possible without cutting through fibres, and as low down as to trace each tendon to the fingers. Those of the thumb may also be treated in the same manner. In raising the latter tendons a few transverse fibres must first be cut; and, before doing so, the space between the first and second extensors should be cleared out, so as to lay bare (if this has not been sufficiently done already in the early stage of the dissection) the whole extent of the radial artery, as it is passing obliquely along the radial side of the wrist. On the back of the hand and forearm no artery of much surgical importance will be observed, unless it be the posterior interosseal in the arm, which is chiefly worthy of notice in the upper third of its course, where it lies in contact with the interosseal membrane.

The anterior surface may next be turned upwards and examined. An incision should be commenced in the arm over the fleshy portion of the biceps, three or four inches above the elbow, and carried down to that across the fore part of the wrist; the skin should then be laid to each side, to meet the dissection on the posterior surface. This had better, however, be done at present only in the two lower thirds of the incision, so as to leave the parts in the upper third, viz., in front of the elbow, for after inspection. Between the skin and aponeurosis, various veins will be observed, with some small twigs of nerves. The

aponeurosis may next be taken off, after dividing it from the annular ligament, to within a couple of inches of the elbow, where it had better be cut transversely. The radial and ulnar arteries may next be displayed. The outlines of the first will have been made visible, throughout the whole course of the dissection, by what has already been done: but to display the vessel clearly, a little cellular membrane must be taken from around it, when it will be seen lying along the radial margin of the flexor carpi radialis; above—between this muscle and the supinator longus; and in the lower third of the forearm, on the surface of the flexor longus pollicis; having a vein on each side, and the continuation of the musculo-spiral nerve (the radial) on its radial aspect. The nerve, which is never at any part very near the artery, will be seen to pass obliquely over the radius, two or three inches above the wrist, to get to the posterior surface of the forearm and hand; and the artery will be observed passing under the extensor ossis metacarpi pollicis, into the space where it has already been dissected. Before it gets this length, a branch occasionally of considerable size (art. superficialis volæ) will, perhaps, be seen passing in front of the annular ligament, to join the radial end of the superficial palmar arch. The ulnar artery may next be looked for. The point of the finger or handle of the knife must be carried between the flexor carpi ulnaris and the flexor sublimis; these must be kept asunder; and, after the removal of a little cellular texture, the artery will be found in the space between them, with a vein on each side, and the ulnar nerve on the ulnar side, almost in close contact with it. The vessels and nerves are surrounded by cellular membrane, which should be removed as low down as the annular ligament, where the same parts have previously been displayed. The situation of the median nerve may now be examined. It will be found between the tendons of the flexor sublimis and the flexor carpi radialis, a little above the annular ligament; it may be traced upwards as far as these muscles can be separated, or the separation of the skin and transverse incision through the aponeurosis will permit, and downwards till it passes under the annular ligament. The last-named part had better now be cut through, when the course of the nerve and of the tendons into the palm of the hand will be made distinct.

When these tendons are raised, the deep palmar arch may be dissected; but this vessel and its branches will be more clearly made out, if the tendons are cut through a little above the wrist and turned downwards.

Attention may now be directed to the elbow. By carrying a transverse incision, from that already made above the external condyle, over the back of the arm, the skin may be readily removed from the posterior part of this joint. Over the prominence of the olecranon process this texture will be observed to be thin; and perhaps a bursa, with a rough irregular internal surface, will be found between it and the bone: but this does not exist in all subjects. The posterior tendinous surface of the triceps extensor, where it is attached to the

olecranon process; the posterior surface of the upper part of the ulna; the condyles of the humerus, and parts of the extensors and flexors on the forearm, covered by the fascia, will now be exposed. By cutting a few aponeurotic fibres, extending between the side of the olecranon and internal condyle, the ulnar nerve will be exposed, where it is about to pass between the upper attachments of the flexors. Even at this stage of the dissection it will be well to mark carefully the external appearances of this joint; and the hand should be made as familiar as possible with the prominences of bone; the finger or thumb should be placed over the head of the radius, and the hand being placed alternately in a state of supination and pronation, the movements of that portion of the bone may be detected; the outline of both condyles, as well as the ridges of bone leading up from them, should be carefully examined; the projections of these parts, and also of the olecranon during flexion and extension, may even now be advantageously investigated; and a useful lesson will be gained by these proceedings, which may afterwards facilitate the diagnosis of injuries connected with, or in the vicinity of, this important articulation.

The fore part of the elbow should now be examined. The incision through the skin over the biceps may be extended a couple of inches further up, or a transverse cut made to allow it to be laid to either side. The skin only should be raised in this first stage of the dissection; the fat and cellular membrane should be left till the superficial veins and nerves are examined. The cephalic vein should now be displayed on the outer margin of the biceps, and, by tracing it downwards, the median cephalic, with the branches joining it from the forearm, may be readily made out; by tracing the median cephalic downwards, the median basilic and its branches will be discovered. The latter should be traced down the forearm; the former upwards as far as the skin will permit. In making this dissection, the veins should be left as much in their natural position as possible; and this can be best done by leaving (as the skin is taken off) the subcutaneous fat and cellular membrane in which they are imbedded, and merely laying the latter aside, in carrying the scalpel along the anterior surface of each vein. In effecting these incisions, care should be taken not to divide any twig of nerve, which may be observed crossing or running in front of the veins.

After the parts have been examined in this condition, the fat and cellular tissue may then be removed to display the fascia. The veins must still be left, and care must be taken to preserve the cutaneous nerves. An incision should next be made along the inner margin of the biceps muscle, through the fascia, and the humeral artery should be displayed as low down as the connexion of this membrane with the tendon of that muscle.

The superficial veins and nerves may now be removed, and the fascia taken off the parts in front of the joint, so as to admit of the humeral artery being traced to its division, and also an examination of the relative position of the different parts. The artery will be seen

on the inner margin of the tendon of the biceps, accompanied by two veins at least, one on each side, with perhaps a third in front; and the median nerve will be found about one-fourth of an inch nearer the internal condyle. The radial artery will now be observed in a sort of triangular space, (if it has not already been examined in this situation,) between the pronator teres and the supinator longus, a branch of the musculo-spiral nerve will be observed on the radial side of the vessel. The ulnar artery can next be traced, and the most satisfactory method of doing so will be, to cut through the superficial flexors, and the pronator teres, in a direction parallel with the vessel: the interosseal artery can also be best got at by this destructive dissection, and its anterior branch can be more readily displayed by turning aside the deep flexor of the fingers, which lies over it, in its course along the interosseal membrane. The recurrent arteries should likewise be attended to in conducting these proceedings.

The dissection of the arm may next be carried a little higher up. A circular incision should be made through the skin a little above the insertion of the deltoid muscle, when, by cutting between this and the parts already displayed along the surface of the biceps, the integument may be turned outwards and inwards, or even completely removed from the circumference of the limb, so as to display the textures immediately beneath. The fascia first presents itself below the subcutaneous cellular tissue, with the cephalic vein lying on its surface, on the outer margin of the biceps; the basilic vein will in all probability have passed under the fascia at some point between this and the elbow. The membrane should now be taken off, and the following parts displayed, viz., the inferior extremity of the deltoid muscle, a great portion of the triceps and biceps, with the ends of the muscles of the forearm, connected with the humerus. With a little careful dissection on the inner margin of the biceps the humeral artery will be displayed, with a small vein on each side, and, perhaps, the basilic in front of it. The median nerve, about the middle of the arm, will lie nearly over the artery, and in close contact with it; it occasionally, though rarely, lies behind it: the ulnar will be considerably to the inner side, on the short head of the triceps; the musculo-spiral will scarcely be seen in this dissection, but its radial branch may be displayed, between the biceps and supinator longus, by separating these muscles with the point of the finger or handle of the knife. In this situation the deep humeral (superior profunda) artery will be observed anastomosing with the radial recurrent; and on the inner side of the arm, the anastomotica magna will be apparent, passing inwards, and sending a branch to run with the ulnar nerve behind the internal condyle of the humerus. The internal cutaneous nerves may either be preserved or not. The finger may now be passed between the biceps and brachialis anticus muscle, when some of the branches of the external cutaneous nerve will be seen passing between them. The former muscle may be cut across at its thickest part, and its lower extremity turned downwards; the artery and nerves may also be

treated in the same way, and thus a full view of the brachialis anticus muscle, covering the anterior part of the elbow-joint, will be obtained.

A circular incision should now be made through all the remaining textures, about three inches above the elbow, down to the bone, which should then be sawn through. The articulations on the separated part should next be examined; and this can now be most conveniently done, the part being separated from the body, as the limb requires to be frequently turned for such a purpose.

Possibly, ere the parts are separated in the manner here recommended, the dissector may wish to obtain a more connected view of the biceps, vessels, nerves, and other parts, and, if so, he may continue the dissection in the mode described at p. 147, and after removing the extremity, may then proceed with the examination of the ligaments, beginning with the shoulder, or at the following paragraph, as he may feel inclined.

Instructions have already been given (p. 138) for dissecting the articulations of the phalanges. The joint between each proximal phalanx and the corresponding metacarpal bone, will next demand attention. The tendons should be taken off the anterior and posterior surface of one of these joints, (that of the finger already dissected will answer,) and by cutting away the vessels and nerves, the interossei and lumbricales muscles, the strong lateral ligaments, extending between the metacarpal bone and the first phalanx, will be readily made out. The posterior surface of the joint will be observed to be covered with the loose synovial membrane, and the anterior will have a firm (almost fibro-cartilaginous) texture over it, which intervenes between the flexor tendons and the synovial membrane, and which, if examined carefully, will be found to be a thick portion of the transverse ligament which passes in front of the ends of the four metacarpal bones in this situation. The joint may now be cut into by dividing one or both of the lateral ligaments, when the rounded extremity of the metacarpal bone will be observed to fit into a corresponding concavity on the phalanx, and that so completely, that, unless they be a little separated, a knife cannot be carried through between these bones without cutting portions of both, or of the cartilages covering them.

The dissection of one of these joints will suffice, therefore the articulation of the thumb with its metacarpal bone may next be examined; and as this one is somewhat more interesting in a surgical point of view, than any of those in the hand, some additional care may be bestowed upon it. The muscles forming the ball of the thumb should first be carefully dissected: the adductor pollicis should also be cleared, and due notice should be taken of the great developement of muscular fibre in this situation, in proportion to the bulk of the hand, or of the bones with which the muscles are connected; for these are points worthy of consideration in reference to fractures, and more particularly dislocations, occurring in the thumb. The muscles and their tendons may next be cut through, when lateral ligaments, differing

little in appearance from those last examined in the finger, will be easily discovered. The joint behind is covered by the two extensor tendons, under which the loose synovial membrane will be noticed; in front, when the long flexor tendon is raised, a texture similar to that on the same surface of the finger will be found, and on each side of the groove for this tendon the sesamoid bones will be observed in the tendons of the short flexor muscle. On laying open the joint, the articulating surfaces will not be found to differ much in appearance from the corresponding ones of the finger. The end of the metacarpal bone will not project so much as that of any other, and will be seen to be somewhat quadrangular in shape. The upper extremity of this bone will be found to be but loosely connected by ligamentous fibres with the os trapezium; that of the little finger is scarcely more firmly so to the unciform bone; but the others will be found not only firmly connected with the carpal bones, but also with each other, so as to be but slightly moveable. Both in front and behind, these joints are covered by ligamentous bands, common to them and the other articulations in this situation.

The posterior and anterior annular ligaments should now be cut across, if this has not already been done, and such tendons as have been left on any surface of the carpus should be raised, so as to permit of a proper dissection of the ligaments, which will be found strong and numerous, on both anterior and posterior aspect, more particularly on the latter. They will be seen to be chiefly connected with the radius and the carpal bones, or extending in various directions from one of these bones to the other. A short round ligament will be observed to pass from the styliform process of the ulna to the cuneiform bone; and two similar bands may be traced from the pisiform bone, one to the unciform and the other to the head of the metacarpal bone of the little finger.

The articulation between the bones of the forearm and the first row of the carpus, should next be cut into behind, and laid extensively open, when the lower extremity of the radius, with the scaphoid, semilunar, and cuneiform bones, will be observed to form the proper moveable articulation at the wrist; the articular surfaces of these bones being covered with cartilage and synovial membrane. The knife may now be carried between the different bones of the carpus, and between them and the metacarpal bones still remaining:—the opposing surfaces will be found covered with cartilage, and provided with synovial membrane.

The articulation between the radius and ulna, in this situation, may be looked at. The latter bone will be observed to lie in a slight notch on the radius: the opposing surfaces being covered with cartilage, and but loosely connected by a few transverse fibres in front and behind, and by a loose synovial capsule.

In dissecting these joints, as well as many others, it will be advantageous to preserve the neighbouring attachments of most or all of the tendons. In examining the surgical anatomy of a joint, it will often

be of service to replace both tendons and muscles; and whatever be the strength of its ligaments, the circumstance should always be borne in mind, that the actual strength of the articulation in the living body depends more on the surrounding textures than on the fibres connecting the ends of the bones.

The elbow-joint may next be examined. With a little dissection on each side, the lateral ligaments will be discovered: on raising the brachialis anticus (which should be done from above downwards), a few fibres will be found on the anterior surface of the synovial capsule, and similar structures, though somewhat slighter, will be remarked on the posterior aspect of the joint, between this membrane and the triceps. The joint should now be laid open, by cutting across the textures in front, or, as will perhaps be of more service, by first removing the olecranon process with the cutting forceps, and then completing the incisions with the scalpel. The connexion of the radius to the ulna above should next be examined; when this is done, and the interosseal membrane also looked at, the anatomical examination, as high as it has gone, may be deemed tolerably complete for present purposes; and various points will be further elucidated when the injuries and diseases of this portion of the extremity are taken into consideration.

The surgical anatomy of the remaining part of the upper extremity may next be examined. The body should be placed with the back uppermost, having a large block under the chest so adjusted as to allow the shoulder about to be examined to hang down, and thus to put the muscles on the posterior surface of the trunk, connected with it, on the stretch. By carrying an incision from the occipital protuberance along the mesial line, as low as the twelfth dorsal vertebra, then another from the spinous process of the seventh cervical, as far as the extremity of the acromion process of the scapula, and dissecting the skin and cellular texture upwards and downwards, the trapezius and part of the latissimus dorsi muscles will be exposed; and by making an incision from the acromion down the outer part of the arm as low as the extremity of the deltoid, or to where the skin may have been already divided in the previous dissection of the extremity, the posterior surface of the latter-named muscle may be also fully displayed. The remaining muscles lying on the back of the neck and chest, which connect the extremity with the trunk, should, with the exception of the latissimus dorsi, be dissected and cut through, one after the other, and, after dividing the rhomboids and the levator anguli scapulæ, due notice should be taken of the size and position of the posterior scapular artery. It will be found immediately under these muscles, about the size of a crow-quill, passing from above downwards along the posterior margin of the bone, and becoming smaller in its course as it gives off its branches. It will usually be found within half an inch of the margin of the scapula, but will vary according to the position of the bone, which, it will be observed, can be moved backwards and forwards with great facility.

The body should now be put face uppermost, and if it is that of a female, the skin should be dissected off the mamma, so as to obtain a view of this gland. This will be most readily done by making four incisions and a circular one in this style (fig. 55) on each side of the nipple; the gland may then be removed, and such an examination made of it as may be wished. The great pectoral muscle must next be exposed, and for this purpose an incision should be made from the acromion process along the clavicle to the upper end of the sternum, and then another from the same part of this bone to its lower extremity, when the skin should be taken off from above downwards. In dissecting in front of the shoulder the anterior part of the deltoid should be laid bare by turning the skin forwards; indeed, it will be as well at this stage of the dissection to raise the skin from off the anterior and upper part of the arm, and also off the axilla, so as to allow of the first view of this important cavity. For this latter object the skin should be turned a little down on the side of the chest, and the margins of the pectoralis major and latissimus dorsi muscles should be clearly displayed. The division between the clavicular and sternal portions of the pectoral muscle should now be examined; next, that between this muscle and the deltoid: the former will probably not be distinct, at least there will be no great space between the two; the latter will in general be of the same size, the two muscles being distant about an inch where they are connected with the clavicle, and in this space the cephalic vein and some branches of the arteria thoracica acromialis will be found. The manner in which the axilla is bounded should now be examined, and the effects of the changes in the position of the arm, when applied close to the side, or separated from it, should also be looked to. In the former position the axilla will appear deep; in the latter so shallow, that every part of it may be reached and touched with facility. The pectoral muscle should next be raised by cutting it through at its attachments to the ribs, sternum, and clavicle, and turning it outwards. The pectoralis minor will now be exposed, and by dissecting on its upper and under margins the axillary vein and artery will be discovered. In order to examine these vessels more fully, the fat and loose cellular membrane should be carefully removed from the axilla. In making this dissection, the numerous small vessels, nerves, and glands, which lie in almost inextricable confusion, should be carefully preserved, and after being examined the nerves and glands should be cautiously cut away, and such of the vessels only as are of considerable size should be preserved. With very little trouble or further dissection, the entire course of the axillary artery and vein, as well as their relation to the axillary plexus of nerves, (which will by the same dissection be also exposed,) may be fully examined, and it

Fig. 55.

will be of advantage in doing so, to cut across the lesser pectoral muscle. If the arm be kept from the side of the body, which it should be in making the dissections recommended, the parts will now appear thus: the axillary artery will be seen at the upper part of the dissection, between the subclavius muscle and the upper margin of the serratus magnus, having the vein in front of it and a little lower. The vessels in this situation are as often termed subclavian as axillary. The large nerves will all be seen on the upper and outer side of the artery. Two inches further down, all these parts will appear in closer contact: the vein will be more completely in front of the artery; two large twigs of nerves, one from above, the other from below, will have joined in front of this vessel, to form the median nerve; and the whole will lie on the subscapular muscle, where it is attached to the lesser tuberosity of the humerus. The course of the subscapular artery on the axillary margin of the last-named muscle will also be noticed.

If the neck has not yet been dissected, and if it is of consequence to be economical with the subject, the parts in this region should next be examined in the manner directed in the section of this work, on the head and neck: as for the further examination of the shoulder, the upper extremity had better be entirely separated from the body, by disarticulating the clavicle, or dividing it at its middle with a saw, and cutting through the subclavius muscle, the axillary vein, artery, and nerves, the serratus magnus, latissimus dorsi, and such other parts connected with the clavicle or scapula as remain to be divided.

The shoulder being removed from the body, the deltoid muscle should be cut through at its attachments to the scapula and clavicle, and turned downwards, when the ends of the muscles connected with the head of the humerus will be observed; the large bursa beneath the acromion process should be opened; the course of the posterior circumflex artery, with its accompanying nerve, round the neck of the humerus towards the deltoid should be looked at; the supraspinatus, infraspinatus, teres minor, and subscapularis muscles should be dissected, and then cut through about an inch from their attachments to the humerus: the capsular ligament should next be dissected by raising the ends of these muscles; and lastly, by dividing this ligament and the long head of the biceps, which will be found within it, the humerus will be separated from the scapula, and the glenoid cavity exposed. In dissecting the suprascapular muscle, the nerve and artery of the same name will be observed on the upper margin of the bone, the one generally passing over, the other under, the little ligament which converts the notch on this part into a foramen. The ligaments of the scapula, and those between this bone and the clavicle, will next demand attention, and lastly those connecting the inner extremity of the latter with the sternum and first rib.

In this description of the manner of conducting the examination of the upper extremity for surgical purposes, I have not deemed it necessary to name each minute vessel or nerve, nor to describe their separate courses; nor have I done so with the ligaments or processes

of bones: my object being, not to describe that kind of anatomy which is found in all elementary works on the subject, nor to give facility to the recollection of mere names; but to encourage that personal and manual examination, which can alone serve the student or practitioner for the study of surgical anatomy.

CHAPTER II.

DISLOCATIONS.

BEFORE mutilating another arm, by operations or otherwise, it may not be amiss for the student to practise the application of bandages, splints, and other apparatus, such as may be required for accident or disease, on the living body; and these proceedings may be accomplished on the subject, on a lay-figure, or, what will be best, on the arm of a friend. They may be of little moment to those who have already had the advantage of being engaged in practice, but many students will derive no inconsiderable benefit from such lessons, as they will afterwards perceive in performing similar manipulations on the living body. In a case of wound of the humeral artery, (inflicted, perhaps, in venesection,) it may be considered advisable to apply bandages from the points of the fingers upwards as far as the seat of injury, and this may now be done as afterwards described.

Before alluding to the manner of applying apparatus in cases of dislocation or fracture, it will be proper to take the nature of such accidents into consideration.

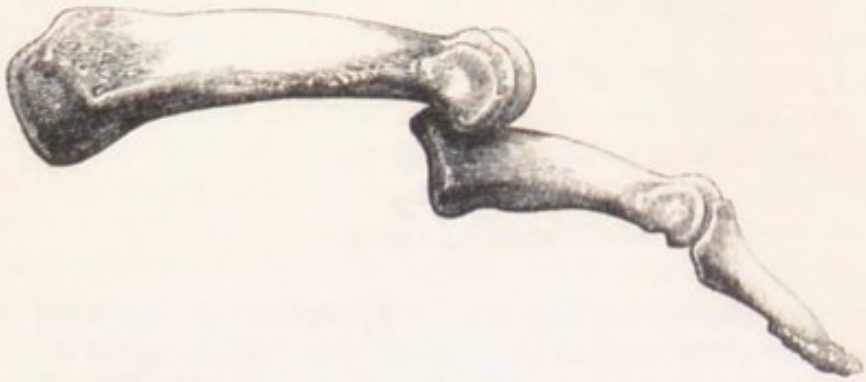
Dislocations in the fingers are of frequent occurrence, and very often of such a nature as to induce the surgeon to remove the injured part by amputation. In such instances, in addition to the displacement, the bones may be broken, the soft parts extensively injured, and the joint or joints laid open.

In simple dislocation of one phalanx from another, the end of the

Fig. 56.

lower bone will ride over that of the upper either above or below; as is represented in the two figures (56 and 57), in which,

Fig. 57.



for the sake of clearness, the phalanges are exhibited divested of all coverings. I need scarcely add, that the distal joint may be dislocated in a similar manner, although it must be admitted that these displacements in the fingers are more rare than some appear to suppose.

Lateral displacement in any of the phalanges rarely, if ever, happens without severe destruction of the parts; as, indeed, may be easily conjectured from an examination of the joints; and, in such cases, amputation may possibly be required. In all probability the dislocation will be compound, and therefore taking the risk of severe inflammation, and also that of a stiff joint, into consideration, I imagine that the removal of the part will often be the best course;—but more will be said on this subject in the chapter on fractures, with which injuries those at present under notice are not unfrequently associated.

For the reduction of a simple case, as above described, the patient's hand must be held firmly in the left hand of the surgeon, who should grasp the lower part of the finger with his right, somewhat in the manner shown in the next drawing, when, by steady extension, the lower phalanx will slip into its proper place. In most instances success will be more rapidly attained, by gently moving the lower part of the finger upwards and downwards, and in some it will be advantageous to bend the member with considerable force towards either the back or palm of the hand.

Simple dislocations of the fingers from the metacarpal bones are of more frequent occurrence than the above; and the fore or little finger, from their comparatively unprotected position, are most exposed to those forces which cause displacement. The phalanx will be either on the palmar or dorsal surface of the metacarpal bone, and may, in general, be readily reduced by following the foregoing instructions. The surgeon, by grasping the finger nearer its root, as seen in this figure

(58) of a dislocation of the index finger backwards, will have all the advantage of a firmer hold, and a more powerful lever. The

Fig. 58.

middle and ring fingers are so well protected by their position, that dislocations of the head of either on the metacarpal bone, is of rare occurrence, unless the injury to the hand is severe and complicated.

The phalanges of the thumb may suffer like those of the fingers, and the preceding observations are equally applicable here. The dis-

Fig. 59.

tal joint is seldom the seat of simple luxation, however, the proximal phalanx being most frequently displaced ; and it may be either in front or behind the end of the metacarpal bone, as exhibited in the accompanying figures (59 and 60).

Fig. 60.

The displacement of the first phalanx backwards (fig. 60), or, as some describe it, of the metacarpal bone forwards, has attracted con-

siderable notice in consequence of the trouble frequently attending reduction, and the occasional impossibility of attaining this object. It is difficult to account for this in a satisfactory manner from any peculiarity of the articulation, as evinced in the bones or ligaments. Mr. Hey imagined that this difficulty was occasioned by a kind of wedge-shape in the end of the metacarpal bone, the thickest part of which being thrust between the lateral ligaments, presented such an obstacle to reduction, that, if these remained entire, it was almost impossible to replace the bones. Though I have never been fully satisfied of the correctness of this view, I am not prepared to deny it; and in a somewhat similar mode of reasoning, I am inclined to think it not improbable, that in some instances the large extremity of the metacarpal bone being driven between the two portions of the flexor brevis, as well as between the lateral ligaments, (which, however, in such a case would doubtless be extensively stretched, or perhaps torn across,) combined with the vast power of the numerous muscles connected with the first phalanx, may be the chief cause of the difficulty experienced in these cases; more particularly when the shortness of the lever which the surgeon has to work with is taken into consideration. I have seen an instance of compound dislocation in this joint, where the end of the metacarpal bone projected through a transverse wound of the textures on its anterior surface, in which the bones could be reduced and displaced at will, twelve hours after the accident, and it seemed to me, that the lateral ligaments were as entire as if there had been no external wound. Anchylosis occurred in this case after severe inflammation and suppuration.

In instances of this dislocation where the ordinary means fail, it seems to me very doubtful if such a measure as removing the end of the metacarpal bone through an incision made directly upon it, should be resorted to; for, although such a wound may occasionally heal by the first intention, (as was long ago noticed by Mr. Hey, in referring to some cases occurring in the practice of Mr. Evans of Ketley, who in two instances cut down upon the extremity of the metacarpal bone, and removed it with success,) there would certainly be great risk of its not doing so, and, in such an event, the results to the patient would be much more painful and annoying, whilst in all likelihood the member (provided it escapes amputation) would be of no more service than if it had been left in its distorted condition. It is well known, and I have seen such examples, that in the course of time, a thumb in this state is gradually restored to much of its original utility.

To facilitate reduction, the old proposal of dividing one of the lateral ligaments, might now be practised with greater propriety than in former times, by performing a subcutaneous division, with a very small and narrow-bladed knife: indeed, by a similar proceeding, the opposite ligament might also be cut in the same case, or any other texture that seemed to offer resistance,—the wound, or wounds, in the skin being so small, that little fear need be entertained of any bad results following the discreet use of such an instrument.

Dislocations in either thumb or fingers can occasionally be reduced by simple pressure, with the surgeon's thumb and fingers, on the displaced end of the bone, and it is often of service combined with extension, as above described; but in some cases neither of these means will answer, and a greater degree of extension must be applied. In such instances, a bit of tape, a silk handkerchief, or soft calico bandage should be slipped round the lower part of the disjointed member, and the ends given to one assistant, whilst another keeps the hand steady. The surgeon can then use his fingers in such a way as he thinks most likely to be of service. The pulleys (afterwards delineated) have even been resorted to in some of these cases! and we need scarcely, therefore, wonder at the instance alluded to by Bromfield, in which the end of the thumb was torn off by an over-zealous attempt of a surgeon to effect reduction.

The noose (clove-hitch, as it is often called) will be best fixed by casting such a one as this (fig. 61), which can be readily imitated

Fig. 61.

with a bit of string. First one circle is made by turning the string from one side to the other (right to left), then a second in the same way; if that last made is now placed behind the other, and the two loops put on the part where the extending force is to be applied, and drawn sufficiently tight, a noose will thus be formed that will not readily slip off, nor will the extending force have any effect in tightening it to an injurious extent round the member.

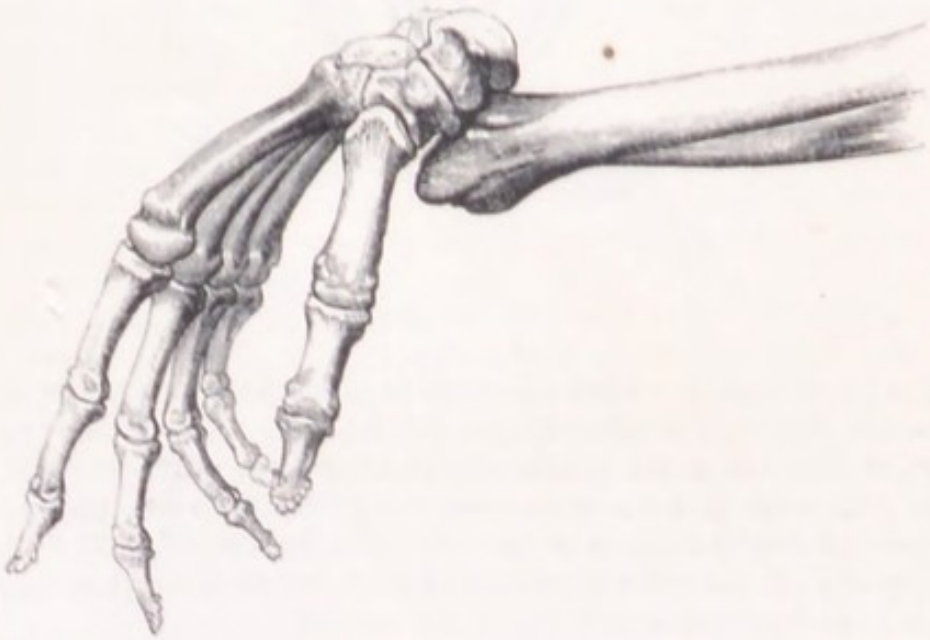
Before applying a tape or bandage, it may be well to protect the skin with a small bit of lint; and, in fixing either of the former, it may be put round the thumb beyond the displacement, or above the end of the metacarpal bone in such a manner that the extending force will act chiefly on this part.

The metacarpal bone of the thumb is sometimes dislocated from the os trapezium. Sir Astley Cooper has described the displacement to-

wards the palm as the only kind which he has met with, and has advised that unless the reduction could be easily accomplished, the parts should be let alone. I have not met with any example of this kind, but have seen several where the end had slipped backwards: in two cases the injury having been occasioned by strong resistance at the distal extremity of the bone. There is little difficulty in reducing the projecting point, but there is much in keeping it in its proper place. I have seen a splint and roller fail in doing so. When it shows a tendency to slip out of its situation, a strong narrow bit of pasteboard should be laid along the lower extremity of the radius, over the entire length of the metacarpal bone, and be retained by means of a bandage for the space of three weeks, when the best possible chance will thus be given for the parts keeping their natural position.

The bones of the carpus are but rarely separated from each other, and only when great force is applied. In many such cases amputation will probably be required; yet it may occasionally be good practice to attempt to save the hand, after removing one or more of the loose and perhaps shattered bones. The os magnum is sometimes thrust backwards, however, without fatal injury being done to the

Fig. 62.



neighbouring parts. In such a case, if the bone cannot be at once pushed into its proper place by the surgeon's thumb, no other attempt should be made, lest it aggravate the evil, by inducing inflammation and caries of the carpal bones. I have seen amputation above the wrist required in consequence of injudicious interference in such an instance. I have known of one example, in which the pisiform bone

was detached from its lower connexions by the action of the flexor carpi ulnaris. Little benefit can be expected from any attempt to keep this bone in its proper position, nor, indeed, is the displacement of much consequence.

The carpus may be displaced either backwards or forwards, or in a lateral direction. In the latter case, the dislocation cannot be complete without great injury, which may possibly necessitate amputation. In the former of these examples, the hand with the bones of the carpus may be deemed the moveable parts, as indeed they really are.

When the first row of the carpus is driven from the articular surface of the radius, in a direction backwards or forwards, the projection thus formed, and the corresponding one on the opposite side, can leave small doubt of the nature of the injury. The two skeletons (figs. 62 and 63) will give the student a tolerably correct idea of each of these luxations, although it should always be remembered, that in the living body the appearances may not be altogether so clear. With these sketches, as with those of the fingers and thumb, the state of flexion is such as, I believe, will generally be met with in practice, although occasionally the angle may be more or less acute, as most surgeons of experience must have noticed.

Fig. 63.

Little difficulty will be met with in reducing these displacements, provided they are seen at an early period. After the lapse of ten or fifteen days, it may be a question whether or not it will be safe to apply such a degree of force as may be required. I have seen one case where reduction was accomplished with tolerable ease after fourteen days, and all went on favourably afterwards. In this in-

stance (the patient was a boy about ten years old, under the care of Mr. Lizars) little force was needed; and in all similar examples violent force or twisting is to be deprecated, for fear of exciting disease in the carpus.

In adjusting these luxations, an assistant should steady the forearm, whilst the surgeon applies the extending force either by grasping the patient's hand in his, or by means of a handkerchief twisted round the hand above the thumb. A slight degree of flexion or extension cautiously applied will facilitate the object in view.

The radius and ulna are sometimes separated at their lower extremities. The ulna appears to be detached from the radius in such cases, and the prominence caused by its extremity leaves no doubt regarding its nature. A little pressure suffices for replacement, but it will not remain unless retained by a bandage, and even then there will, perhaps, be a projection, which fortunately, however, is productive of little or no after inconvenience; indeed, in many persons advanced in years, a kind of slow spontaneous displacement of the lower extremity of the ulna occurs naturally, which causes no annoyance whatever.

One or both bones of the forearm may be displaced from the humerus. The head of the radius may pass in front of the external condyle, or it may be behind it. In the former case, which seems to be the more common of the two, the bone is in the position represented in the drawing (fig. 64). I have only seen one well-marked

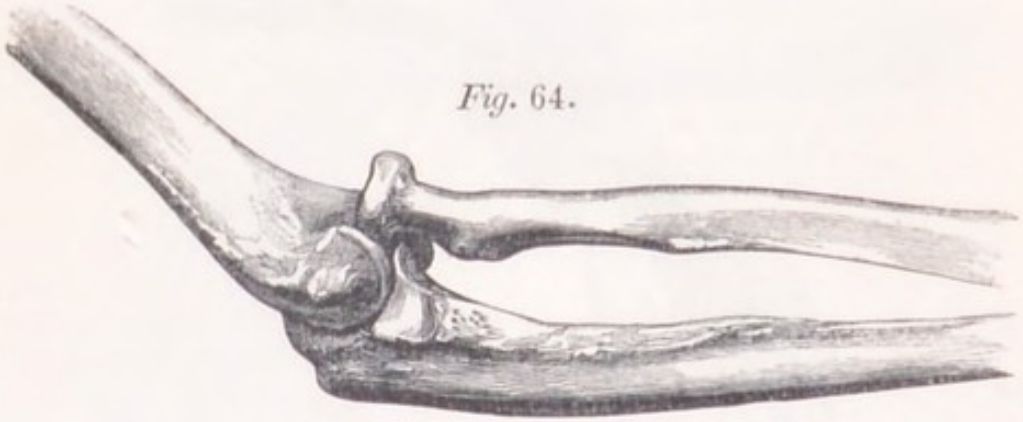


Fig. 64.

instance of the latter, and it was on a subject in the dissecting-rooms. Figure 65 exhibits it: the head of the bone could be felt immediately under the skin, yet the displacement seemed to have produced very little inconvenience, for the distortion was only apparent on a close examination (as may be seen from a cast in the collection at King's College), and the motions of flexion and extension were tolerably complete, as were also those of supination and pronation. In either instance the injury is most likely to be occasioned by the patient falling, and attempting to save himself by throwing out his

hand. The rupture of the annular ligament must, in these examples, precede and facilitate the displacement. From the frequency with which the former luxation is met with in the dissecting-rooms, I am inclined to think that the accident is often overlooked ; and I believe it to be much more common than that backwards. My own

Fig. 65.

experience, especially in the dead-room, leads me to suppose that Sir Astley Cooper's estimate of the relative frequency of these two injuries is the most correct, although it is worthy of notice, that, while he states the dislocation forwards as being the most common, Boyer asserts, with equal precision, that the head of the bone passes most frequently backwards.

When the head of the bone rests in front of the external condyle, it seems to produce little inconvenience, saving a slight diminution in the motions of flexion and extension, more particularly the former.

In all instances, however, where either of these injuries is detected at first, the head of the bone should be drawn, by extending or bending the elbow, or perhaps thrust at once, into its proper position ; and, though it may be a little troublesome to retain it there, the best chance will be given by keeping the elbow-joint quiet, and in a bent position, by means of a bandage ; and should great steadiness and some considerable pressure be required, then a splint, similar to that used for fractures in the lower part of the humerus, may be had recourse to.

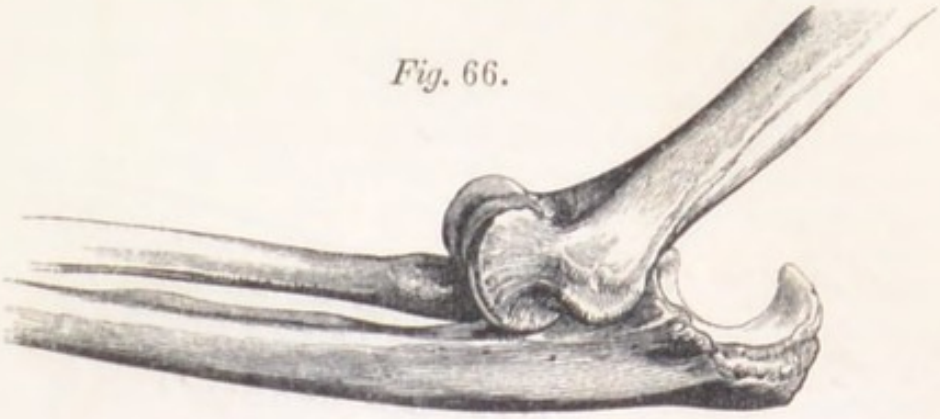
The bones of the forearm can scarcely be dislocated forwards on the humerus without a fracture of the olecranon process, and such an injury I believe to be very rare ; they are, however, not unfrequently displaced backwards, as represented in figure 66, and the nature of the accident will be readily made out by any one acquainted with the anatomy of the joint. In such a case the coronoid process will probably be broken. The unnatural prominence, both in front and behind, as well as the fixed position of the bones, will sufficiently indicate what is wrong.

One of the most distinct cases of this luxation which has ever come under my notice, occurred in a boy about ten years of age, who, in

playing at leap-frog with his companions, fell upon his hands, and thus sustained the injury in one arm.

If this accident is seen by the surgeon shortly after its occurrence, the two bones can be drawn down with little trouble into their proper situation. The forearm, which will be a little bent at the joint, should

Fig. 66.



be drawn down in the axis of the humerus, and, by bending it a little further, in all likelihood the bones will be replaced. An additional force must be applied, should there be much difficulty ; but care must be taken, more particularly if the injury be of some standing, not to apply a great degree of violence, as this may be productive of more serious injury to the joint, by the additional inflammation thereby induced.

Dislocations of the bones of the elbow, forwards or in a lateral direction, are of very rare occurrence, and can happen only in violent injuries ; the former accident being, as already stated, complicated, in all probability, with fracture of the olecranon.

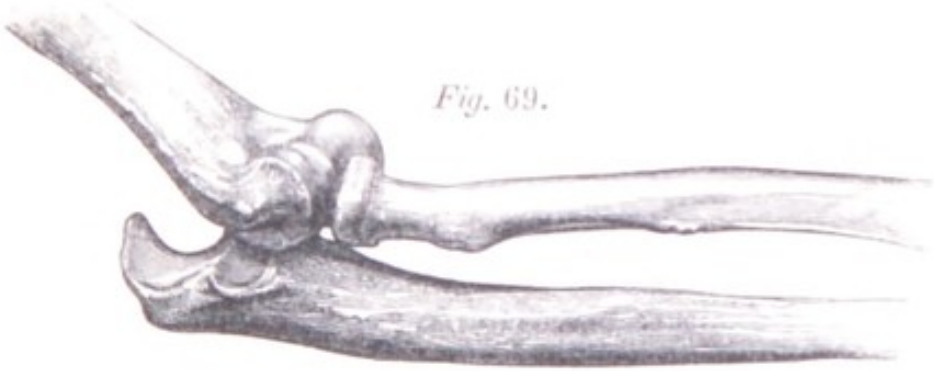
Any surgeon, however, who has seen much among the lower orders, as in dispensaries and out-patient hospital practice, must agree with me in thinking, that it is impossible to say what dislocations may not take place in this articulation. I have myself frequently seen the joint in such a distorted condition, from injuries of old date (probably luxations and fractures combined), that the most experienced anatomists have been unable to appreciate the true condition of the ends of the bones ; and in many of these cases the facility of movement was remarkable, as was also the muscular development, which was such as to give the parties an excellent command over the extremity. The two sketches (figs. 67 and 68) of the lateral displacement of both bones,—the one inwards and the other outwards, will give some idea of such injuries, although I imagine that on the living body the regularity here delineated would not be so perfect; for the force which would cause such displacements would, in all probability, produce separation of the two bones, and fracture too, perhaps of one or both, or of the lower end of the humerus.

Fig. 67.

Fig. 68.

The figure below (69) represents a very rare form of luxation in this situation, viz., a displacement of the ulna backwards, with the

Fig. 69.



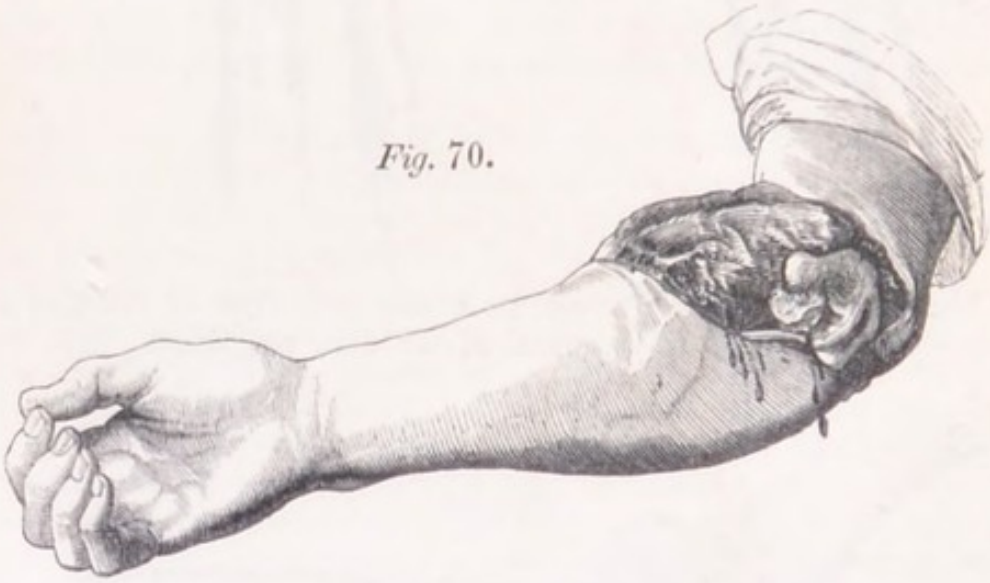
radius thrown slightly forwards. Such a case has been referred to by Sir Astley Cooper, who mentions two of the kind. I can fancy such

an injury being complicated with fracture of the radius, lower down, so as to permit the lower fragment with the ulna passing upwards; and here, too, I imagine that the coronoid process of the ulna might be broken off.

Should any of these cases be such as to admit of remedy without amputation (and that such do occur there can be no doubt), there may or there may not be difficulty in replacing the bones; and here, as in all other injuries of this joint, whether the attempt at reduction is successful or not, too much care cannot be bestowed in keeping the limb quiet, and in a bent position. At first, as the patient will be kept to his bed, the arm may be placed on a cushion, and afterwards it should be carried in a sling.

In certain compound dislocations of the elbow, when complicated with fractures of the coronoid or olecranon process, or of the condyles of the humerus, and in which, were the ends replaced, there might be every reason to apprehend severe inflammation, which might probably end in caries of the bones; were the case one, in short, where at the first glance amputation might be deemed the only resource, it may be well to pause and contemplate the propriety of cutting away the exposed and injured ends of the bones, and thus give the patient a chance of having his hand preserved. There can be no doubt, that in many instances such practice would be better than amputation; but in such as is represented in this drawing (70),

Fig. 70.



(taken from an arm which I amputated some time ago in King's College Hospital,) the soft parts seemed too much injured to encourage me to cherish a hope of saving the limb by such a proceeding as that referred to. The particulars of this case, and my reasons for preferring amputation, were given in the Lancet, October 2nd, 1841: but assuredly in less severe injuries it would be proper to try the chance of saving the limb, without or with excision, as might be deemed most advisable.

The attention may now be directed to dislocations of the shoulder-joint, which, in one form or other, are of such frequent occurrence. When this joint is examined anatomically, it will be readily perceived that its weakest part is below, in the space between the teres minor and subscapularis, where it is protected neither by muscles nor tendons, and where, moreover, the capsular ligament is less likely to restrain the head of the bone than at any other point. These circumstances, combined with the lever force of the humerus when a person falls with the arm thrown forwards for protection, may account for the frequency of dislocation of the head of the bone in this situation. It is impossible in most instances to ascertain the position of the limb previous to the accident, nor is it of much consequence to know whether the displacement has been occasioned whilst the arm has been raised from the side, or by direct violence over the shoulder, as undoubtedly may be the case. In whatever way it may be accounted for, the accident—displacement into the axilla as it is called—is of more common occurrence than any other sort of dislocation in this joint. The bones occupy this position (fig. 71); the head of the

Fig. 71.

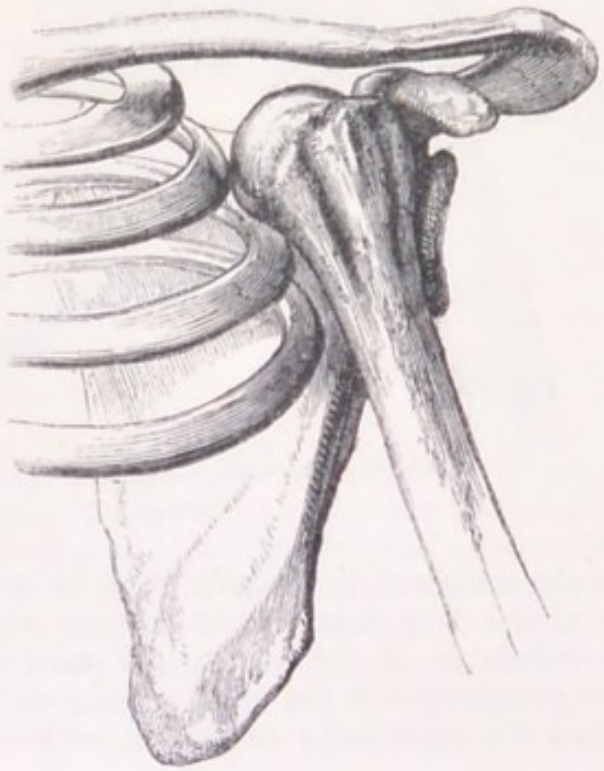
humerus rests on the margin of the scapula below its neck, in front of the attachment of the long head of the triceps, and it may be slightly in the substance of the subscapular muscle, as may be imagined from an examination of the drawing. In several dissections which I have had the opportunity of making of recent injuries of

this description, I have found the parts as I have stated; the capsular ligament has been extensively torn, with part of the tendon of the subscapular muscle; in one instance, the supra-spinatus was greatly stretched; in another, the tuberosity, into which the tendon of this muscle is inserted, was torn off; in all the axillary vessels and nerves were slightly on the stretch, and in none of these was the circumflex nerve torn. In some examples of this dislocation of old standing, I have found it impossible to trace this nerve throughout its course, as it seemed to have been ruptured at the time of the accident: in others again, I have traced it with great ease. In the former I have particularly remarked the atrophied condition of the deltoid muscle, whilst in the latter the diminution in bulk has not been more than might have been expected, as the result of restricted movements in the joint.

The features of this accident are in general so well marked, that it might be supposed impossible to overlook its nature. This is, however, too frequently the case. The history of the accident, the immobility of the limb, the pain in the armpit, numbness of the fingers, with (in some instances) œdematous swelling in the hand, the separation of the elbow from the side, the increased length from the acromion to the olecranon, and, above all, the flatness of the shoulder, with the prominence in the axilla, should sufficiently point out what is wrong.

The head of the humerus is occasionally thrown inwards and upwards, so as to rest under the pectoralis major muscle, and to be in contact with the pectoralis minor and coracoid process of the scapula,

Fig. 72.



as just represented in figure 72; or it may be driven backwards on the dorsum of the scapula, of which I have seen one well-marked example, which may be understood by this design (fig. 73). In the latter

Fig. 73.

case, the humerus slopes slightly forwards, and the head of the bone will be felt in its unnatural position under the spine of the scapula; in the former this may also be done, though not so distinctly; and the arm will slope backwards and outwards, as shown in the sketch: in both the deficiency under the acromion, the history of the accident, as well as the general marks of dislocation, will indicate the nature of the injury.

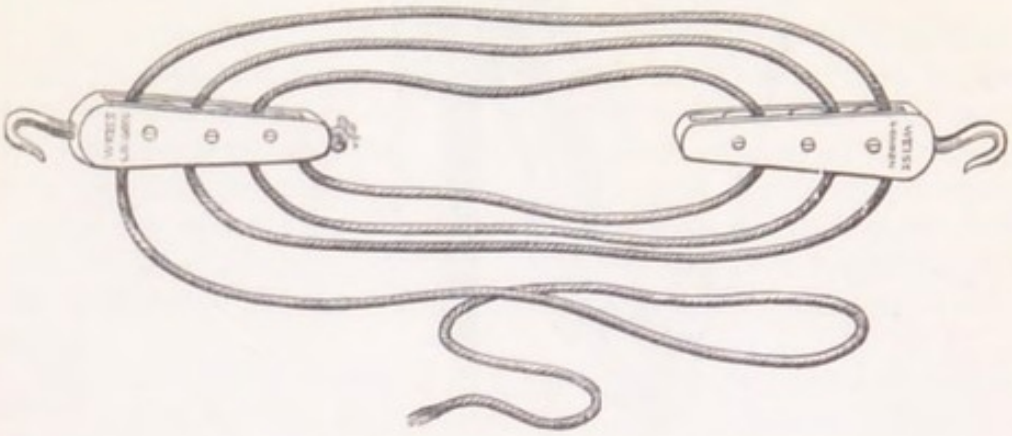
Dislocations of the shoulder-joint may be reduced in a great variety of ways; but, as it would be inconsistent with the nature of this work to describe or even refer to them all, I shall merely speak of those which I consider most worthy of attention.

One of the most simple methods of reducing dislocation of the shoulder-joint is as follows:—The patient should be seated on a chair, a table-cloth or sheet, folded to the breadth of eight or ten inches, placed around the chest, its middle being close under the injured part, and its two ends given to an assistant standing on the opposite side; another cloth should be fixed by the middle on the arm immediately above the elbow, and its ends entrusted to another assistant; the surgeon, placing himself behind the arm, should lay hold of the extremity in such a way as to bend the elbow, and move the humerus in a rotatory direction on its long axis, whilst the two assistants are engaged, the one in keeping the body steady, the other

in making gradual extension. If this force be judiciously applied as thus directed, the head of the humerus will, in all likelihood, pass into the glenoid cavity with a kind of snap, which will be perceptible to both patient and surgeon. It may, however, be necessary to apply more force by means of additional assistants, and the operator may also require to be more rude in that which he himself exerts. In such examples, the warm bath, the abstraction of a quantity of blood from a vein in the arm, and the exhibition of plentiful doses of the solution of the tartrate of antimony, will be of great assistance.

If success cannot be obtained in this way, a stronger force must be applied by means of pulleys (fig. 74), which should be used in the

Fig. 74.



following manner:—The patient should be seated on a firm chair, or on the floor, his body enveloped as above described, and the ends of the cloth attached to some point fixed in the floor or wall (p. 166); the hook of one end of the apparatus should then be fixed in a towel, which has previously been properly fastened round the patient's arm above the elbow, and the other hook being attached to a fixed point, opposite to that above mentioned, the extension may be applied by a single assistant, who draws by the loose end of the cord. The surgeon, placing himself on the outside of the arm, should keep it bent, and by the same manœuvre as already directed, viz., rotating the humerus on its own axis, the desired object may be accomplished. In cases of difficulty, when the extending force is supposed to be sufficiently applied, it may be of advantage for the surgeon to put his knee into the armpit, and desire the assistant suddenly to quit the rope, when, by depressing the lower part of the arm, and using it as a lever, the knee being the fulcrum, the head of the bone may be forced into its proper position. On the common principles of mechanics, this plan might be supposed to answer well; I must say, however, that although I have often seen it of service, I have observed it to fail, and have much more frequently seen the end of the bone slip suddenly into its natural place during the application of the extending force. Instead of a sheet, tablecloth, or towel, the surgeon may be provided

with a kind of stock apparatus, which, with the pulleys and screw already referred to, may always be kept by him in readiness for use. It consists of an oblong piece of stout canvas, between three and four feet in length, and about nine inches in breadth at the middle: here there is a hole of sufficient size to allow the arm to pass through, close up to the axilla and scapula: and each extremity is terminated with a stout iron ring. When the arm is put through the hole, and this broad belt is drawn up to the shoulder, the two rings can be brought together on the opposite side, by bringing one before and the other behind the patient's body, and then be fixed to any

Fig. 75.

convenient point by means of a towel or piece of rope. The side of the belt next the skin is usually lined with chamois leather, to prevent chafing; and it may be well, too, when it is used, to further obviate this annoyance by placing a folded towel, as a pad, in the axilla. Another portion of the apparatus consists of a kind of clasp, made of iron and leather, to fix around the arm above the elbow, by means of screws which lessen its calibre. This circle is well padded within, and also lined with chamois, and has a couple of belts attached to it, which are provided at their loose ends with a ring each, through which, when brought together, the hook of the pulley is passed. Such

apparatus, with pulleys and screws, may be had of Mr. Weiss or any other instrument-maker. The belt I deem greatly preferable to a sheet, which, unless a hole be cut in its centre, only offers its resistance below the axilla, whilst the former fixes the scapula in a much more efficient manner; and it is of the utmost consequence that this bone should not be acted on by the extending force. The clasp is very apt to slip from the lower part of the arm, and I am inclined to use in its stead a jack-towel, fastened to the arm by the clove-hitch (p. 153), or a thick and sufficiently long and stout skein of coarse worsted thread, which, from its softness and elasticity, is less likely than the towel to injure the skin. Such methods and apparatus as those above described, modified and applied according to circumstances, I have seen almost invariably resorted to during the fourteen years in which I was connected, as pupil and surgeon, with the Royal Infirmary of Edinburgh, and they seldom failed to answer the objects for which they were used. The foregoing sketch (fig. 75) will make my description more intelligible. The patient is represented as seated on a couch or chair, with the surgeon in the position above described. The body-belt may be supposed to be fixed above the level of the injured shoulder, whilst the pulleys are below; in some instances the latter may be placed highest, and in all it is evident that when the extending force is being applied there must be a straight line betwixt the extreme points. In addition to the apparatus above referred to, I advise that a couple of common iron staples should be kept at hand, as they will be convenient to drive into the floor or wall for fixing the body-belt or pulleys,—for the handle of a door, a bed-post, or bar of a grate, will not offer sufficient resistance in such cases, as I have experienced. Such a screw as that here represented (fig. 76) may be had in the ironmonger's shop, and two, somewhat larger than that in the figure, will answer as well as the staples.

Fig. 76.

Another plan, which is attended with less trouble than those above described, and also obviates the necessity for pulleys, consists in placing the patient on a couch or mattress upon his back, when the surgeon seats himself alongside, and places his foot, the boot or shoe being removed, in the patient's axilla: he then lays hold of the wrist with both hands, or a bandage, which he may have previously fastened round the arm above the elbow, and by throwing his body backwards and pushing his heel upwards, the head of the bone will be made to glide into its proper place. I have known this plan succeed when others had failed, even though aided by the pulleys; and I believe, that, if judiciously and energetically applied, few examples will be met

with, more particularly when the head of the humerus is in the axilla, in which it will not answer. If it be found necessary, a prodigious additional power may be gained by passing a towel under the axilla, and desiring an assistant to pull upwards, whilst the surgeon increases the extending force, as he throws his body backwards, by having had, whilst in the sitting posture and slightly stooping, the band attached to the patient's arm fixed round his own shoulders. This drawing

Fig. 77.

(fig. 77) will convey a very distinct idea of the most important features of the explanation above given.

These are the methods of reducing dislocations of the shoulder-joint, which, in so far as I am aware, are most commonly in use; there are others, however, which some consider equally efficient, and for a description of which I must refer to the works of Paré and Scultetus, to Heister's surgery, or other systematic authorities of the last and preceding century. The ancient ambi, the scala, and the glossocoma, are now looked upon with interest, only as relics of bygone ages: although Mr. Bransby Cooper relates the case of a farmer near Norwich, who, being frequently the subject of luxation of the humerus into the axilla, used to "do the doctor," by suspending himself over a gate, his body on one side, his arm on the other, we no longer hear of patients being suspended by the armpit over the upper bar of a ladder, or the top of a door, nor hung from the ceiling by the wrist of the injured arm, with the sanction of the modern surgeon. Though the pathology of luxations in this joint is now better known than in former times, the history of their treatment clearly shows, that it would indeed be difficult to resort to any method which has not pre-

viously been tried and recommended. The surgeon will best display his judgment, not by obstinately refusing to resort to any plan but that which he may think best, but by attempting, after his first effort has failed, any other which will give his patient a reasonable chance of relief: if he fail with one, he may succeed with another; if gentle force will not suffice, he must apply a greater amount; if a steady extension will not answer, he must try the lever and fulcrum; and, should one attitude for the arm not do, he may place it in another; he may move it gently from side to side, upwards and downwards, or twist and twine it rudely in all directions to attain the wished-for result; and should he succeed, as in all likelihood he may, he ought not on that account to imagine, that the successful plan in this instance, and that only, is the best for all future cases.

It will be remarked, that I have drawn no broad distinctions between the methods to be pursued in one dislocation and another. The means above recommended, I have seen successfully used, whatever might be the position of the bone; and the references which have been made to others now deemed obsolete, as well as the occasional necessity of varying the plans and the attitude of the limb, will be sufficient to show, that the surgeon must often trust more to his own skill and mechanical ingenuity, than to any minute rules which might be given here, but which are purposely omitted, as not being in accordance with the arrangements for this work.

It may often be a question, whether or not, in dislocations of old standing, the surgeon should persist in, or even attempt, the application of violent force to effect reduction. I have seen a most excellent practitioner fail at the shoulder, after the lapse of three weeks, when another, making the attempt a few days afterwards, succeeded. I have myself been successful in the eleventh week; and, though cases have been put to rights even after the third month, the propriety of interfering with the generality of such instances may admit of doubt. Frequent experience on the living subject, and that acquired in the dissecting-room, have sufficiently demonstrated the fact, that even when the head of a bone is left in its abnormal position, the limb below will gradually acquire an amazing latitude of movement, and a new joint will be formed, which, in many respects, will almost equal in efficiency the natural articulation before the injury. I have seen individuals with old unreduced dislocations of the shoulder move the elbow backwards and forwards, and also raise the hand to the head with the utmost facility; and every one experienced in the dissecting-room and in museums must be familiar with the admirable manner in which nature adjusts the newly opposed surfaces to each other. These observations are peculiarly applicable to the shoulder and hip-joints, but they should be kept in view in other regions also: I cannot imagine that they will engender carelessness either in the examination of any joint supposed to be the seat of displacement, or in the application of remedial measures, and I shall only, therefore, add the views entertained on the above important question by one of the

greatest of all authorities on the subject, Sir Astley Cooper, who, in the preface to the posthumous edition of his work on Dislocations and Fractures (1842), has left behind him the following statement, grounded, it must be kept in mind, on an experience greater, perhaps, than ever fell to the lot of any other individual: "I feel," says he, "that my professional brethren will be disposed to think that I have limited to too short a period the attempts at reduction. It has been stated that dislocations have been reduced at four, and even six months after the injury; and this assertion I am not disposed to deny; indeed, I have myself had an opportunity of witnessing examples of the fact: but, excepting in very emaciated, relaxed, and aged persons, I have observed that the injury done in extension, has been greater than the advantage received from the reduction; and, therefore, in the case of a very strong muscular person, I am not disposed, after three months, to recommend the attempt; finding that the use of the limb is not, when reduced, greater than that which it would have acquired in its dislocated state. Let this be fairly represented to the patient; and then, at his request only, the reduction should be attempted; but, 'with all appliances and means to boot,' the extension must be very gradually made, and without violence, to avoid injury to the muscles and nerves."

It is customary to suppose that the head of the humerus cannot be luxated directly upwards; but I have long been of opinion that such an event, to a partial extent, may, and indeed does, occur pretty frequently. I have met with various examples in the dissecting-rooms, in which the end of the bone has been in close contact with the acromion process and spine of the scapula, or with the coraco-acromial ligament,—lying, in the one instance, a little above and behind the upper part of the glenoid cavity; in the other, somewhat above, and in front, between the natural articular surface and the coracoid process; both, however, coming strictly under the title of partial luxation upwards. Whether these effects were the result of immediate violence or of gradual change, I cannot decide: the capsular ligament seemed entire, but elongated, in some of the examples, whilst in others the articular surface of the humerus was in contact with the parts above, the capsular ligament being attached to the surrounding textures, which, condensed and infiltrated with lymph, bore all the marks of former inflammation. Within these few years the occurrence of rupture of the tendon of the long head of the biceps has been noticed by Mr. Stanley, Dr. Knox, and others; and Mr. John Soden, Jun. of Bath, has related (Trans. Med. & Chir. Soc. 1841) the particulars of a case of supposed sprain in the shoulder, which dissection afterwards proved to be a partial displacement of the humerus upwards, and luxation of this tendon forwards on the lesser tuberosity. That this tendon is displaced in the luxations forwards or backwards, (or perhaps, to speak more correctly, that the head of the bone in such instances is displaced from the tendon,) there can be little doubt: I have seen the change more than once in the dissecting-room.

In some shoulders I have found the tendon partially torn and elongated, lying either in the natural groove, or in a new one formed by its friction: in others I have observed the tendon torn across about an inch from its upper extremity, which floated free within the capsule, whilst the other end was adherent to the groove between the tuberosities. In some of these, old unreduced dislocations existed; in others, every mark bore evidence that this injury had at one time occurred. There is now in my collection, in the museum of King's College, a preparation strongly corroborative of the above observations. On a subject, I noticed that one shoulder was more prominent than the other; and in the progress of the dissection I found the head of the humerus lying immediately under the deltoid muscle, in contact with the acromion, and surrounded by a very thin capsule of cellular texture. On raising the head of the bone, I ascertained that the long tendon of the biceps was torn, the under end being adherent in its natural groove, and that, in addition, a dislocation of the head of the humerus (forwards in all probability) had been in a manner reduced; but, instead of passing again into the capsule, had been thrust between this texture and the deltoid muscle. Only a small portion of the glenoid cavity was visible at its lowermost point, the greater part being covered by the flattened capsule. Doubtless, in this case, the original opening in the ligament had been only sufficient to let the head of the bone escape, and not free enough to permit of proper reduction. Such an occurrence I believe to be exceedingly rare, almost all evidence going to prove that the capsular ligament is in general so extensively torn open, that the head of the bone cannot possibly be obstructed by it in its backward course: yet the preparation confirms the observation of Delpech, who, though he suspected such an occurrence, had himself met with no anatomical proof of the fact.

I have seen in practice several examples of supposed rupture of the tendon of the biceps, attended with the usual symptoms of severe sprains of the shoulder-joint; but I cannot say that I was ever convinced of the reality of the injury. The knowledge that such a rupture may occur, however, accompanied or not with luxation of the bone; that the entire tendon may leave its groove; that the capsular ligament may lie behind the bone, after reduction has been supposed to be completed, must be of considerable practical consequence, as the surgeon may thereby explain the cause of certain conditions of the shoulder resulting from injuries of this most important articulation, whether the latter have been palpable or obscure in character.

I have already stated (p. 162), that the circumflex nerve, as it passes behind the neck of the humerus, has been found both stretched and torn in different cases, when the head of the bone has been driven deep into the axilla; and these facts sufficiently account for the loss of power, and decay in bulk, of the deltoid. In some instances, it is easy to understand that the nerve may regain its functions after being merely overstretched; whilst in others, the same event may happen, but more slowly, after union of the divided parts,—a fortunate occur-

rence, which I imagine must happen but rarely. Loss of power in the deltoid is not, however, a common sequence of simple luxations.

Compound dislocation of the shoulder is rarely met with in practice. The extensive and perhaps complete separation of the soft parts from the head of the bone will permit most speedy and simple reduction; but in some examples the injury may seem so great, that, instead of attempting to save the arm, it will be better to amputate at the joint. I do not suppose that it can ever be requisite to remove a portion of the humerus to facilitate reduction: were such a question mooted, I should most incline to enlarge the wound in the integuments. Were the head of the bone injured at the same time, excision might then be the best practice, provided it was still determined to give the limb a chance. I have seen one example of compound luxation of this joint. It was occasioned by the spoke of a large water-wheel, which, in revolving, came in contact with the arm, caused a large rent through the deltoid and skin, and thrust the end of the humerus prominently outwards. The patient, though stunned, was not seriously injured elsewhere; yet it was thought advisable to amputate. The state of shock continued for several hours; and the operation, partly on this account, and also to give time to procure instruments, was delayed till next morning. Meanwhile the head of the bone was replaced, which was easily done, and the edges of the wound were brought together. When the surgeons met again, the man seemed in such a favourable state, and the parts looked so well, that it was wisely resolved not to use the knife. The wound closed without a bad symptom, a slight synovial discharge continued for about three weeks, and some months after I saw this individual in excellent health, and already able to make a tolerable use of the injured arm.

I feel that I ought not to quit the subject of luxations of the shoulder-joint without referring the reader to the late edition of the well-known work of Sir Astley Cooper, which has just been issued under the valuable superintendence of Mr. Bransby Cooper, and which, in the present state of our knowledge, leaves but a narrow field for further observation.

Dislocation of the clavicle may occur either at one extremity or the other. When at the outer end, a projection may be felt and seen on the upper surface of the acromion process. The displacement, in ordinary cases, is seldom to any great extent, the ligaments between the clavicle and coracoid process apparently preventing it. I have known this injury mistaken for dislocation of the shoulder. The sternal extremity may be thrown either in front of the upper part of the sternum, or, in other cases, somewhat backwards and upwards. Such accidents upon the whole are of rare occurrence, as the force likely to occasion them is more generally productive of fracture of this bone. In the luxation of the outer extremity, which is more frequent of the two, and exhibited in the following figure (78), an attempt may be made to keep the end of the bone in its proper position by means of a pad in the axilla, and bandages round the shoulder and

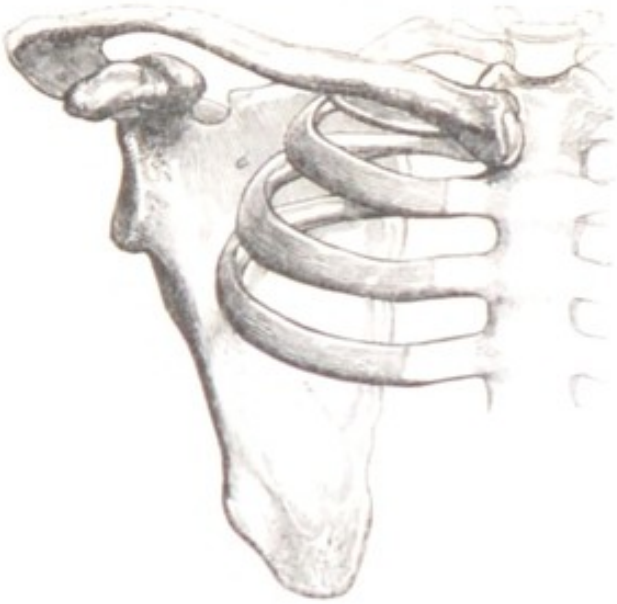
Fig. 78.

chest; a pad must also be placed upon the outer extremity of the clavicle, which must be covered by some turns of the roller, so as to assist in fixing it in its proper situation. These means, however, combined with keeping the arm steady in a sling, will in all likelihood not have the desired effect; and, moreover, the pain which the injury occasions, is not so great as to induce the patient to submit to the irksomeness of a continued application of such an apparatus. Unless the displacement be considerable, I believe it will be the best plan in most instances to leave the shoulder alone, and merely to keep the fore-arm in a sling.

When the inner extremity of the clavicle is luxated, a plan similar to that above described may be pursued, a pad being placed over this end of the bone (should the case require it), instead of the outer. Here, also, it is extremely difficult to keep the extremity in its proper seat. A false joint will most probably be the result, and fortunately in this instance, as in the preceding, this condition is productive of no serious inconvenience. The next cut (fig. 79) exhibits the most common displacement of the inner end of the clavicle; the end, however, may be more in front of the sternum.

I once saw a case of displacement of the inner extremity of this bone in a newly-born infant, which had happened during birth. The end rested in front of the sternum, and could be pushed into its pro-

Fig. 79.



per place with great ease; but, when left alone, it immediately slipped out again. Nothing was done, a new joint formed, and the child afterwards possessed as much power in the one arm as in the other.

Sir Astley Cooper refers to a case of displacement of this part of the bone backwards, which occurred to Mr. Davie, of Bungay, in Suffolk, wherein that gentleman successfully removed about an inch of its extremity to relieve the patient of dysphagia, occasioned by pressure upon the œsophagus. The displacement had occurred gradually in consequence of great spinal deformity; and Sir Astley states, that he had never seen an instance of the luxation resulting from violence, although he admits its possibility.

Several cases of this dislocation, occasioned by violence, have been observed since Sir Astley Cooper's work was first published; and I may refer the reader to the London and Edinburgh Monthly Journal of Medical Science, for October 1841, for some interesting notices of examples of the kind.

Displacement of the upper margin of the latissimus dorsi muscle, beneath the lower angle of the scapula, has been referred to occasionally. I have not seen an instance of the kind on the living body. It is quite possible, however, judging from appearances on dissection, that such an occurrence may happen; but I should suppose that a slight movement of the arm and scapula would put all right again.

CHAPTER III.

FRACTURES.

FRACTURES of the bones of the hand and fore-arm are of common occurrence. In all instances where amputation is not requisite, there is little trouble in replacing the fragments or in keeping them in proper position.

In fractures of the phalanges it is occasionally difficult to detect the nature of the case. In such examples the fragments are not displaced and there is scarcely any necessity for apparatus, as the pain which the patient suffers, on any considerable motion of the part, will induce him to keep it sufficiently steady. When there is displacement, a slight extension will suffice to put the fragments into apposition; and a little slip of pasteboard in front and behind, kept on by a bandage, or by a few turns with a narrow strip of adhesive plaster, will constitute all the apparatus required. If the phalanx connected with the metacarpal bone happens to be the one under treatment, it will be most satisfactory to prevent all motion of the joint above; and this may be done by carrying the splint along the palm of the hand, and fixing it by a few turns of a roller, broader than that used for the finger.

The metacarpal bones when broken are seldom much displaced, and there can be no difficulty in setting the fragments. There is no need of a splint (except when the destruction of the soft parts has been considerable), as the neighbouring entire bones will answer the same end. However, should one be deemed necessary, a piece of pasteboard, about the breadth of the hand, should be placed on the palm, and fixed there by means of a bandage. The splint should extend a little above the wrist, and as far down on the fingers as to allow them to rest upon it; by such means the most perfect quietude will be insured.

When the bones of the carpus are broken, the injury is generally of such a nature as to endanger the safety of the hand. Should amputation not be deemed necessary, a splint of pasteboard should be applied in front, so as to prevent all movement. As little force as possible should be used in putting or keeping the fragments together, and every effort should be made to moderate the inflammation consequent to the injury.

The bones of the fore-arm are often broken, either singly or conjointly, and the radius is most frequently the seat of injury. This bone generally gives way, in consequence of a fall, when the hand is thrown out to support the body; it may, however, be fractured by a blow, or a weight coming upon it. It is seldom broken in its upper extremity, compared with the frequency of the accident in the middle or lower part, more particularly in the latter; and here, when the injury is occasioned by the weight of the body being transmitted

through the bone, the fracture is often comminuted, the fragments being separated longitudinally as well as transversely. The accompanying figure (80) exhibits a fracture of this bone, in a situation where it is by no means uncommon. The lower fragment is represented as leaning towards the ulna, the pronator quadratus being usually considered the cause of this approximation; but in general all fractures in the fore-arm evince this disposition, the fragments inclining more to the mesial line than towards the surface.

Fig. 80.

In most cases the injury is not difficult to detect, especially when about the situation displayed in the sketch; occasionally, however, in the lower part, when the fracture is about an inch, or a little more, above the carpus, the difficulty is extreme, in consequence of the swelling which follows the injury, and the pain attending the examination. In a suspicious case, (that is, when from the pain, particularly during attempts at pronation or supination, and swelling, combined with the nature of the violence, there is every probability that the case is actually one of fracture,) as the severity of the injury will render the part useless to the patient for weeks to come, the best practice will be to treat it as one of fracture, although it will be advisable to explain matters to the patient, lest some other practitioner, by using more violence, or perhaps having a more favourable opportunity for examination, detects a fracture, and so lays the first party open to the suspicion of carelessness or incompetency. In such an instance, then, and of course where the fracture is distinct, the hand must be kept on a line with the long axis of the fore-arm, and a splint of pasteboard, about ten inches in length and two in breadth, or of length and breadth proportioned to the size of the part, should be applied on the anterior surface of the fore-arm and hand; another should be placed behind, and both retained by a common roller.

In applying these splints, it is customary to put a piece of lint between them and the skin, to prevent injury from the contact of the hard substance. The pasteboard (which I in general prefer to wood for splints in the upper extremity) may either be wetted in tepid

water, or not, previous to application; I think this of little consequence: but, whenever it is done, care should be taken that the substance is not too much softened, lest, under the supposed security of the splint, displacement occur again ere the latter hardens and assumes a permanent form.

The ulna may be broken at any part of its course. Figure 81 exhibits the fissure in a part of the bone which is often the seat of fracture. It may be lower, however; but the additional strength higher up gives considerable security to this extremity of the shaft. Here, also, as with the radius, the fragments may lean to the opposite bone; and I must, therefore, beg attention to my remarks in reference to the treatment of fracture in both bones. A fall or blow will probably be the cause of such a fracture. I once treated an instance of the latter kind, about three inches above the carpus, which was occasioned by the patient, in striking downwards, hitting the back of a chair, not being aware of its presence.

The treatment differs in no respect from that of similar accidents in the radius. When the olecranon process, however, is broken, the case is more serious; for, in addition to the fracture, there is an injury of the joint. In an instance of this kind I once found it necessary to per-

Fig. 81.

Fig. 82.

form excision of the ends of the bones of this articulation, in consequence of inflammation and caries resulting from the primary injury. Such events are, fortunately, by no means of general occurrence; but non-union of the fragments may be the result, and a partial loss of power with the triceps extensor, as may be imagined from an examination of a specimen of this kind in my possession (fig. 82). This preparation shows the distance to which the process may be separated by the action of the triceps; and in order to prevent such a result, the arm must be kept extended so as to keep the fragments as nearly in contact as circumstances will permit. A splint eight or ten inches in length, kept in front of the joint with a bandage, will answer this purpose.

Here it will be proper to keep a watch on the condition of the articulation,—at first, lest high inflammation should ensue, and latterly to prevent a stiff joint, which last may happen if the former has been considerable; for if there be a likelihood of this result, it may be well to put the elbow in a bent position, as the patient will probably have more use of the arm in this attitude, even though bony union does not occur, than with the part in a state of extension and anchylosed (in a manner) at the same time.

Both bones of the fore-arm may be fractured at the same time, and the fissures may be almost opposite to each other, as represented in

Fig. 83.

either of the sketches (figs. 83 and 84), or one bone may be broken in its upper third, another in its lower. When the injuries are towards the middle of the fore-arm, as exhibited in the first of these cuts, and possibly, too, when higher up, there may be some difficulty in making sure that both are broken; but if a little above the wrist, as in figure 84, the mobility, as well as other circumstances, will leave no doubt about the nature of the accident.

The treatment of these injuries will not, in general, differ from that in fracture of a single bone. In the latter case, when there is no great tendency to displacement, a single splint may, probably, be found sufficient; here, however, two should always be used, and, in adjusting them, one in front the other behind, it must be remembered that the fragments, if allowed to be too close to each other, may coalesce, and thus, as they may actually become united by callus, the movements of supination and pronation will be lost. If proper care is bestowed in adjusting the splints and bandages, the muscular cushion on each surface of the interosseal membrane may be so kept between

the bones, that such a misfortune can scarcely happen. This caution should not be overlooked even, as already stated in a preceding page, in the case of fracture of one bone only; and in most instances, particularly when the fore-arm is thin and flat, it will be a wise precaution to lay a pad along each surface before the splints are applied. If the fractures are near to the elbow, they may be treated much in the manner recommended for those in the lower end of the humerus.

Compound fractures are by no means unusual in the fore-arm, but unless the injury be otherwise severe, such cases generally do well. Sometimes everything will go on as in simple fractures, at other times there may be diffuse inflammation, suppuration, exfoliation, and the usual train of misfortunes resulting from compound fractures elsewhere; but even in most unfavourable looking cases the surgeon should never resort to amputation while there is the slightest hope of saving the hand; for however unwieldy the part, it will assuredly be better than any substitute which can be afterwards made use of. In such cases the pads, splints, and bandages will not require to be materially different from those which are used in other instances, although it may be requisite to adjust them in such a way that proper care can be taken of the external wound.

The formation of a false joint may follow such injuries (simple or

Fig. 84.

Fig. 85.

compound) as those under consideration, and the sketch (fig. 85), taken from a preparation in King's College, gives a good example of the kind after a double fracture, in which the fragments of the radius are united, and those of the ulna, opposed to each other by smooth, callous looking surfaces, surrounded by slight exudation of new bone. Such a condition may or may not be accompanied by great inconvenience; and if it is thought proper to interfere, the seton, as recommended in the chapter on false joints, will probably afford the best chance of success; but more will be found on this subject in the chapter on Incisions in the upper extremity.

Occasionally in young subjects (before puberty) one or both of these bones will bend before breaking. Perhaps all bones do so, more or less, before fissure occurs; but that to which I allude is sometimes remarkably conspicuous. This sketch (fig. 86) of a young radius (as may be seen by the epiphysis having separated) gives a good illustration of the probable condition of the bone in such cases: at first there may only be a bend; but as the force is continued, the convex part gives way, and at last, according to the friability, the whole thickness will suffer. The figure represents, at one part, bending and fracture combined, and towards the lower extremity a slight indentation and curve may be observed. It may not be deemed a scientific analogy to compare this radius with a walking-stick in a similar condition, yet there is, in many respects, great resemblance; and any one who has examined such accidents on the living body will agree with me in thinking so. In several instances which I have met with in practice, the distortion has been well marked, but crepitus has not been by any means distinct; considerable force has been required to straighten the fore-arm, and then a splint has appeared less necessary than in ordinary fracture, although I have always thought it best to apply one. The setting of the fragments has forcibly reminded me of earlier days, when, by an unlucky "cast," my fishing-rod had suffered in a somewhat similar manner.

Fig. 86.

In all severe fractures of the hand and fore-arm it will be best, if not absolutely necessary, to confine the patient to bed at first, where the part can be conveniently placed on a pillow, with the hand on a level with the elbow, or even a little higher; and when he sits up or moves about, the extremity should be bent at the elbow and kept in a sling, until the patient feels that he can dispense with such an

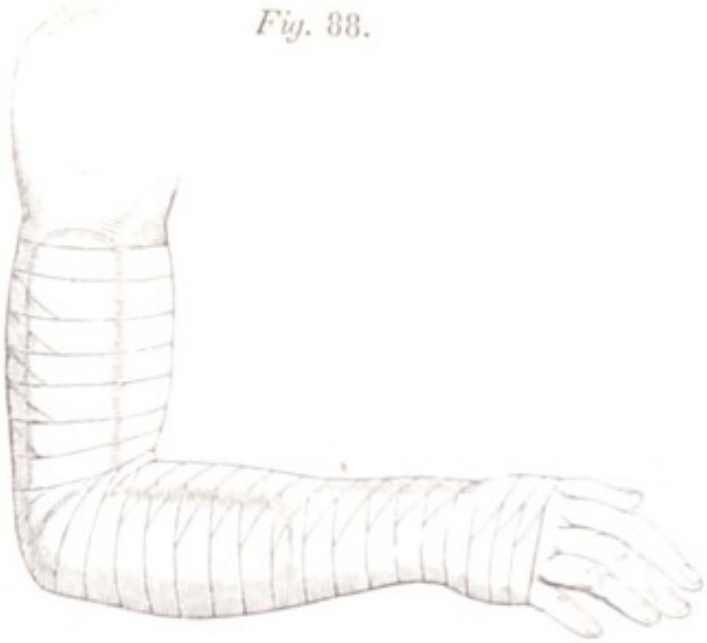
apparatus. A bandage passed round the wrist and neck, as exhibited in figure 90, may be used on such occasions, or a leather case, with suitable straps (as may be had in the shops) may be preferred; but in general a handkerchief-sling answers admirably; and as such an apparatus is familiar to all, I need say no more about it.

Fig. 87.

Fracture of the lower part of the humerus is of more frequent occurrence than that of the upper portion of the fore-arm. The bone may be broken in its shaft, as exhibited in this cut (fig. 87), the articular surfaces may be separated, or a condyle may be broken off. One of these injuries may happen by itself, or all may be combined, as was the case in the example from which this sketch was taken. In the shaft there will be no difficulty in detecting the nature of the injury, and very little extending force will be sufficient to replace the fragments; in the condyles the swelling will often cause difficulty in the diagnosis, but a slight pressure with a bandage serves to keep the fragments in apposition; and in both instances an apparatus, similar to that represented in figure 88, will be requisite. A piece of pasteboard, of the shape similar to that here shadowed out, should be applied on one surface of the elbow, and another of a like kind on the opposite, and both should be retained with a bandage, which should extend, as here exhibited, from the hand to the middle of the arm. Sometimes it will be found that the fingers become œdematous, when they also must be enveloped in narrow rollers. In many instances the swelling around the elbow will be so great, that it will be impossible at first to draw the bandage as tight as it is represented in the sketch; indeed, in many of these cases a good deal must be left to the discretion of the practitioner:—often it will be necessary to temporize until inflammation has subsided; and although I have mentioned pasteboard splints, these will sometimes be found not sufficiently strong, and wooden ones, or those of iron, tinned or japanned, will sometimes be preferable. Occasionally, when the condyles only are implicated, a bandage alone will keep the fragments in apposition.

In a case which I saw lately, where I supposed there was fracture of the external condyle, and where, although the part was quite movable, no apparatus was applied, from the supposition that the patient could not survive the other injuries he had sustained (which he,

Fig. 88.



nevertheless, did for a month), I found the bone had been fractured immediately above the condyles, and that a fissure extended through the articular surface into the joint; yet the fragments had united as favourably as if every possible care had been taken of them by means of apparatus.

Not long ago I had a case in King's College Hospital of compound fracture immediately above the condyles. A small wound on the skin seemed to communicate with the joint, and severe inflammation ensued. The case, nevertheless, did well, though I found it requisite, about a month after the receipt of the injury, to remove by incision a portion of the external condyle which had become necrosed. In all fractures in this situation, or in the upper part of the fore-arm, I should strongly recommend the bent position at first, and that after the lapse of three weeks or a month gentle movements should be commenced, to obviate stiffness, which is very apt to follow such injuries.

Fracture may occur in any part of the humerus above the line exhibited in figure 87; indeed this bone suffers more frequently about its middle than elsewhere, and the nature of the injury may in general be most readily detected; the swelling and distortion of the arm, its diminished length, should the fragments ride over each other, and the crepitus, will all be distinct. The dark line in the drawing (fig. 89) exhibits a common seat of fracture in the upper end of this bone, where, I believe, it is most frequently seen in persons advanced in years. Whether the fracture be lower down than the insertions of the muscles which form the anterior and posterior boundaries of the axilla,—a little higher between these muscles and the tuberosities in the surgical neck, or between these prominences and the head,—in

Fig. 89.

the anatomical neck, as it is called,—the treatment should be the same. The lower fragment should be sufficiently drawn down, the upper kept in its natural place by a small pad in the axilla, a pasteboard splint, about two and a half inches broad, and long enough to reach from the elbow to the acromion, should be laid on the outside of the arm, and both should be retained by means of a roller, which should be first carried round the limb and then round the chest, as represented below, in figure 90. The bandage round the chest keeps the parts steady by fixing the shoulder, and the pad in the axilla answers the double purpose of preventing displacement of either fragment inwards; for if the fissure is above the insertions of the latissimus dorsi and pectoralis muscle the lower fragment may be drawn towards the side by their action, and if below their insertion, the upper fragment may be drawn in a similar manner by the same influence. There is great trouble in retaining a bandage round the chest in a proper position for any considerable length of time, such as may be required in the instance of fracture at present under con-

Fig. 90.

sideration; it must, therefore, be put right from time to time. I avoid a deal of trouble in these fractures, and in many others, on which I wish to retain a bandage for a long period, by moistening the calico with a thick solution of starch, or dextrine, at the time it is put on, which, when dry, causes the turns of the roller to adhere firmly to each other, and prevents their being displaced either by the movements of the patient or the contact of the usual coverings in the way of dress. To prevent œdema I generally envelope the hand and forearm in a bandage. The limb, as in all other serious injuries of the superior extremity, must be worn in any convenient sling, such as that exhibited in the figure.

A complicated kind of injury sometimes happens at the shoulder, viz., dislocation of the head of the humerus into the axilla, and fracture in its neck, of which I have seen two well-marked instances, admitting no possible doubt regarding their nature. In such cases an attempt should be made to thrust the head of the bone into its proper place:—the thumb or fingers may be used for this purpose; or, as was proposed by Delpech, a tourniquet may be applied, the acromion being the fixed point. If this cannot be done (and even if it can), the arm must be put up as if for a simple fracture in the neck of the humerus, and whatever be the result, no attempt need be made in future to reduce the luxation, as it will not succeed, and may do much harm. In both these examples a false joint formed between the shaft of the humerus and the glenoid cavity, and the head of the bone could be distinctly felt fixed on the lower margin of the scapula during the ordinary and, of course, somewhat limited movements of the arm. This injury has often induced me to ask the question, how the head of the bone, being fairly separated from the shaft above the tuberosities, and therefore in all likelihood within the capsular ligament, had continued to survive. Doubtless, some portions of capsule or periosteum had still kept up a vascular connexion, but the separation between the head of the bone and the shaft was so great in the instances to which I allude, that it was difficult to imagine that any bond of union had been left when the injury happened, and possibly the part may have been merely enveloped in a newly-formed cellular capsule.

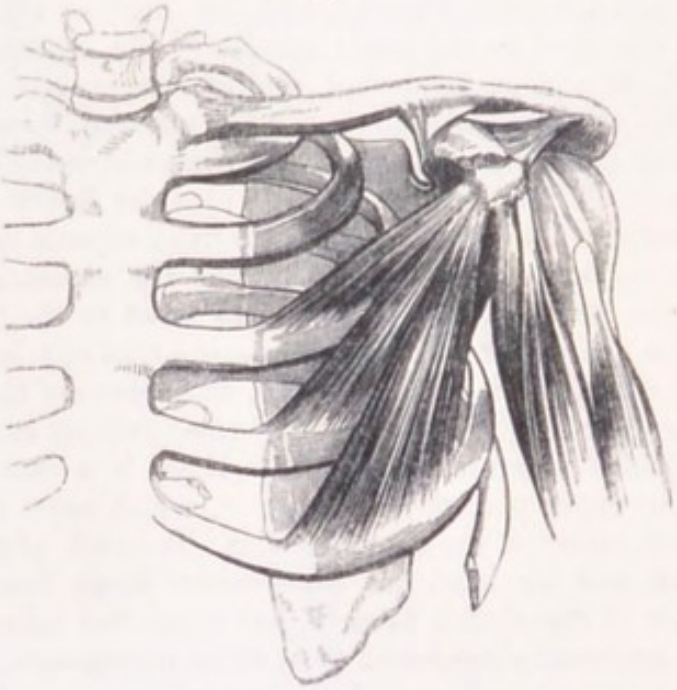
In the valuable museum at Fort Pitt there is a rare example of fracture in the upper part of the humerus, which must have accompanied a severe injury of the shoulder-joint: the neck of the bone has been shattered, and the head has been driven down into the cancellated structure of the shaft: nevertheless union has taken place, and the joint has apparently recovered most of its movements.

Although I have recommended the use of pads and bandages in these cases of fracture in the neck of the humerus, I am of opinion that in some instances the surgeon may dispense with them. Persons advanced in life seem most liable to such fractures, and most of the examples which have come under my notice have been in females, on whom there is difficulty in adjusting any apparatus. I am doubtful, if in aged persons, who may probably not require

much active or vigorous use of the arm, whether as much advantage will result as will compensate for the necessary annoyance and restraint of such treatment. I lately saw a case of fracture in the surgical neck of the humerus in an old woman, a patient in King's College Hospital, in whom the pad in the axilla and bandage occasioned alarming œdema in the hand and fore-arm, and otherwise caused both patient and all of us much trouble. Finding that there was no disposition to much displacement, I removed all the trappings, and let her keep the extremity in that position she found most agreeable. This proceeding added greatly to her comfort, for she was bedridden with a fracture in the upper part of the thigh, which befel her at the same time. In three weeks union seemed to have taken place, and she made some use of the arm. Some weeks afterwards this patient died, and on dissecting the shoulder, I found the fragments firmly united, and in most excellent apposition.

The scapula is occasionally the seat of fracture. The glenoid cavity may be broken into various fragments,—a rare kind of injury, of which, however, there is an excellent specimen at Fort Pitt, exhibiting several fissures crossing the articular surface: sometimes it is separated from the body of the bone at the neck, and in either instance, it may be difficult to detect the nature of the case. In the

Fig. 91.



first, I should doubt if it would be possible to discover the injury: in the latter, the patient will have fallen, or have received a severe blow on the shoulder. The absence of all characteristic marks of dislocation, the humerus being distinctly felt through its whole course, and, when rotated, ascertained to be sound, the slight fall-

ing down of the head of this bone, the inability to move the arm without great pain, more particularly when it is twisted backwards, and the presence of crepitus, all conduce to the suspicion of the nature of the case. I have known an instance where the coracoid process of this bone was broken, and drawn downwards by the combined action of the pectoralis minor, coraco-brachialis, and biceps muscles: nothing could be done to keep the process in its natural position. Fig. 91 gives an example of this kind. The acromion process may be broken, but the accident is of rare occurrence. I have dissected a number of examples of apparent fracture of the end of this process; but in such instances it is doubtful if the movable portion had ever been fixed to the rest of the bone. Whilst the acromion may be said to prevent extensive dislocation of the head of the humerus upwards, the round head of this bone may, in like manner, be deemed a preventive to any part of the process being driven downwards. This may probably be the reason why the acromion is so seldom broken. The body of the scapula may be split in any direction; the fissure is usually transverse, and below the spine: the fracture is somewhat rare, but there is nothing in its nature or treatment calling for particular comment here. The various lines in the drawing (fig. 92) will point out the ordinary position of some of the fis-

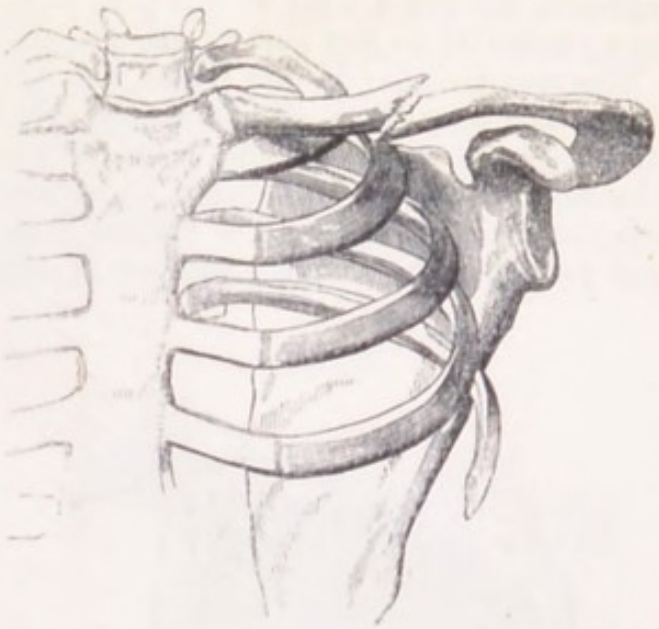
Fig. 92.

sures here referred to. A flannel roller round the chest usually constitutes the mechanical appliance, and when the neck of the bone is supposed to be the seat of injury, the treatment may be similar to

that for fracture of the upper end of the humerus, great care being taken to keep the arm well up in a sling.

The clavicle is often the seat of fracture, being generally broken about its middle, though either extremity may suffer; a fall, or weight coming on the shoulder, being the most common cause of the injury. The nature of the case can be made out by the sight alone in many instances, but the application of the fingers will put the matter beyond doubt. When there is much displacement, the outer extremity of the inner fragment will invariably be felt over the other portion of the bone, immediately under the skin, as may be imagined from the accompanying design (fig. 93).

Fig. 93.

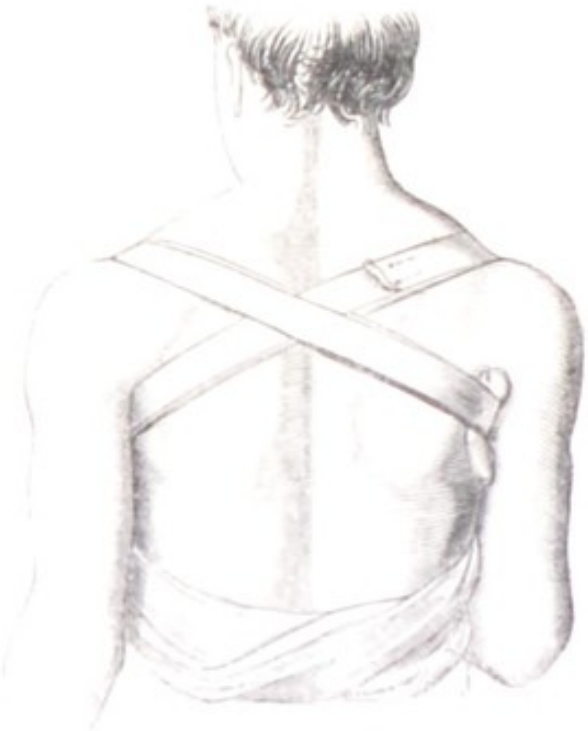


The arm should be put up in this way:—a large pad, composed of tow or hair, or a soft towel folded, should be placed in the axilla, whilst the shoulder is drawn upwards and backwards: a few turns of the roller should then be passed over the shoulder and under the pad, so as to retain the latter in its position; the arm should then be applied close to the side, and fixed with numerous turns of the roller round the chest, as exemplified in figure 90. The starch, as already recommended, will be of great service if used in this case. The figure referred to (although intended to illustrate the mode of treating fractures in the upper end of the humerus) shows the appearance of the parts when thus secured, and the portions of the roller over the shoulders, as there represented, will be of great service in keeping the bandage from slipping down, in all instances when the chest is thus enveloped: these, particularly that on the left shoulder, may be either outside or inside of those round the chest. Generally it will be found best to apply them outside, and they can be fastened to the others by means of pins, a needle and thread, or with the starch. Occasionally, a pad

is placed over the inner fragment when it shows any disposition to rise, and then some additional turns over the shoulders are required.

Two belts, one passing round each shoulder, and drawn towards each other behind, between the scapulæ, so as to keep the shoulders well back, or a figure of 8 as shown in cut 94, made behind from shoulder to shoulder, will serve the same purpose as the above plan; indeed, in most instances, one or other of these two methods may be preferred, and whichever is adopted, the fore-arm must be carried in a sling until the fragments have united.

Fig. 94.



I once had occasion to remove various fragments of this bone, which had become necrosed in consequence of neglected treatment. The patient, a fine young man about twenty years of age, had the right collar bone broken by the falling of a tree; not being aware of the nature of the injury, he worked as a reaper for several hours after, until obliged to desist from excessive pain: violent inflammation, suppuration, and necrosis followed; but after the dead portions were removed, he made a rapid and excellent recovery.

Fractures of the clavicle will often cause greater trouble than those which are considered of a more serious character, and the utmost pains will not on all occasions suffice to prevent a slight prominence of the inner fragment. Fortunately, however, this condition is productive of no future inconvenience.

CHAPTER IV.

LIGATURE OF ARTERIES.

THE arteries of the hand, already examined, are liable to injury, and the aid of the surgeon is generally necessary to suppress the hemorrhage. If the ends of the divided vessels can be laid hold of, no doubt the best practice will be to apply ligatures around them. The surgeon, however, has not always this in his power, and he must, therefore, suit his measures to the circumstances of the case. Thus in a wound of the palm of the hand, where it may not be practicable, with propriety, to search for the bleeding vessel, the chief artery leading to the seat of injury should be secured. In an instance of wound between the forefinger and thumb, the radial artery must first be tied, and this operation may be done in any part of the course of the vessel. Though it may be readily got between the first and second extensor of the thumb in the dead subject, by making an incision between them about an inch in length, over the trapezium, and nearly parallel with the long axis of the radius, the swelling of the parts may be so great as to preclude such an operation, or, at all events, to render it more painful and tedious than the occasion demands. The radial must then be sought for a little higher up: indeed, under most circumstances, I would recommend that the vessel should be at once exposed in the front of the fore-arm. The most eligible part for securing it in this situation will be about three inches above the wrist, where the pulsations of the vessel can be readily felt through the skin. The fore-arm being placed in a supine position, on a firm table, an incision should be made through the skin, two inches in length, about half an inch on the radial margin of the tendon of the flexor carpi radialis, and the vessel will be speedily exposed, after the division of the aponeurosis and the separation of a little cellular texture in close contact. Should it not be convenient to operate so low down, the vessel may be secured in the space between the supinator longus and the pronator teres: an incision of the length above recommended, or perhaps a little longer, should be made, and in both instances two small veins will be found in contact with the artery.

The ulnar artery, should the wound be on the ulnar side of the hand, should first be tied, or it may be necessary to secure it after ligature of the radial. The situation of the wound, as well as a little pressure on the main artery leading towards it may give an idea which vessel it will be best to secure. If the ulnar is to be operated on, the best part for securing it is about two inches above

the wrist, where it will be found accompanied by two veins between the flexor carpi ulnaris and the flexor sublimis: the nerve will be on its ulnar side. The vessel is more deeply seated than the radial; yet, if the parts be in a healthy condition, the operation should be easily accomplished. I have known a surgeon make a transverse incision, so as to cut the vessel across by way of discovering it; but this practice is not to be recommended. If this vessel cannot be secured at some point below the junction of the flexor carpi ulnaris and the flexor sublimis, it will be better at once to secure the humeral, than to cut into the fleshy mass at the upper part of the fore-arm; for, although the ulnar artery can be readily exposed by a good anatomist in this situation on the dead body, the wound would be so deep, the division of muscles so extensive, and the probability of great trouble being experienced during the process so likely, that I cannot recommend such an operation on the living.

It may happen that, for wounds such as those above referred to, as well as for other circumstances, the surgeon may deem it at once requisite to put a ligature round the humeral artery, or, (as has happened in consequence of the anastomoses between the interosseal arteries and those of the lower part of the fore-arm, or in the hand, still keeping up the hemorrhage,) he may find such a proceeding necessary, after having secured both the radial and ulnar. The operation will be best accomplished in the lower-third of the arm, where an incision about three inches long should be made through the skin and intervening textures, along the inner margin of the biceps. The vessel, as has already been shown in the dissection, is accompanied by two veins in this situation, and it may happen to have the basilic in front, either above or below the fascia. This vessel, if it be at all in the way, should be held aside with a blunt hook, and the same should be done with the internal cutaneous nerve, or any of the smaller twigs that may be met with, and seem in danger of being divided, though, in my opinion, little trouble need be taken about the latter. The median nerve will lie on the inner or ulnar margin of the vessel; it may, however, be fairly over, or, as sometimes happens, behind the artery, of which irregularity I have met with various examples. I have known this nerve tied instead of the artery; but the surgeon speedily discovered the mistake, removed the ligature, and placed it on the vessel.

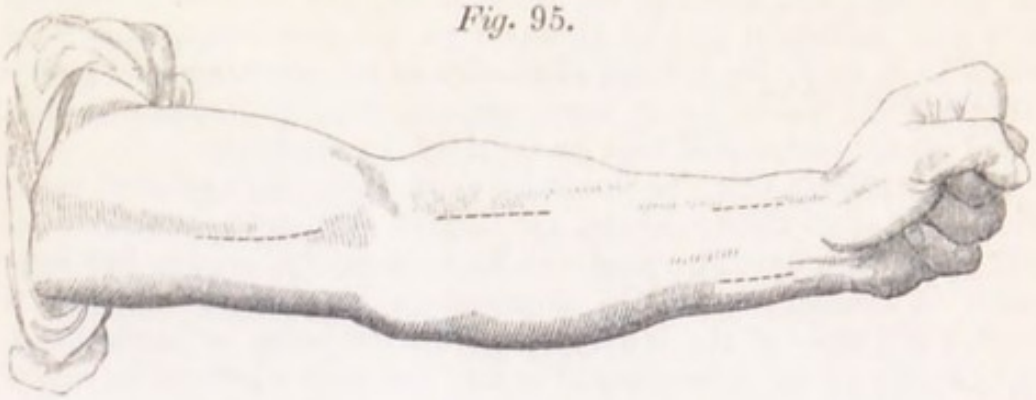
The anatomist will here remember also that there may be a high division of the humeral artery, and that it may be necessary to search for the vessel continuous with that which has been wounded, should he, in the capacity of a surgeon, find that the application of a ligature to one vessel has not been attended with the desired effect.

If the surgeon has it in his option to select a portion of the artery for the seat of deligation, there can be little doubt that the lower-third of the arm should be preferred; but he may be obliged to search for the vessel higher up: in which event the same instructions will serve, even as far as the axilla, where, however, it must

be remembered, that the coraco-brachialis muscle intervenes between the short head of the biceps and the vessel. The veins and nerves will occupy nearly the same relative position, only the latter will be closer to each other, and the former somewhat larger in calibre.

The drawing of the arm (fig. 95) with the dotted lines will give an idea of the position of the incisions above recommended; but it may be well to remember that much longer lines than these proportions indicate may occasionally be of advantage.

Fig. 95.



When the humeral artery has been punctured in venesection, the surgeon may wish to try the effect of pressure, before he thinks of securing the vessel with a ligature, and for this purpose each finger, and the thumb also, should be surrounded with a narrow bandage; long narrow folds of lint should be placed over the radial and ulnar arteries, and along the humeral for two or three inches above the wound, and these should be firmly retained with a common-sized roller, care being taken that the pressure is not so great as to obstruct the circulation completely. Mr. Tyrrell has related five examples of successful practice by pressure.

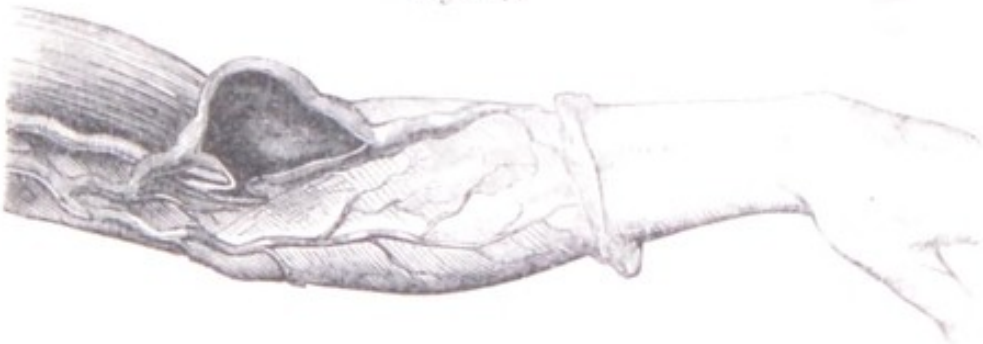
Though it is quite possible that this plan will succeed in obviating the bad effects of such an injury, the probability is, that it will not, and a species of aneurism will be the result. The wound in the skin seems to close as readily in these cases as if no such accident had occurred. The internal state of matters varies, however:—thus, the blood may pass directly from the artery into the vein, the two vessels being in close contact, when the latter will become much enlarged in size in the vicinity of the communication, and the branches of the former (radial and ulnar) diminished, in consequence of the usual quantity of blood not passing through them.

The drawing (fig. 96) admirably illustrates the external aspect of this form of disease, to which the name of aneurismal varix is usually given, and the figure (97) immediately below, shews the communication between the artery and vein. In another instance a communication may exist between the two vessels by means of a little aneurismal sac,

Fig. 96.

constituting the condition termed varicose aneurism. Again, a large collection of blood may form in front of the elbow which may be either circumscribed by a distinct sac, or diffused extensively upwards and downwards in the course of the vessel,—or, as happens more rarely I believe, a small circumscribed false aneurism may be the result, the punctured vein either closing in the usual manner, or becoming obliterated by pressure and inflammation. In such an example I

Fig. 97.



once assisted Mr. Lizars to place ligatures on the humeral directly above and below the opening into the sac.

There is little difficulty in detecting the nature of such cases, both from their histories and condition, as ascertained by the ear and fingers, and the line of practice to be followed is in general equally clear. If there be merely a simple communication between the artery and vein, which produces but slight inconvenience, the surgeon had better not interfere. If, however, such a state of matters should be the cause of much emaciation and loss of power in the limb, as well as of annoyance otherwise, or if an aneurismal tumour should, by increasing, threaten to burst or endanger the limb by mortification, an operation will be required, and this consists in ligature of the wounded artery. Though it is known that such an operation as has been already described, (p. 189,) will answer in some instances, it seems to be allowed by all good authorities, that the best plan is to secure the vessel at the seat of injury, by the application of a ligature above and below the wound. I have known a second interference required, within a few weeks after the humeral had been tied in the lower-third of the arm, in consequence of the continued free communication of blood from below with the opening in the artery. The operation will vary in its nature according to that of the disease. If the vein still carries blood, an incision about three inches in length should be made along its inner margin, and by holding it a little aside the artery may be exposed at the seat of injury, and a ligature put upon it above and below. I once saw the artery tied in this way without meddling with the communication between the two vessels; in repeating it, I recommend the lower ligature to be applied first, as the pulsations will enable the vessel to be easily distinguished, whereas, if the upper one be first secured, this guide will be lost, and as the vessel may have been punctured rather low down, where the operator may have some difficulty in tracing and recognising it, this recommendation ought not to be neglected. In the case referred to, though the vessel was very perceptible before the application of the first ligature, which was put on above, there was some difficulty in distinguishing it after the circulation was checked, chiefly owing to the condensation of the surrounding textures, the result of inflammation following the original injury.

Though in an instance where the aneurismal tumour is small the vessel may be tied as thus directed, it may be as well, however, to cut into the tumour, and evacuate the contents,—a proceeding which is absolutely requisite when the swelling is extensive. In such examples, the circulation through the artery must be checked by pressure higher up, either with the tourniquet or the fingers. If the collection of blood be great (perhaps from six to twelve ounces), the vein will in all likelihood be obliterated, or it may be impossible to distinguish it on the surface; a free incision, three or four inches in length, may therefore at once be made into the tumour, parallel with the artery, and when the clots are removed,

the orifice in the vessel will not be difficult to detect, more particularly if the pressure on the arm above be taken off for an instant: the artery should next be carefully insulated a little above and below the wound, and the ligatures applied as directed. A probe may be passed with advantage into the orifice, to serve as a kind of guide whilst dissecting the vessel from its connexions.

Wounds in the axilla occasionally open the main artery or one of the principal branches, and the surgeon may perhaps have an opportunity of securing the vessel immediately above and below the orifice, either through the wound in the skin already made, as was done by Hall, by extending it as I have known done on one occasion, or by making a free division of the integuments and pectoral muscle as was practised by Desault, in an example of extravasation following a sword-wound in the armpit.

The axillary artery is sometimes the seat of aneurism also, in which case it may be requisite that a ligature should be applied nearer the heart. If the tumour is low down, there may be sufficient room to operate below the clavicle; if it be high up, or of considerable magnitude, as is not unfrequently the case, the subclavian artery should be secured at the root of the neck, as afterwards described in the section on that part of the body; indeed, in all instances of axillary aneurism I should prefer the latter operation, as, in addition to its efficacy being equal to that of the other, I consider it less troublesome and dangerous in its performance. Some surgeons have preferred that below the clavicle, however, and it may be done in the following way:—The patient being laid on his back on a convenient table, with the shoulders and head slightly raised, and the elbow separated a little from the side, instead of cutting the skin, so as to get between the two portions of the pectoral muscle, or between it and the deltoid, I recommend that a lunated incision, (such as may be seen marked (A) in a drawing in the after-part of the volume exhibiting the incisions for operations on the large arteries of the neck,) should be made from within an inch of the sternal extremity of the clavicle to the point of the acromion process, and that the clavicular portion of the pectoral muscle should be cut across in the same direction. On the dead body it is not difficult to expose the artery in either of the spaces aboved named, particularly between the pectoral and deltoid muscles. On the living, however, I should deem it much more troublesome. The circumstance of saving a small portion of the pectoral muscle I consider of very trifling importance compared with the advantages to be obtained by dividing it, and therefore I should not hesitate about selecting the operation now described. The space between the two portions of the pectoral is so small, that it is far from desirable to attempt the operation there, and the risk of wounding the cephalic vein and branches of the thoracica-acromialis artery is considerable, if the space between the pectoral and deltoid is selected. These vessels are in danger at the outer extremity of the incisions I have recommended; the vein, however, may be held aside, should it be found troublesome, and from the size of the

wound, the arterial branches, if any are divided, may be readily compressed or tied. When the muscular fibres are divided,—a step of the operation which should be done cautiously on the point of the forefinger or a director,—the loose cellular membrane and fat, between the pectoralis minor and subclavius, should be carefully raised and turned aside; the vein will then be brought into view, when, by having it held a little downwards with a blunt hook or spatula, the artery will be discovered and may be laid bare, but to such an extent only as to allow the needle to be passed around it, which should be done from below upwards, taking care, by keeping the point of the instrument in contact with the vessel, to exclude any branch of the axillary plexus of nerves, all of which lie on its upper and posterior side. If the patient is unsteady, or the surgeon is unwilling to use the blade of a common scalpel in the deep parts of the wound, he may advantageously separate the cellular membrane near the vessels with the handle of the instrument, or tear it with a blunt steel or silver spatula, which cannot endanger the division of any more important texture.

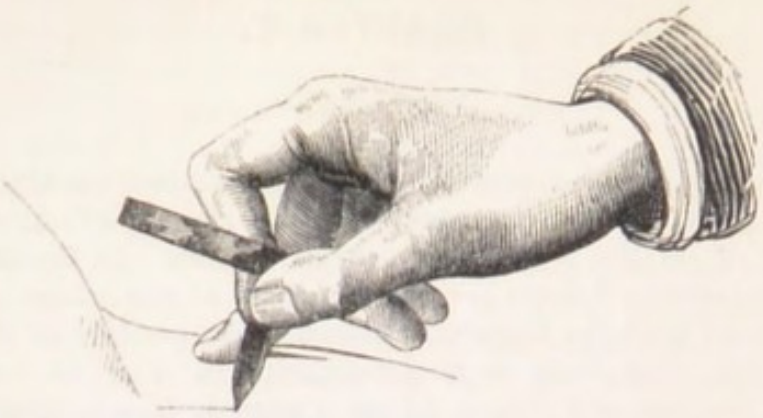
Notwithstanding the success of this operation in the hands of Keate and Chamberlayne, and that it has occasionally been practised and recommended by most competent authorities, it appears evident, either that the cases admitting or requiring the operation are few in number, or that a very general preference has been given to that of Mr. Ramsden above the clavicle, which in the present day seems the only method pursued in axillary aneurism, unless it be to trace the subclavian still nearer the heart. In examples of wounds of the axillary artery, it must, indeed, be rare to meet with such an instance as that which occurred to Mr. Hall (Bell on Wounds, p. 60, 3rd edit.), which, however, was only in the upper part of the humeral. It will more usually be observed that the injury to the vein, nerves, and other textures, leaves so small a chance of the arm surviving, that the surgeon may reasonably take into consideration the propriety of amputating at the shoulder-joint. A most interesting case of diffused aneurism in the axilla, the result of an injury (dislocation, I believe, of the shoulder), occurred some years ago in the practice of Dr. Nichol of Inverness: Mr. Syme, of Edinburgh, placed a ligature on the subclavian above the clavicle, but the hemorrhage still seeming to go on, amputation at the shoulder-joint was performed (Syme's Principles of Surgery, p. 115, 3rd edit.), and the result was successful. No time elapsed in this instance, after ligature of the artery, to permit the occurrence of gangrene, as happened in the case related by Mr. White, and also in that which occurred to Desault, in both of which, had amputation been performed, instead of deligation of the main artery, the patients would in all probability have been saved.

CHAPTER V.

VENESECTION.

THE operation of venesection may be practised on the dead body by the beginner, and the sooner he avails himself of an opportunity of doing it on the living so much the better. In the latter case it should be done as follows:—The fore part of the elbow should first be examined with the fingers, to ascertain the position of the humeral artery, and that there is no irregularity in it or its branches: a common bandage or a riband, about a yard in length, should then be carried round the arm three inches above the elbow, and drawn sufficiently tight to prevent the circulation in the veins; that in the artery being allowed to go on with full vigour, as may be ascertained by feeling the pulse at the wrist. In order to throw the most of the venous blood into the superficial vessels, the patient should be desired to put the muscles of the fore-arm into action, which can be best done by grasping some object with the hand. One of the veins at the bend of the elbow must next be selected for the operation: either the median basilic or the median cephalic. If the latter be chosen, there is no danger of doing any harm with the lancet, unless a branch of the musculo-cutaneous nerve be injured, which some suppose may cause trouble; if the former, then all care must be taken to protect the humeral artery, which will probably lie immediately beneath, only separated from the vein by that part of the aponeurosis of the fore-arm, which is sent off from the inner margin of the tendon of the biceps. In operating on this vein, a branch of the internal cutaneous nerve may be cut, but there is little occasion to dread the supposed effects of such an injury. Notwithstanding the situation of this vessel over the artery, it is commonly selected, being in general the larger of the two, and therefore the most likely to yield with ease the desired quantity of blood. After the bandage has been applied for a few minutes, the thumb of the left hand should be put upon the vein a little below the part meant to be opened, and the lancet, held as in figure 98, between the thumb and forefinger of the right hand, should be pushed through the skin into the vein, in such a direction as to cut it obliquely; the point of the instrument should then be raised, so as to describe the segment of a circle, and thus the wound in the vessel will be nearly as large as that in the skin. Were the lancet thrust in and drawn out again, in consequence of the shape of this instrument, a sufficient opening could scarcely be made, without transfixing the vein. Instead of holding the lancet almost at a right angle with the vein, as may be supposed from the drawing, it may occasionally be placed in line more parallel with the thumb, and thus it will puncture at a less acute angle than the sketch indicates. Besides keeping the skin and the vein steady, the thumb, placed as above directed, commands the

Fig. 98.



flow of blood, until a dish convenient for its reception is held opposite the wound: the thumb should then be raised, and after the quantity of blood required has been allowed to escape, the bandage should be loosened, when the stream will immediately cease to flow. A few folds of lint or linen rag, about two inches square, should then be put over the wound, care being taken that its edges are in close contact, and the bandage which has been already in use should be put round the elbow in the form of the figure 8, the arm being kept slightly bent.

This is one of the operations where it will occasionally be more convenient to use the lancet with the left hand than with the right. In opening a vein on the left arm, for example, it will be best to use the left hand, as the surgeon can stand behind the arm, and avoid the first jet of blood. In all instances of this operation, every care should be taken to perform it in as cleanly a manner as the circumstances will permit, so as not to bespatter any of the surrounding objects, more particularly the patient's body or bed-clothes; and the more effectually to guard against this, the precaution of placing a towel to protect the parts beneath should not be omitted.

It is seldom indeed that any evils result from the above operation, but such as they are may be treated according to the observations which may be found in the introductory section of this work, or in those devoted to the injury of the humeral artery occurring during the use of the lancet in this situation.

CHAPTER VI.

EXCISION OF THE MAMMA.

No operation of much surgical importance is ever required on those parts of the back which have already been dissected. On the anterior surface of the chest, the removal of the mamma is an operation which is frequently performed. The course of the external incisions for this will vary in different cases, according to the size and shape of the diseased mass; in some examples I have made vertical incisions thus (fig. 99); but in the generality of cases, they should be made nearly in the course of the fibres of the great pectoral muscle. The operation may be performed in this way:—The patient should be seated on a chair, or, what will be better, laid on a table, and the elbow on the affected side held in such a way as to throw the pectoral muscle on the stretch. A lunated incision should then be made with a scalpel, or, as I prefer, a clasp bistoury, along the upper surface of the tumour, and another on the under; if the disease is large, the skin above and below should next be dissected from it; if it is small, the wounds should be carried nearly as deep as the pectoral muscle; and, in either case, the mass should be dissected out, by cutting in a horizontal direction from above downwards, or from below upwards.

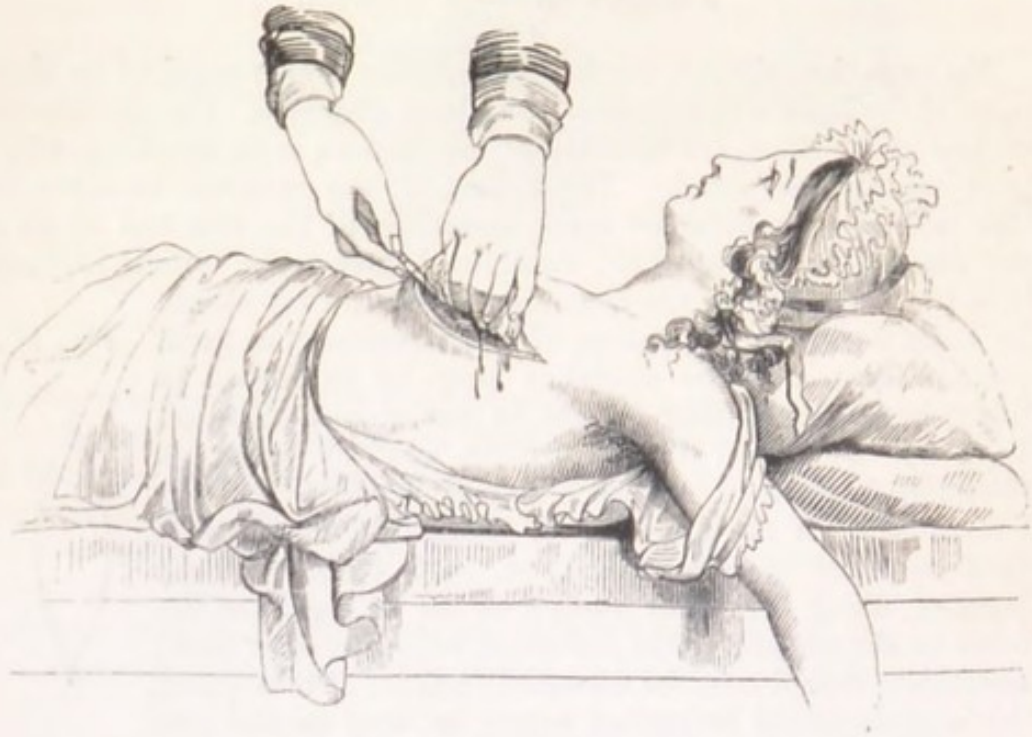
Fig. 99.

In this proceeding, as in others where the disease is supposed to be malignant, the surgeon, as already stated in my remarks on tumours, can scarcely err in taking away too much. Fortunately, the skin is usually so lax in this situation that there need be little fear of not being able to bring the edges of the wound into apposition, and the first incisions should therefore be made at such a distance from each other, as not only to include the affected part, but also a portion of the healthy textures, and the knife must subsequently be carried to such a depth as to secure the complete removal of the disease. The pectoral muscle must be laid bare in many instances, and even portions of its substance removed, should the mass be connected with it. Four or six arteries will bleed actively, if they are not compressed by the assistant's fingers as soon as cut. When the tumour is removed ligatures should be applied, and the wound dressed and treated according to the ordinary principles of surgery. If the edges can be brought accurately into contact, adhesion may be obtained at once; if not, the wound must of course heal in a slower manner by suppuration and granulation.

The following drawing (fig. 100) will serve as an outline of the position of the patient, that of the surgeon, who may be imagined to be on her right side, and the style of making the incisions. The

tumour may here be supposed to be small, but it must sometimes be much more extensive than is represented.

Fig. 100.



It is often requisite in the removal of the mamma to take away at the same time diseased glands in or near the axilla. For this purpose, the extremity of the wound nearest the armpit should be extended by an incision into this space, when, by separating its edges, the glands may be uncovered, and, if they are small and loosely connected, the knife may be carried round them on all sides. This instrument cannot be used too cautiously in this space, however, and it will be safer to use the fingers a good deal, and, in a manner, to tear out the glands, only making small incisions from time to time, when the cellular membrane does not easily give way. When the textures about to be cut cannot be readily seen, and when there is any suspicion of a vessel of magnitude being in danger, the glands should be separated from their surrounding connexions as well as can be accomplished by moderate force with the fingers or handle of the knife, and after a loop of strong thread has been cast around the remaining tissues, the knife may then be applied between it and the part to be removed. In some instances the diseased glands are so near the mamma, and so loosely connected, that they may be dissected out at the same time, and with the same incisions; but it is frequently more convenient to take away the large mass first.

These proceedings in the axilla are almost invariably attended with more trouble than the other steps of the operation: to facilitate them, and in some degree to avert the danger of cutting in this situation, I strongly

recommend that a free opening should be made in the skin, and that even a portion of the lower margin of the large pectoral muscle should be divided, instead of attempting such manœuvres through a small aperture on the surface.

It will be found difficult to hold and elevate the diseased glands, either with the fingers, hooks, blunt or sharp, or with the common dissecting forceps ; and, in preference to the plan of passing a needle and thread through them, using the volsellum or any other method with which I am acquainted, I now make use of the hook-beaked forceps, represented at p. 27, which will be found exceedingly serviceable in removing small tumours in any region of the body.

In giving these directions, and speaking so familiarly, as it were, of removing enlarged glands from the axilla, as part of the operation for excision of the mamma when affected with malignant disease, I beg it to be clearly understood, that I am by no means an advocate for the use of the knife, when, in such cases, the axilla has become the seat of malignant action. There are some occasions, however, when the glands are but slightly enlarged (perhaps merely from irritation) and loosely connected, on which it may reasonably be deemed advisable to operate, and it is in such instances (and where the glands ought not to be left on the mere supposition that irritation is the sole cause of their enlargement), that the above directions are applicable.

CHAPTER VII.

INCISIONS. EXCISIONS.

Besides the incisions already recommended for operations on the arteries, there are many others required in practice, some of which may be performed on the dead subject. Thus, before the limb is mutilated by any amputation, incisions may be made in the course of some of the nerves. A wound, about an inch in length, may be made along one margin of the palmar surface of a finger, so as to lay bare a digital twig. An incision about one inch and a half in length may be made between the flexor carpi radialis and the flexor sublimis, a little above the annular ligament, so as to expose the median nerve in this situation. Such operations are occasionally required in cases of tic douloureux ; and some years ago I assisted my friend, Dr. James Simson of Edinburgh, to perform the one last referred to, in an instance in which the nerve had been cut across by accident, about an inch above the wrist, where it was proposed to restore its continuity, and thus, perhaps, the lost sensibility of the side of the hand supplied by its branches. The ends of the nerve were found in the cicatrix ; but unfortunately, a small tumour, such as is occasionally seen on nerves after amputation, had formed on the extremity

of the upper portion, which required removal, and thus occasioned a loss of about an inch in its length; the two extremities were brought into as close contact as possible,—they could not be brought to meet, but the favourable result which might have been reasonably expected, if there had been no loss of substance, did not take place. I have lately been informed that both the temperature and sensibility of those parts supplied by this nerve have increased.

In an instance of painful ulcer on the arm, a little above the inner condyle, I have seen a portion of the ulnar nerve, supposed to be involved in the sore, removed with excellent effect. The painful open surface which had been present for many months, and resisted all attempts at cure, speedily put on a more healthy aspect, and the operation, although it deprived the little finger and the ulnar side of the ring one of sensibility, was attended with all the benefit that could have been desired.

Incisions are sometimes made in cases of erysipelas, and a knowledge of anatomy will indicate the safest places for applying the knife on such occasions: they are required, too, in cases of whitlow in the fingers, in suppurations, for the removal of tumours, of diseased or dead portions of bones, and occasionally, also, for false joints. In all these operations, the general rule of cutting parallel with important parts, should be carefully kept in view. In certain instances it will be absolutely necessary to sacrifice some tendon, large nerve, or vessel: about the wrist, it may sometimes be deemed advisable to dissect out wens, ganglions, or solid tumours, and it will scarcely be possible to avoid the division of some such textures; yet, by great care, most of the important parts may be avoided even here. I have often succeeded in removing ganglions from the back of the wrist without dividing any tendons, although the tumours lay close upon the carpal bones, and in one instance I removed a large, firm, fatty tumour from the front immediately above the wrist, although it dipped among the tendons, and actually touched the pronator quadratus. I should wish it understood, however, that I do not recommend operations in such cases unless there is some good reason, for at all times there is danger of severe inflammation coming on, which may leave the wrist in a stiffened condition ever after. I should say the same, too, for chronic collections of fluids in the sheaths, either of the extensors or flexors of the fingers,—for although instances are not wanting to show that injurious inflammation does not invariably succeed to operations in this situation, the surgeon will do well to calculate the chances of such an occurrence, and, therefore, whether he does right in submitting his patient to such a probability.

In swellings depending on effusions, I have occasionally, as already stated in my remarks on the treatment of tumours, succeeded in curing these affections without incisions; but such a course will sometimes be necessary. In some instances loose fibro-cartilaginous bodies are observed in these sheaths, which can be got rid of only by recourse to the knife. Some time ago I treated a case of the kind in

the sheath of the flexors of the middle finger: there was a considerable swelling extending the length of the two proximal phalanges, which prevented the patient from closing her hand: an incision about an inch in length permitted the escape of several hundred of these little objects, when, by accurately closing the wound and keeping the finger steady on a straight splint for a few days, the incision closed, and a cure was the result. Here I would not have made the orifice of such length, had I not known that the swelling had been twice punctured before with a lancet, which, however, only allowed the fluid to escape, whilst the bodies, being retained, acted as the cause of future effusions.

Little ganglionic tumours have occasionally been noticed on the knuckles, supposed to be developed in small bursæ, which are said to occupy these situations; but I have not myself met with any cases of the kind. Over the olecranon, however, I have seen well-marked examples. Although it may be doubted whether a bursa occupies this situation in all individuals, it cannot be denied that, in many who are in the habit of leaning much on this part, such a condition obtains, and the swelling is liable to attacks of inflammation, similar in most respects to those which are seen in the bursa over the patella. The condition, from being seen so often in those who work on the side in low-roofed mines, has received the appellation of "Miners' Elbow." The treatment may be conducted according to rules inculcated in other parts of this volume, more especially with regard to the affection familiarly known as "the house-maid's knee," to be afterwards noticed in the section on the inferior extremity.

The bursa under the acromion is rarely the seat of disease, and unless it be to caution the young practitioner against mistaking such a case for disease of the shoulder-joint, I know of no observations peculiarly applicable to such cases, further than those detailed in other pages.

In my remarks on fractures of the upper extremity, I have exhibited a drawing of a false joint in the ulna, succeeding to such an injury. Here it might be thought advisable in the course of treatment to expose the callous surfaces by means of incisions, and then to treat them in the manner recommended in the chapter on false joints. In such an operation, if the radius was entire, it might be difficult to evert the fragments. Any portion of the bone might be easily reached without touching important parts, by dividing the skin along the ulnar side of the limb. The radius, however, could not so easily be exposed; indeed, unless in its lower-third, it could not be got at without dividing muscles, and were the false joint so placed I should in most instances question the propriety of interfering in this way at all, as I cannot imagine that non-union would cause such serious inconvenience as to necessitate such a proceeding. That the surgeon may occasionally interfere, however, in this way must be admitted, for an interesting case of the kind is related in the London and Edinburgh Monthly Journal of Medical Science for October 1841, where resection

was performed on the fragments of the radius, and those of the ulna were treated with the seton,—success following in about twenty months from the receipt of the injury, which was a compound fracture occasioned by the bursting of a gun.

In false joints after fracture of the olecranon (p. 176), I think it would in general be best to let matters alone. I have seen a person make excellent use of the arm in such a case.

In the shaft of the humerus it is evident that, in false joint, the extremity would be of little service, and if milder measures did not answer, I should not hesitate about exposing the ends of the fragments, and such an operation might be readily and safely accomplished on any surface of the limb, excepting that on which the artery is placed. After using the knife, and treating the ends of the bone as might be deemed advisable, the wound should be brought together by stitches and straps, and, the fragments being placed in proper position, the future treatment might be such as would be resorted to in a case of compound fracture.

On the dead subject an incision may be made between the deltoid and pectoralis major muscle, so as to expose the cephalic vein. A wound about an inch in length should be made for the purpose. Lisfranc has recommended such a proceeding in instances where the veins in front of the elbow are so small or so enveloped in fat, that venesection cannot be performed in the ordinary manner. I have never heard of such a proceeding being adopted in this country, and, for my own part, would rather select the external jugular vein, the temporal artery, leeches, or cupping. The vein in the neck might also be obscured by fat; but any of the other measures would, in my opinion, be preferable to making such an incision, which might, after all, only expose a vessel so small that a sufficient quantity of blood could not be obtained from it. I have often, in the dissecting-room, noticed this vein scarcely larger than a crow-quill, and where the superficial veins are not very conspicuous at the elbow, I imagine that this one will be small in proportion.

Such a condition as that represented in the next drawing (fig. 101)

Fig. 101.

has occasionally been the subject of operation. The hand here exhibited shows the little and ring finger in a state of permanent contraction. At first this affection shows itself by slight inability to extend one of the fingers (generally the little one), which is at last, in the progress of years, crooked up into the palm, and by this time the ring finger will also have assumed a nearly similar state, and possibly too the middle finger will be somewhat rigid. At first sight (as is well displayed in the drawing) the flexor tendons seem to be the cause of this distortion; but the dissections of Dr. Goyrand and others have shown, that the cellular tissue between the skin and palmar aponeurosis usually gives rise to it. Dupuytren asserted that the fascia itself was the chief cause. In all instances where the contraction has been extreme, it has appeared to me that skin, cellular tissue, fascia, and even tendons, have been more or less in such a state of permanent rigidity as to prevent the extension of the fingers; indeed, I have observed in the dissecting-room, that in cases of old standing, when all the textures were removed with the exception of the ligaments, the fingers could not even then be stretched out without some force, and that they immediately afterwards resumed their crooked position. In some cases I believe, that one or other of the textures above-named may be more in fault than the rest, and in others the lumbricales and interossei are in part the cause, as I have had reason to suppose from the examination of a finger which I once removed in consequence of this affection.

It has been asserted, that those who are so employed as to cause much pressure on the palm (such as gardeners, carpenters, &c.) are more subject to this condition than others: it may be so, but the figure above exhibited was from an individual who had been less occupied in this way than most people.

I have treated such a case with subcutaneous division of the rigid textures, and it is a method I consider preferable to any other. A narrow knife should be pushed under the skin in front of the contraction, and then carried through the most prominent band, whether this be merely the aponeurosis, condensed cellular tissue, or tendons, and thereafter the fingers should be gradually extended on a splint by means of bandages. The latter apparatus must be constructed by the ingenuity of the surgeon to fit the pecularities of the case, and I believe that a clever adaptation of such means may go far to obviate and even remove various deformities in the hand and fingers resulting from the causes above referred to, as was proved many years ago by M. Dutertre, who, in 1814, published some most interesting cases of successful practice, by means of incisions and apparatus, in removing adhesions, contractions, and distortions, resulting from burns.

The thumb seems occasionally to be affected in such a manner as to prevent a person using a pen, and from having been seen in parties who are chiefly occupied in this manner, the condition has received the elegant and appropriate denomination of "Scriveners' Spasm." Although there is no lack of that profession in Edinburgh, I never

met with a case of the kind; but Stromeyer has succeeded in the cure by dividing the tendon of the long flexor.

In one instance I successfully divided the tendon of the flexor sublimis connected with the ring finger, and also that of the profundus, above the wrist, for permanent contraction of the part, and I have once seen the tendon of the palmaris longus cut across by subcutaneous incision, for a contraction of the wrist.

Incisions may be required in various parts of the extremity for the removal of diseased or dead portions of bone, and, with few exceptions (as the elbow and shoulder-joints), no set rules can be stated for such operations, further than those which must be apparent to any one at all acquainted with such matters. I must refer to my remarks on amputations of the metacarpal bones, as explanatory of my own views on some of these points. A good anatomist and judicious surgeon may do much in some of these cases to obviate the necessity for amputation; but I doubt if there is much utility in practising on the dead body, resection of the lower ends of the bones of the fore-arm, or portions of their shafts. It is customary in what may be termed "dissecting-room surgery" to exhibit such operations; and drawings of healthy bones exposed with appropriate incisions, having also the chain saw passed under them, have been published on the subject; but these can give a very inadequate idea of anything like good surgery, applicable to the living body. The wrist joint has, however, been excised, (at all events, the end of the radius,) and portions of the shafts of one or other of the two bones have been removed with success. I have often myself, with the aid of the cutting forceps (p. 11), and gouge (p. 13), removed portions of the bones of the hand, wrist, and fore-arm, and seen others do the same; but in the latter region I have not seen any instances where resection of the entire thickness of a bone has been required, although in Edinburgh, where excisions may be said to have been much in vogue for many years, there would have been little hesitation in resorting to such a method, had favourable cases presented themselves. However, that such examples may occur has been proved by instances of the kind, which have been published by continental surgeons, and with a knowledge of anatomy and of the principles of surgery, I see nothing to prevent any one resorting to a laudable attempt to save a patient's hand.

The bones composing the elbow-joint are frequently the seat of injury as well as of disease, requiring amputation in the arm. In some instances, however, the surgeon may most judiciously endeavour to save the lower part of the member, by removing the injured or diseased portions of bone only. The operation of excision of the elbow-joint has been much more frequently practised of late years, and apparently with greater success than when it was first recommended towards the end of last century by Park and the Moreaus. At all events, the operation has now been so frequently performed with happy results, as to induce many surgeons of the present day to

give a patient the chance of saving an arm, which, twenty years ago, would in all likelihood have been doomed to amputation.

In the early part of the present century, notwithstanding the excellent treatise on excision of carious joints, published in 1806 by Dr. Jeffray, of Glasgow, such operations seemed to have attracted but little attention from the practical surgeons of the day. To M. Roux and Sir Philip Crampton we may be almost said to be indebted for the revival of excision of the elbow; but to no living practitioner, in so far as I am aware, is there so much merit due on this score as to Mr. Syme, who has I believe, within the last twenty years, had more personal experience in this operation than any other single cotemporary.

The operation is certainly most successful in young patients, but even in the adult there is ample proof that it may be done advantageously; and although bad consequences have followed in some examples, amputation would not, in all probability, have been attended with better results. When a patient dies after amputation of a limb, no properly educated surgeon would ever dream of denouncing this operation, or stating that it should never be done again; and excision of the ends of some of the bones, more particularly of those of the elbow, seems to me of such undoubted utility, that the circumstance of certain examples having terminated unfavourably ought in no degree to be admitted as a just argument against the general performance of such operations. Any surgeon may amputate an arm, but when once done, it can never be replaced; and no artificial apparatus can ever be compared, either in appearance or usefulness, with the parts, whatever may be their condition, after successful excision of the elbow-joint.

The main object in such a proceeding is to remove all the diseased portions of bone, and this ought to be accomplished with as little injury to the surrounding parts as circumstances will permit. By laying open certain sinuses, which may exist in some instances, sufficient room may be obtained, but in general it will be better to make either a crucial incision (fig. 102), or one in the form of figure 103, as shown below.

Fig. 102.

Fig. 103.

The posterior surface of the joint is evidently the most eligible part to make a free opening, the large artery and nerves, with the exception of the ulnar, all lying in front, being separated, too, from the bones by the brachialis anticus muscle. The operation is accordingly always done on the dorsal aspect. The patient may be either laid on

a table, with his face downwards, or be seated on a chair; the former position insures greater steadiness on his part, and I have seen it most frequently preferred, but the latter I have myself selected, as I think the operator can so move the arm as to enable him to inspect the ends of the bones more accurately than whilst the patient is kept on his face. I believe, however, that the position of the patient is of less moment than some seem to imagine. Whichever attitude is fixed upon, the arm and fore-arm should be firmly held by an assistant; then if the extent of the disease is not supposed to be great, a crucial incision should be made directly over the olecranon; but if, on the contrary, a free exposure of the parts be deemed requisite, the other incision (fig. 103), represented on the last page, which is similar in shape to that made by Moreau in his first operation, should be selected. On raising the flaps, which should consist of the entire thickness of the skin, as well as the condensed and infiltrated cellular texture underneath, the olecranon process will be laid bare: in cutting on its inner margin, the ulnar nerve must be carefully preserved from injury, which can be best done by dissecting it out of its position behind the internal condyle at this stage of the operation, and holding it aside with a blunt hook during the future steps; the attachment of the triceps should next be divided, and the cutting forceps used to separate the olecranon from the ulna. The surgeon will now be enabled to appreciate the condition of the articular surfaces more clearly than heretofore, and will be guided in his future steps by the apparent extent of disease. He may now, with the forceps, divide the remaining portion of the upper end of the ulna, the head of the radius, and whatever part of the humerus he may deem necessary. In the adult the saw may be requisite for the latter purpose, but in a young patient there is no difficulty in effecting this object with the instrument recommended, and occasionally the gouge may be of service in scooping away small spots of the carious surface which cannot be reached by either forceps or saw.

Fig. 104.

These portions of bone (fig. 104) have been preserved to show the piecemeal manner in which the operation may be accomplished. One of the fragments is the olecranon, the other a portion of one of the condyles of the humerus, and both are in a state of caries. In the case in which I removed them, various smaller portions were also cut and picked away, and the patient, a boy about fourteen years of age, made an excellent recovery.

In some instances the lateral ligaments must be cut through, to allow

the ends of the bones to be fairly turned out; and in all cases of extensive disease, this had better be done at once; in doing so, however, there is no necessity for exposing such an extent of their shafts as was formerly deemed requisite, as the saw (a common small amputating one, such as is represented at p. 10, is the most efficient) may be used with perfect ease, without the presence of a broad spatula in front of the bone, as is recommended by some even in the present day; indeed, the method of removing the diseased portions of bone here described seems to me to constitute a most important difference from that resorted to by Moreau, who, in separating the "enlarged and rough" end of the humerus, doubtless went far beyond the actual disease, and thus made the wound unnecessarily extensive and severe. The sketches of the parts removed by him, in my opinion, sufficiently indicate this, and I hold it to be of the utmost consequence, in the performance of this operation, to distinguish between caries and that enlarged and hardened condition of the bone in the immediate vicinity of this disease, which, though altered in structure, may be allowed to remain, whilst, to insure success, the former must be taken away. Though in disease of the elbow-joint of old standing, it frequently happens that the swelling of the soft parts is very extensive, it by no means follows that the bones are affected in equal proportion; indeed, it most commonly appears that the caries is limited to the articular surfaces or their immediate vicinity; and though large portions of the shafts of the bones have been occasionally removed with success, when the disease has necessitated such extensive wounds, a judicious advocate for excision would, in all probability, in such a case, give a preference to amputation.

Fig. 105.

The drawing on the side of this page (fig. 105) gives a beautiful representation of the ends of the bones of this articulation in a state of caries. The cartilages have disappeared, and left the surfaces in the characteristic condition of this affection. The "enlarged and rough" extremities are likely enough to be mistaken for disease by those who are not familiar with such appearances, but the experienced eye can at once detect the difference, and the same individual knows that whilst in the thick and rough parts there is an excess of vitality, as it were (as evinced by the formation of new bone), there is

the lowest amount of it on the surfaces which have been denuded of cartilage. In short, these (the latter) are the only parts absolutely requiring removal; but to facilitate this, and to make the surfaces in some measure level, so that they may come into tolerable apposition, and adhere by bone, or make a firm and stout false joint, it is advisable to remove some of the rough parts, although it is seldom necessary, for the excision of the caries, to go much beyond the articular surfaces.

The drawing immediately below (fig. 106), I esteem as one of the most graphic in this volume. It is taken from a preparation of a dis-

Fig. 106.

eased elbow in my collection at King's College, and may be considered as faithful a representation as an engraving will admit of. The body, which has been added by the artist, may be supposed to be lying face downwards, or seated on a chair; the bend at the elbow is just such as may be seen in life, although at this stage of the operation the fore-arm may be bent and twisted in all directions; the swollen state of the soft parts, and the enlargement of the ends of the

bones are well displayed; marks of several small openings on the inner side of the joint, and the carious articular surfaces are well made out too; the shape of the incisions and flaps, and the ulnar nerve immediately behind the internal condyle, must also give clear illustration of what I have stated in previous pages. The joint is extensively diseased; in fact, it appeared so much so, that I deemed amputation advisable, and accordingly performed it, being afraid, from the exhausted condition of the patient, that he would not be so safe with such a wound as that for excision; but I have seen the latter most successfully practised in limbs equally bad, where, however, the circumstances were better otherwise, and I imagine that any one who has witnessed many of these operations, must admit the general accuracy of the representation.

Although, generally, the bleeding has ceased ere the divided portions of bone are removed, one or two small vessels may require to be tied; the edges of the wound must then be brought together and stitched, and the arm must be kept in a bent position during the remainder of the treatment. A stiff arm will probably be the result, but in some instances a new or false joint forms, which is no bad substitute for the original one. In the early treatment after the operation, a pasteboard or other splint, such as that delineated at p. 181, should be worn on the inside of the arm, so as to keep it steady; but in the course of three weeks or a month, a little motion should be encouraged.

During the performance of this operation the humeral artery will scarcely require to be compressed; and if the excision be done as above described, there is no danger of wounding this vessel in front of the elbow, as the brachialis muscle, lying between it and the joint, must be a sufficient protection in all instances where the knife is used with ordinary discretion.

It is seldom that excision is required in any part of the shaft of the humerus; but should it ever be deemed necessary to expose any portion of this bone, there would be little difficulty or danger in doing so by making the incision on the posterior surface of the arm, as in the operation for false joint already referred to.

In some instances of injury or disease of the head of the humerus, the surgeon attempts to save the upper extremity by the performance of excision of this portion of the bone. In gun-shot injuries, when the soft parts are not extensively destroyed, the operation may be adopted with the most happy results, and it has now been done so frequently in civil practice, that it is justly esteemed one of the most legitimate and brilliant achievements of modern surgery. When the head of the bone is shattered into fragments, an incision extending four or five inches from the acromion, in a line with and through the fibres of the deltoid, as recommended by Larrey, in imitation of the original operation performed by White, will enable the surgeon to remove as much of the injured bone as may be required: the wound in a muscular subject will be found narrow and deep, and although I

have succeeded in removing fragments of necrosed and carious bones through such wounds,—in which, however, I did not open the capsule,—I give a decided preference to freer incisions, whether the head of the bone is to be removed for gun-shot injury or for caries. These may sometimes be advantageously made by laying open sinuses, and the operator need not be prevented from doing so, by any fear of the effects of dividing the deltoid freely; but, as a general rule, I recommend the adoption of a plan similar to that originally followed by Morel. The patient being seated, or laid on his back with the shoulder raised, an incision should be made with a strong bistoury, commencing opposite the coracoid process, and ending about an inch behind and below the root of the acromion. It should be semilunar in shape, as represented in the upper dotted line in the figure on page 233, exhibiting amputation at the shoulder on the right side; the extreme convexity should be about four inches under the acromion, and thus the greater portion of the deltoid will be included in this flap. In the drawing alluded to, the knife is represented as being about to be thrust in below the root of the acromion. On this side it will be most convenient to do so, especially if the surgeon stands a little in front of the patient, and on the left shoulder the wound may be made to commence as above directed. However, the operator may suit his own taste in these matters. The skin and deltoid being divided, the flap should be drawn upwards, a few touches of the knife being sufficient to separate the loose connexions of this muscle. A bold incision should next be made through the tendons attached to the tuberosities on the humerus, dividing them and the capsule at the same time to such an extent, as to permit the head of the bone being turned out by a slight twist of the arm below. This part should then be laid hold of by the surgeon, or an assistant, and held steady whilst the common saw (p. 10) is used to remove as much of it as may be deemed necessary. If the operation is done for a shattered bone, its head cannot be thrust out like the end of a lever, as thus directed, and therefore the surgeon must make the best use of his fingers, or any convenient hook or forceps, to enable him to raise the fragments. The diseased or injured portions being separated, the glenoid cavity should next be carefully examined, and if disease be present, it should be scooped away with a gouge, or cut off with pliers, either straight or curved, as represented in previous pages. The lower surface of the acromion should also be examined and scraped, gouged, or the whole process removed, according to circumstances. In the first incision, the knife will probably divide the cephalic vein, and some branches of the thoracica-acromialis: these, however, should give no trouble, and throughout the operation the only large vessel interfered with is the posterior circumflex, which will be cut in dividing the posterior margin of the deltoid. A ligature will be required, which may be put on before the head of the bone is meddled with, or afterwards, as may be found most convenient:—the hemorrhage in the interval being commanded by the finger of an assistant. All

injured or diseased bone being removed, the flap should be laid down, and the edges stitched. If matters go on favourably afterwards, the wound heals kindly; and though the part may be stiff, as indeed it will most likely be, there is such free play of the scapula and clavicle, and of the articulations below, that a very useful extremity remains. I have seen some admirable results from this operation, but, like other excisions, some judgment is required in discriminating the cases to which it is applicable.

In contemplating an operation of this kind, previously to its performance, the surgeon ought not to limit himself to one mode of procedure; but should rather, trusting to his anatomical and manipulative skill, adapt his measures to the peculiarities of the case: he may make the flap above described more to the back part of the joint in one instance than in another; he may make a kind of square-shaped flap, thus (fig. 107), one incision in front of the articulation, the other behind, both being united above by a transverse division of the deltoid a few lines below the acromion. A flap, four inches in breadth and three in length, as was made by the elder Moreau, can then be turned down, or, by making the transverse incision below, the flap may be turned upwards. A incision, as recommended by Sabatier, a ,—or lines thus ,—

Fig. 107.

in short, the surgeon has the option of cutting any where, and in any direction, over a most extensive surface where he need not dread coming in contact with any large vessel or nerve,—the axillary plexus being so completely out of the course of all reasonable incisions, that if he is weak or ignorant enough to have a doubt on the latter subject, he will best display his remaining stock of wisdom by not interfering with the case at all.

It will seldom happen that excisions are required in either scapula or clavicle. In the latter bone I have referred elsewhere to an instance in which, after a compound fracture, I removed various loose fragments.

In 1819 Mr. Liston removed a vascular growth situated chiefly below the transverse spine of the scapula, and with it three-fourths of the bone. The bleeding is described as having been frightful. The scapula has even been more extensively attacked than in this case—the whole bone having been removed, and the superior extremity with it.

In 1837, Mott removed nearly the whole of the clavicle for an osteosarcoma, the size of a "couple of fists." The operation was said to

have been most difficult, and upwards of forty ligatures were required. In 1832, Dr. Warren removed the whole of this bone for a similar disease, and the proceeding, though very formidable, was not attended with such hemorrhage as in Mott's case.

No set rules further than those of the common principles of surgery can be given for such operations. All those alluded to were evidently by the operators themselves deemed of the most formidable kind, and such, in my opinion, as should induce others of less acknowledged reputation and experience to weigh well all the circumstances before resorting to the use of the knife.

CHAPTER VIII.

AMPUTATIONS.

When the phalanges of the fingers or thumb are the seat of incurable disease, amputation is generally performed, as excision of one of these bones, or a portion of it, would probably leave the remaining part of the member neither useful nor ornamental. Occasionally a small portion of carious or necrosed bone may be removed with advantage, but amputation is most frequently resorted to. This operation may be required for destruction of the soft parts, as well as of the bones, as exemplified in the effects of various forms of inflammation, constituting whitlow; in the growth of tumours, and those external injuries to which the fingers are particularly exposed.

When a portion of a finger requires removal, the operation may be done either at a joint, or in the continuity of a phalanx. For the former, the best procedure, in my opinion, is to apply a long narrow-bladed bistoury to one side, then, after cutting the skin and lateral ligament, to carry it into the joint behind, by changing its position, then through the articulation and the textures, on the palmar aspect, so as to leave a sufficiency of soft parts to cover the extremity of the bone, and unite readily with those on the posterior surface.

The drawing (fig. 108) shows the first position of the bistoury, and the dotted lines point out the course of the incisions and the size of the flaps. Perhaps that in the palmar aspect may appear somewhat too large, but here, as in many other situations it is seldom that the operator will find that he errs in leaving an excess of soft parts. The rag round the point of the finger may be supposed to cover the disease or injury for which the operation is required; but it has been exhibited for the additional purpose of adding force to my recommendation that

the part had better always be thus enveloped, as the surgeon can then grasp it more readily with his left hand, and move it in such directions as will facilitate the progress of the knife.

Fig. 108.

If the operation is done between the articulations, (that is, in the continuity of a phalanx,) I recommend it to be performed in this way: a blade, similar to that exhibited in the drawings, should be pushed from one side of the finger to the other, close in front of the bone, and a flap made from this surface; a lunated incision should then be made across the posterior aspect down to the bone, when, by using the cutting forceps, the amputation will be completed.

Figure 109 shows the position of the knife after transfixion, and the lines exhibit the length of each flap. Here the point of the finger has been left uncovered, to illustrate the recommendation in the preceding page; for it must be apparent, from the condition of the end of the finger, that the operator cannot have such a secure hold of it as when covered by rag or surgeons' lint.

In either of these proceedings two arteries may require to be tied, though it is possible that no ligature may be necessary, and in both a single stitch will suffice to keep the edges in contact.

Amputation of one or more of the phalanges may be done in a

variety of ways, such as by a circular incision, or by leaving two flaps, one on each side of the finger; but after operating in all the different

Fig. 109.

manners recommended by different surgeons, I seldom resort to any other than those above described, and of the two I generally give the preference to that in the phalanx between the joints, as in figure 109.

When the whole finger is to be removed, the knife should be passed from one side of the joint to the other in this way: the heel of the blade should be laid on the skin, about half an inch below the articulation, when by drawing it downwards, with a little pressure towards the joint, the lateral ligament will be reached, and should then be cut; the knife should next be carried across the articulation, and then outwards, so as to make a flap similar to the one already made on the opposite side. After the vessels have been secured (two will perhaps require to be tied) the opposite surfaces should be kept in apposition by means of a couple of stitches; a fold of lint should then be applied over the wound, and retained with a bandage carried round the hand, which will also have the effect of keeping the fingers still.

After the separation of the finger, as above described, I strongly recommend the removal of a portion of the metacarpal bone ere the margins of the wound are brought into contact. This can easily be done by carrying the point of the bistoury round the bone, about three fourths of an inch above its extremity, and then dividing it with the forceps.

The flaps, however, might be a little too long were the incision made so low down as in the operation just described, and those represented in this hand (fig. 110), will leave flaps sufficiently long to make an excellent cicatrix, provided the end of the metacarpal bone is removed; but if

it is to be left, then the skin on each side of the joint should be retained of the full length above recommended.

Fig. 110.

Fig. 111.

Of late I have been in the habit of removing a portion of the metacarpal bone, in all cases requiring amputation of the whole finger. I do not find that the operation is much more troublesome or difficult; and the additional pain is of no great moment, especially when the advantages of the procedure are taken into consideration. In no instance am I aware of bad effects having followed, such as injurious inflammation, or deficiency of that degree of strength in the hand that might be expected to remain after amputation of a finger in the ordinary manner.

The figure 111 shows a hand after having been treated in this manner; and if it be contrasted with figure 116, further on, I think that, in so far as appearance goes, the comparison is greatly in favour of the method by removing the end of the metacarpal bone. In the hand from which this representation is taken, I was obliged to amputate the whole finger, in consequence of incurable disease; and as the young gentleman was somewhat particular about its appearance, I was pleased afterwards to find that he had not a fault to complain of. It is not reasonable to expect that after the performance of any of these operations the hand can be of the same strength as it was pre-

viously ; but certainly in this instance, as in many others treated in a similar manner, I have not heard any complaints on this score, and the patient, whose hand is now exhibited, was not aware, after the lapse of two years, of any material difference in the power of grasping with either organ.

I have occasionally observed that if some care is not bestowed on the dressing, the fingers may be made to cross each other at the points ; and sometimes, also, I have noticed that if too little bone was removed, there was a slight prominence on the back of the hand. Both of these conditions are observable in this hand (fig. 112) from

Fig. 112.

Fig. 113.

which I removed the middle finger, but with too small a portion of the metacarpal bone. By applying the cutting forceps sufficiently high, and afterwards taking care to keep the remaining fingers parallel with each other, these objections may be obviated.

I should wish it understood that, in thus removing the metacarpal bone, I do not at all interfere with the skin in the palm, and that I keep the point of the knife so close to the bone, that I do not even divide the transverse ligament, as the supposed necessity for cutting this texture has by some been made an objection to this mode of operating, on the score that the hand is weakened thereby.

It will be observed that in these proceedings I have recommended that the finger should first be removed, and the small portion of bone afterwards ; but if the operator chooses, both may be taken away at

the same time. On the fore and little finger I generally prefer the latter mode, and in such cases I extend the incision a little higher, by such a line as that exhibited in figure 113. For such an operation the point of the knife should first be applied over the back and middle of the metacarpal bone, then carried downwards along the side and under surface of the joint, and up again to meet that first made, as indicated by the dotted lines; after this the soft parts nearest the bone must be divided, and then the forceps may be used in such a manner as to cut the bone obliquely, so that there shall be no angular projection. The wound need not be so near the middle of the hand as here exhibited, for if it is placed more between the finger and thumb, the cicatrix will be less conspicuous. Figure 114 represents the hand of one of my patients after such an operation.

Fig. 114.

In the fore-finger, if the upper end of the metacarpal bone is sound, I should certainly make a point of saving it, for various reasons which must be obvious to any one acquainted with the anatomy of the hand; and in the little finger I should also feel inclined to save the upper end of the bone if I found it in a healthy state; but, to lessen the chance of its extremity being observable, I would cut it across obliquely as above-mentioned. The operation should be done in a manner similar to that on the fore-finger last described, and the hand will present such an appearance as that exhibited in figure 115, which may be considered as directly in contrast with figure 116, immediately following, where the end of the bone has been preserved.

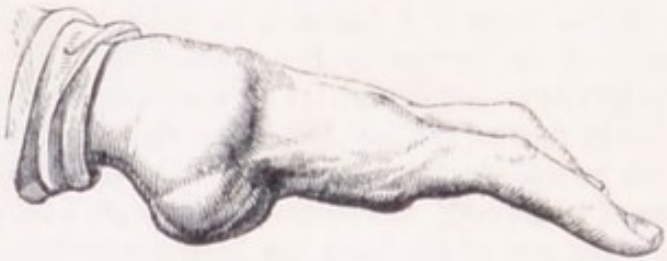
Fig. 115.

Fig. 116.

I hope it will not be imagined from the preceding recommendations that I am an advocate for unnecessary mutilation. In other parts of the extremity it is an object of importance with the surgeon to form what is called, in common language, a good stump, and my own opinion is, that operations, such as I have described, are well calculated to do so in this situation. There may, however, be many instances in which it might be advisable to leave the end of the metacarpal bone, and if it were sound this should be done. Not long ago I saw a baker, who had lost one of his fingers, and with whom, according to his own account, the breadth of the palm was of great consequence.

In proof of my anxiety not to remove more than is positively required, I must refer to the next cut (fig. 117), which exhibits the stump which I was enabled to make in an instance of gun-shot in-

Fig. 117.



jury of the hand, where even the two fingers which were ultimately preserved were in an almost hopeless condition. The bursting of a pistol caused extensive compound fracture and laceration in the thumb, fore, and middle fingers, and, in addition, the palm was most severely shattered. I resolved, nevertheless, to attempt saving the two fingers, which were less seriously damaged. Accordingly, by making a transverse incision on the back of the hand, and another on the palm, both within an inch of the carpus, and then carrying the knife downwards in front and behind, a little on the radial side of the ring-finger, I managed, notwithstanding a subsequent severe attack of erysipelas, to save such an organ as is represented in the sketch. I have known even a single

finger preserved with advantage, and the figure below (fig. 118) shows an instance where the thumb was the only member which it was thought proper to leave.

Fig. 118.

If the flexor and extensor tendons still preserve a certain amount of influence, these remaining portions, though they be small, will be of infinitely more service than any artificial substitute. For my part, I should say that such cures reflect greater credit on the surgeon and the art which he professes, and, moreover, are a better cause for self-gratulation, than the more extensive mutilations, which, from time to time, he feels himself obliged to inflict.

Occasionally it is absolutely necessary to remove either the whole or a large portion of a metacarpal bone, and both ingenuity and skill may be exhibited in some such cases. Thus, in the hand which is here represented (fig. 119), it was evident that the fibrous tumours (as I afterwards found them to be) involved the metacarpal bone and first phalanx of the forefinger, but it was difficult

Fig. 119.

Fig. 120.

to make sure that the disease was not also connected with the contiguous bone in the hand. Here I resolved to be guided by what I ascertained during the progress of the operation, and in performing it, finding that the disease was limited to the fore-finger and its sustaining bone, I was enabled to preserve the rest of the hand, as here represented (fig. 120). The proceeding was accomplished much in the manner already described for removing the index finger.

The next drawing (fig. 121) exhibits a large fibrous tumour connected with the middle of the palm, and with the middle and ring-fingers. It is the largest of the kind which I have seen; but we have the cast of a larger one in the Museum at King's College, and

Fig. 121.

there is one of greater magnitude portrayed in the third volume of the quarto edition of John Bell's Surgery. Here I intended to remove both the affected fingers and their metacarpal bones, but the patient refused to submit to an operation, although he had come many miles for the purpose of having one performed.

When two or more fingers require to be amputated at the same time, the metacarpal bones, if sound and covered by sound parts, had better be left entire. Each finger may be taken off separately, lateral flaps being made: or, what will answer better, a transverse incision can be carried across the dorsal surface of each a little below the articulations;

another may then be made in front; the lateral ligaments and other textures should next be cut through in any manner most convenient to the operator, and thus the parts may be removed one after the other.

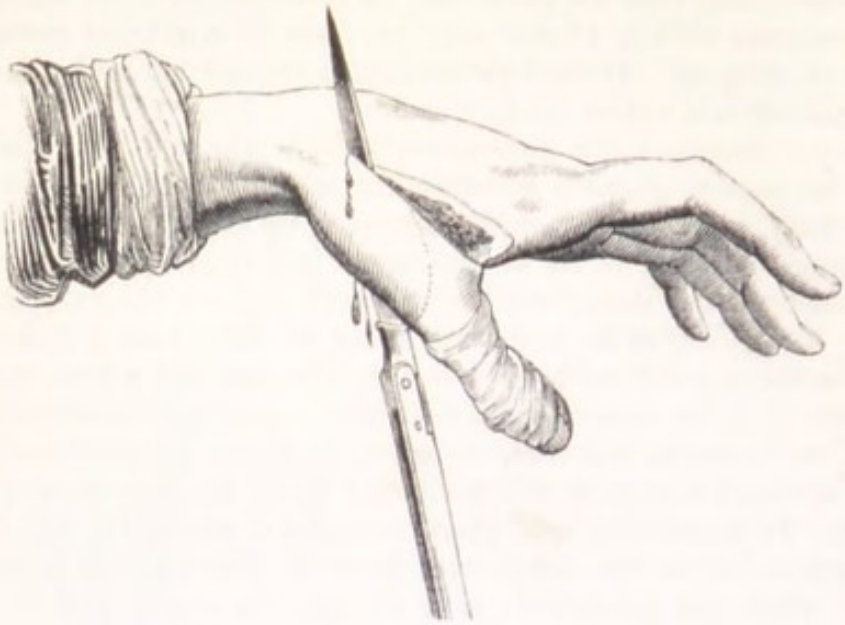
Amputations of the thumb may be done in a similar manner to those of the fingers. If the two phalanges require removal, the metacarpal bone should not be meddled with.

In some instances the metacarpal bone is the only one diseased, and it becomes a question whether the whole thumb is to be sacrificed in such cases. The usual practice is to do so, but I doubt its correctness. The thumb is of such great utility, that it ought not to be removed on such considerations as might induce the removal of a finger. In saying this, I do not mean to state that a finger even should be taken away without due consideration and a just cause: I only wish it to be remembered, that this organ is of incalculable advantage to the hand, and that, therefore, if it can be preserved, even with diminished utility, it will be better to do so than to sacrifice it entirely. In corroboration of these remarks, I may state that I have seen extirpation of the metacarpal bone of this member performed, and the phalanges preserved; and though the organ was far from being strong, still the patient (a female) could use the needle with tolerable facility not long afterwards; and the appearance of the hand was less remarkable, and evinced slighter trace of mutilation, than if the thumb had been entirely removed. If an attempt were made to save a finger by excision of a diseased metacarpal bone, (and there can be no doubt that such an attempt would succeed,) the organ would really be of little service. There are other fingers to compensate, in some measure, the loss of one, but the loss of the thumb can never be supplied. Moreover, the thumb will be, in all likelihood, a much more powerful organ, after the extraction of its metacarpal bone, than the finger after a similar loss, as may be conjectured from the difference in length of the two, both in the remaining portions, and those that are taken away, as well as from the firmer cushion of soft parts that will remain from the ball of the thumb, than from the corresponding textures in the hand.

The metacarpal bone of the thumb may be removed through an incision on its radial margin, where the surgeon may avoid cutting either the extensor or flexor tendons. The distal extremity should first be detached from its connexions, when the bone can be used as a lever whilst separating it from the other parts. The radial artery will be endangered whilst cutting some of the fibres which bind the bone to the os trapezium.

When the thumb and metacarpal bone are to be removed, the operation may be done by carrying a bistoury through the soft parts between the metacarpal bone and that of the forefinger upwards, until it is arrested by the trapezium; then through the joint; and lastly, by cutting downwards, and forming a flap of the fleshy substance constituting the ball of the thumb. The drawing (fig. 122) exhibits the bistoury in the first of its course, and the dotted line shows part of

Fig. 122.



the incision outwards, this being formed after the end of the bone has been disarticulated.

The operation may be done in a manner somewhat similar to that recommended for removal of the fore-finger with a portion of its metacarpal bone, by detaching the phalanges and distal end of the larger bone, and then continuing to use the point of the knife until the member is separated from the trapezium.

Of these two methods, some give the preference to the latter, in which it will be observed there is only a single cicatrix left; whereas in the other there must be one both behind and in front.

In all these operations, and in many others, indeed in most, in different parts of the body, though the cutting instrument is held in the right hand, the dexterous use of the left will be of infinite service. In amputation of a finger it will (as I have already stated with reference to the phalanges) be advantageous in most cases to wrap a bit of lint round it, so as to enable the surgeon to take a firm hold with the thumb and forefinger of his left hand; when, by turning in a proper direction, he can throw the textures about to be cut so much upon the stretch, that the slightest touch of the knife will divide them; and in operating at a joint, unless the part intended to be removed be held to one side, it will scarcely be possible to pass a knife across without coming into contact with some point of cartilage or bone.

A common scalpel may be used for all the operations above described; but I invariably prefer a long, narrow, and somewhat slender bistoury, the blade of which is about three inches in length, and about a quarter in breadth at its widest part. It may be fixed in a common ebony handle, but for convenience I give the preference to the clasp bistoury, which shuts into its handle after the fashion of a

pocket penknife. In some of the recent drawings, the proportions of the bistoury, even when thus diminished, may be appreciated. The narrowness of the blade enables the operator to pass more rapidly across the joint, while its length permits him to shape the flaps with a freer sweep of his hand, than when he uses the broader, shorter, and less elegant scalpel.

I cannot conclude these observations on amputations of the phalanges and fingers, without adverting to the greater facility of performing them on the living subject than on the dead. In the latter, the skin and other soft parts are usually so thin, that it requires great care, and even skill, to reserve sufficient flaps; whereas, in the former, the subcutaneous cushion of fat almost invariably gives a more favourable opportunity of preserving a better covering to the end of the bone; and in some cases, (as in the thickening attending severe forms of whitlow, in which the whole or a part of the finger may require removal,) the textures surrounding the joint operated on may be so infiltrated with lymph, that a sufficient and very excellent stump may be reserved; though it must be remembered that such a condition renders it perhaps more troublesome to get into the joint, when this locality happens to be selected or required.

In caries of the bones of the carpus, or of the ends of those connected with them, amputation is in general the only resource; for although, as I have already stated, excision may occasionally be performed, such cases are more rarely met with than those of a more serious character.

Amputation of the hand may be performed at the articulation of the carpus with the fore-arm, or it may be done a little higher up where the bones will require division with the saw. The first of these two operations may be done in this way:—the hand being held in a horizontal position, with the back upwards, a scalpel, or, what is better, a large bistoury, such as is exhibited in the drawing (fig. 123), should be carried, in a semilunar course down to the bones from one side of the wrist to the other, about one inch or more below the articulation; this flap should then be dissected up, and the posterior part of the joint opened: this and the future steps of the operation will be facilitated by bending the hand downwards, in the manner exhibited in the figure; the textures on each side of the wrist should next be cut through; and lastly, a flap, similar in size and shape to the one already made, should be preserved from the front. The lines of incision are marked out in the figure by the dots below the wrist.

In severe injuries of the hand requiring amputation, where a sufficiency of soft parts can be preserved to cover the end of the radius, this operation may be performed in preference to that higher up: it possesses no particular advantage, however; the length of the stump is of no great consequence; the flaps, with the numerous tendons in them, may not heal readily; and unless it be that the operation may be performed on an emergency with the apparatus in an ordinary

Fig. 123.

pocket-case (no saw being required), I can see no good reason for preferring it to the more common operation a little higher up.

Amputation in the fore-arm may be done in this way:—the elbow being slightly bent, and the hand placed in a state of pronation, a blade about six inches long should be passed from one side to the other behind (or above) the bones; it should then be carried in an oblique direction, so as to come through the skin about an inch and a half lower down; the flap thus formed should now be raised, and the knife should next be passed across close in front of the bones, and then carried obliquely downwards, when a second flap, similar in size and shape to that already made, will be formed: both of these should now be drawn slightly upwards, and after all the textures close upon the bones have been divided with the same knife, care being taken to pass its point between them, the saw should be applied close to the roots of the flaps, and the part separated. If the latter instrument be well used, it is of little moment whether a single bone or both be cut at once. Some prefer to place the hand about to be removed in a state of supination, and to make the anterior flap first: others hold it between pronation and supination; but I have never been convinced that, under ordinary circumstances, any one of these three positions possesses such advantages over the other two, as should induce the surgeon to prefer it in all instances. It is of consequence, however, to observe the attitude in which the limb may be placed,

so as to avoid passing the knife between the bones,—a mistake I have seen happen.

The first position of the knife and the lines of incision are here shown (fig. 124). The posterior or upper flap, as thus exhibited,

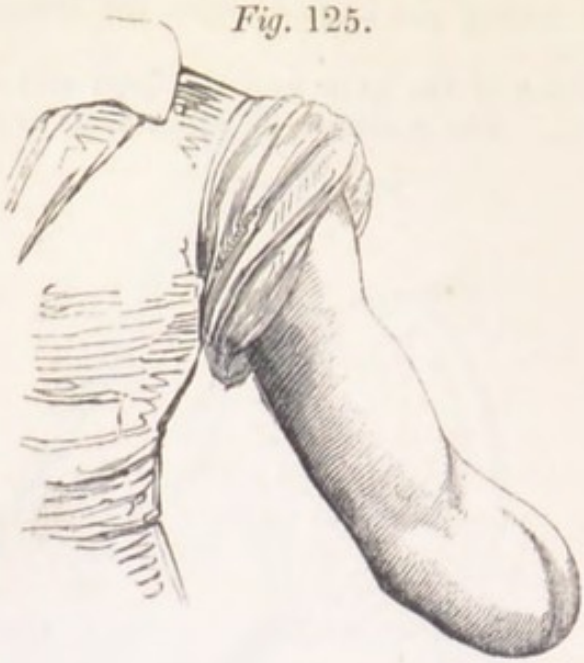
Fig. 124.

would be small in proportion to that below, but to avoid this, it is well in such a situation, (indeed it is so in most parts of the extremities,) to grasp the textures about to be transfixed, and to elevate them in such a manner as to keep more above the blade than can be done without this manœuvre. Such a proceeding is well exemplified in the drawing illustrative of amputation in the thigh with anterior and posterior flaps, and it will be found to facilitate transfixion, both for the first and second time.

It will often be observed that the tendons hang out of the wound after the flaps are brought into apposition, especially if the incisions have been made near the wrist. It may be advisable sometimes to cut small portions of them away: occasionally I have known these projections slough, whilst at other times no inconvenience has resulted further than a slight difficulty at first in covering them with the skin.

The drawing (fig. 125) exhibits a stump made after the method above recommended. The sketch was taken from a patient whose hand I had to remove in consequence of a severe injury by machinery.

Fig. 125.



The remaining part of the fore-arm is sufficiently long to admit of any kind of apparatus being applied as a substitute for the hand. It may be well on all occasions to keep the latter object in view: the part can scarcely be left too long for the attachment of anything of the kind, but the surgeon might inadvertently apply the knife so close upon the elbow, as to leave too short a portion below for the purpose in question.

Amputation, as above described, may be performed in the fore-arm at any point between the wrist and elbow with equal facility; the radial and ulnar artery will each require a ligature, the interosseal arteries, particularly the anterior, will also require to be tied, and possibly one or two more of a smaller size. The flaps may next be laid together, and retained by means of three or four stitches.

During the performance of these operations, the circulation must be arrested by compressing the humeral artery with the fingers or tourniquet, as recommended, and exhibited in the drawings, at pages 19 and 22. In those at the wrist, the assistant who holds the arm may compress the two main arteries with the points of his fingers until ligatures are applied; and the like may be done, if required, during the minor proceedings on the hand and fingers.

I need scarcely add, that the circular operation may be applied in any part of the fore-arm; but considering the flat shape of the member, and other circumstances referred to in the chapter on amputation, I should on all occasions give the flap method the preference in this locality.

It will be observed that in describing these different operations, I do not enter into such minute details as some may expect; but I must beg of the reader, when he is not satisfied in these respects, occasionally to refer to the introduction, where he may possibly find what he

wants, or, at all events, such general instructions appertaining to all operations, as to evince to him the propriety of not embodying them again and again in other parts of the volume.

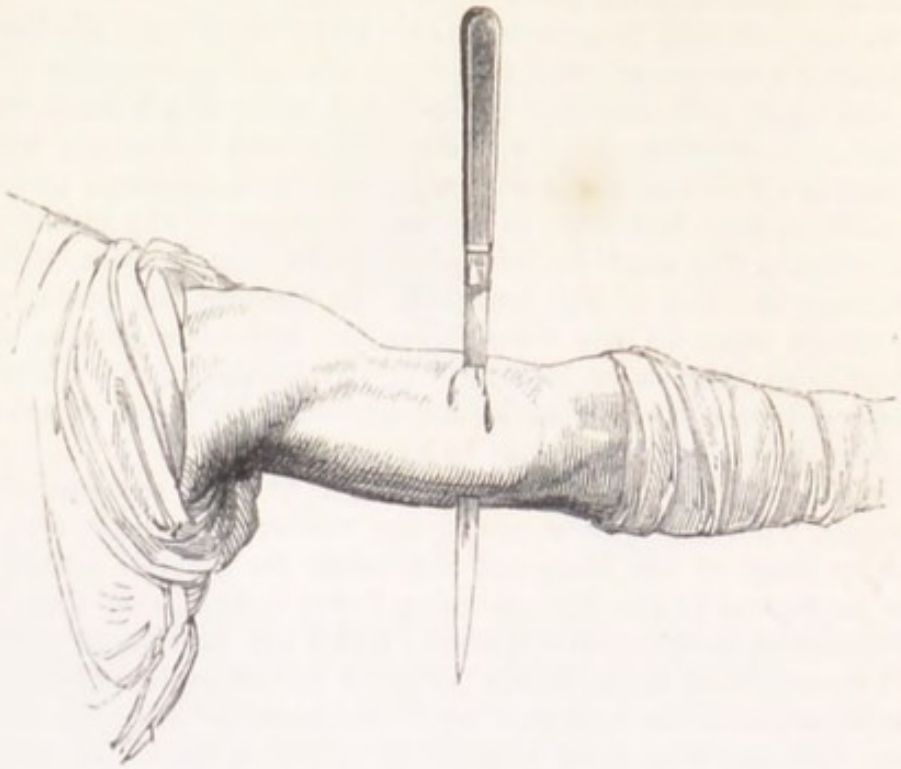
The fore-arm may be removed at its articulation with the humerus, by making a semilunar incision through the soft textures on its anterior and upper part obliquely towards the joint, which must then be cut into, by dividing the brachialis muscle and ligaments, when by bending the limb backwards the bones may be so displaced as to allow the knife (a long bistoury) to be carried across to the posterior surface, where a flap must be left, which, with that in front, will cover sufficiently the end of the humerus. In making the posterior flap, the triceps must be cut through, or the olecranon process may be divided with the saw or forceps, and left in the stump. The same vessels will be cut across as in amputation a little lower down, and the same style of dressing must be pursued.

The method here describsd is similar to that recommended by Vacquier, who, however, removed the olecranon. Dupuytren transfixed in front of the joint, and then made the anterior wound in the same manner as in the flap operation lower down: sometimes he left the olecranon, at others cut it away, and I am inclined to agree with M. Velpeau, that there seems no great advantage in preserving it. If any portion of the fore-arm below the junction of the head of the radius with the ulna could possibly be saved, I should certainly prefer amputation as described at p. 224 to this proceeding; if not, I would rather operate above the condyles of the humerus, being convinced that a better stump would thus be formed, than by leaving the articular surfaces: but it clearly appears, notwithstanding the sanction of so high an authority as Dupuytren, who performed this operation frequently, that there are few advocates for it in the present day.

Amputation above the elbow may be done in the following manner:—the patient being seated or laid on a table, the humeral artery secured by pressure, as already described, with the elbow separated from the side, the arm should be transfixed three inches above the external condyle, with a knife about seven inches in length, which should be carried obliquely downwards and forwards, so as to make from the inner surface a semilunar flap between two and three inches long: this should then be raised, and the soft parts on the opposite side divided in the same manner, and to a similar extent; the two flaps should now be drawn upwards, and the knife carried round the bone, which should next be sawn through, and the removal of the part is thus completed. The humeral artery being secured with a ligature, the pressure above should be taken off, and any other branch, that bleeds freely, tied; the flaps should then be brought into contact, and kept in apposition with four or five stitches.

The following drawing (fig. 126) shows the position of the knife, after transfixion, and the dotted line the shape of the anterior or inner flap. The arm may either be straight, as there exhibited, or slightly bent at the elbow, according to circumstances.

Fig. 126.



The humerus is covered by nearly an equal thickness of soft parts throughout its circumference, and it seems to me a matter of little moment from which side the flaps are taken, provided the main vessels or nerves are not split. If the artery is thus divided, there may be some trouble in securing it; if it be a large vein, more injury has been inflicted on it than the operation warrants, and, if one or other of the nerves, the same remark is applicable; for in both instances very troublesome results might follow.

The operation should be done in the lower third of the arm if circumstances will permit, but the same instructions will answer for any part of its extent between the condyles of the humerus and its neck.

The next cut (fig. 127) exhibits the stump on one of my patients, whose arm I amputated some time ago at King's College Hospital. The flaps here were slightly different from those referred to in the description of the operation as given above; but the stump, in my opinion, could not have been better, from whichever side the soft parts had been preserved.

For a description of the circular operation in this situation, I may refer to page 131, and shall here only state to those who may prefer this proceeding, that the arm, in my opinion, presents the best part of the upper extremity for the application of such a method.

In performing amputation of the arm, the surgeon may stand on either side he chooses, or that may be most convenient. I generally prefer the outside, and, for reasons stated in my observations on am-

Fig. 127.

putation in the thigh, commonly make the inner flap first; but on neither of these points do I consider it imperative to adhere to any single rule.

Before the young surgeon thinks of amputation at the shoulder-joint, I must beg him to refer to my observations on excision at this articulation. If he has it in his power to make a reasonable attempt to save the extremity, he ought of course to do so; but it often happens that he cannot do otherwise than adopt this last of all resources. Extensive injuries, by machinery or otherwise, gangrene, phlegmonous erysipelas, growths in the soft parts or in the humerus, caries or necrosis of this bone, may each necessitate amputation at the shoulder-joint, and fortunately it is an operation so easy in its performance, and at the same time comparatively, and in reference to its magnitude, so safe in its results, that, under ordinary circumstances, when it is imperatively demanded, the surgeon may resort to it with the sanguine hope of a speedy and permanent recovery for the patient.

Supposing the joint to be in a tolerably natural condition, and that the surgeon prefers a printed authority to that which should be his legitimate guide—a knowledge of anatomy—he has an extensive field to choose from. Between twenty and thirty different methods of

doing this operation have been recorded, not one of which can be clearly understood without a competent anatomical knowledge. The effort of distinguishing the minute differences between any two or three of these plans actually requires as much study (with some at all events) as does the anatomy of the joint itself, whilst the knowledge acquired in the one pursuit is of incalculably less value than the other. Few surgeons, in the course of extensive practice, meet with many occasions for the performance of this operation; but, on the other hand, the necessity for an acquaintance with the physical structure of the shoulder, is, in a manner, paramount. I do not mean by these remarks to discourage the study of the opinions and proceedings of many who are justly considered our best authorities on such matters: but, as it is not within the compass of this work to describe, or allude to, all that has been said or done in surgery, or to point out the trifling shades of difference in the practice of twenty or thirty individuals, — each of whom, be it remarked, is an authority perhaps equal to any other,—I shall rest satisfied with describing two methods which I have myself resorted to on the living body, after having given to most of the others a fair consideration and trial on the subject.

If the left arm is to be removed, the patient may be seated, but the position will be better if he is placed on a firm table, with the shoulder a little elevated and projected beyond its margin. The surgeon, standing on the patient's left side, should then lay hold of the arm a little above the elbow, and move it from the side and slightly backwards, so as to give a view of the skin in the axilla. A sharp-pointed amputating knife, seven or eight inches in length, held in the right hand, should then be pushed through the skin in the armpit, immediately in front of the tendons of the latissimus dorsi and teres major muscles, and carried upwards and obliquely forwards, until its point protrudes a little in front of the extremity of the acromion: during this movement a good anatomist, with a dexterous hand, may actually open the capsule behind, by adroitly touching the tendons of the teres minor and infra-spinatus; but there is some danger of breaking the point of the instrument against the humerus in this attempt, and the operator may rest contented with cutting as close to the joint as safety in this respect will permit. With whatever object the thrust is intended, it will be greatly facilitated by moving the elbow outwards, upwards, and backwards,—indeed, unless this be attended to, there is every chance of the point of the knife appearing through the skin long before it has reached the extremity of the acromion: still keeping the arm in the attitude last mentioned, the knife should be thrust up to its heel, and then carried, with a sawing motion, downwards, backwards, and outwards, (*i. e.* towards the surgeon,) so as to make a flap four or five inches in length, formed chiefly of the posterior part of the deltoid with the tendons of the latissimus dorsi and teres major, and of the skin behind; this flap being raised by an assistant, the point of the knife should be used to open completely the posterior and upper part of the joint by a thorough division of the teres minor, infra-spinatus,

supra-spinatus, capsule, and long heads of the biceps and triceps; and to facilitate these steps, the elbow should now be carried in front of the chest, and the head of the bone pushed backwards. When the textures are sufficiently divided, the same movement will cause the luxation of the articular surface: the knife should then be passed in front of the bone, and carried downwards and forwards to form a flap about the same length as the other, by dividing the subscapular muscle, the remaining portions of the capsule and of the deltoid, short head of the biceps, pectoralis major, vessels, nerves, and skin of the axilla and forepart of the shoulder. In the last movements of the knife, the axillary artery must be divided; and to restrain hemorrhage an assistant, at this period of the operation, should grasp the soft parts in the axilla. As soon as the arm is detached, a ligature should be placed

Fig. 128.

on the main vessel, the subscapular, and any other artery which may continue to bleed. The edges of the wound should then be brought in contact, and the line of union will be nearly perpendicular, the flaps being posterior and anterior.

This drawing (fig. 128) will serve to make my description clear. The knife (which, in my opinion, the artist has represented a little too long) is seen transfixing the shoulder, and the dotted line shows the size of the posterior flap, which, in such a case as this, where the deltoid appears so well developed, may be made of any reasonable size and length which the surgeon may choose.

This operation is nearly similar to the mode proposed by Lisfranc, and may be varied in different ways. The point of the knife need not be entered so low: in which case, it may be pushed further forwards,

and an upper flap, consisting chiefly of the deltoid, may be first formed. Then, to make sure of having this flap (made in either way) of the largest possible size, an assistant may be directed to grasp and raise the deltoid, whilst the parts are being transfixed, and unless the surgeon has great power in his left hand, it may be as well that he should, at the first, entrust the management of the arm to an assistant; for, when it is held up by another's aid, he can use his own hand in assisting to get the head of the bone out of its socket, so as to allow the knife to be applied in front. On the dead subject, or in an arm emaciated by disease, there is little trouble in elevating the bone; but if the arm be weighty, and the subject muscular, as is often the case in severe injuries necessitating this operation, the forcible manner in which it is drawn to the side, by the action of those muscles which remain, after the first flap is formed, is really surprising, and unless the surgeon be himself possessed of equivalent energy he will have great difficulty in counteracting the combined opposition of weight and muscular action.

On the right side I have operated in this way:—The patient has been laid on a table, and, standing in front of him, I have with a stout clasp bistoury, made a semilunar incision from a little behind the root of the acromion towards the coracoid process, and thus made a flap from the skin and deltoid, similar to that described at page 210 for excision of the head of the bone: this being raised, I have opened the joint from above, and preserved another flap from the remaining parts below the bone; and here, also, before dividing the axillary artery, I have desired an assistant to seize the vessel above. Here I regulated the movements of the humerus by holding the arm with my left hand. The next figure (129) will make the above description more easily understood: the point of the knife should, however, be a little higher up.

For my own part, I should be as well content to use a bistoury for these operations, as the more imposing-looking amputating knife; but with such an instrument the first flap on the left shoulder would be made by cutting from the skin towards the joint. There are few, however, who would not prefer a long knife, and such a one may be used on the right shoulder as well as on the left. The operator may either cut the flap, as I have directed above, from the skin towards the joint, or he may transfix immediately below the acromion, as was done by Dupuytren, introducing the knife either in front of the joint (at the coracoid process) or behind it (at the root of the acromion), according to the side on which he stands, and cut his way outwards. But I fear that already such operations may appear sufficiently complicated, even by my brief allusions to these various modifications and alterations which, after all, form but a small proportion of those which have been proposed from the time of Le Dran to the present day.

It will be observed that on the left side I have recommended lateral flaps, and on the right horizontal. A good anatomist would, however, have no difficulty in reversing these, that is, making lateral flaps on

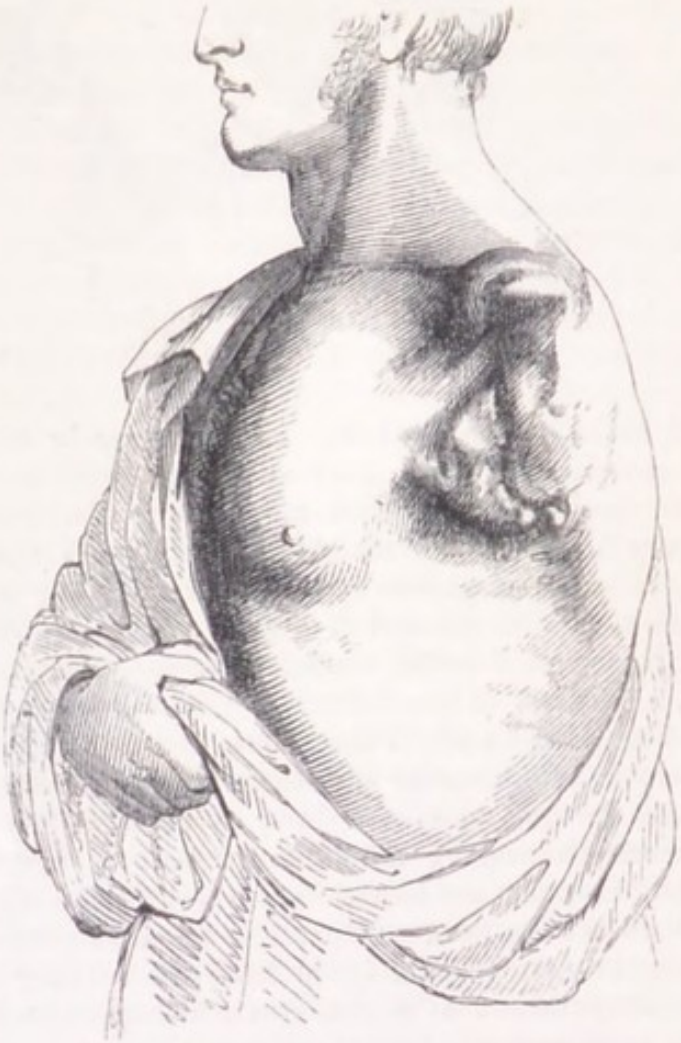
Fig. 129.

the right and horizontal on the left. He can scarcely err in preserving sufficient covering to form a good stump in either or in any way, and his chief anxiety will be with reference to the axillary artery. It is customary to desire an assistant to compress the subclavian above the clavicle, as it passes over the first rib, by means of his fingers or thumb, or with the end of a good-sized key covered with a pad of lint. However, I would not have the operator trust too much to this plan. In most of the instances where I have seen it pursued, indeed I may say in all, I have observed it to fail. It is certainly very easy to compress the subclavian in this situation, in every properly-formed person, when the body is at rest; but the violent muscular movements during amputation make a vast difference: the clavicle and shoulder are almost invariably drawn upwards, and the pressure then is uncertain. I have known a surgeon blinded for an instant with the first gush of blood from the axillary artery after its division in amputation, at a time too when he expected that the subclavian was commanded. So sceptical am I as to the utility of this practice, that I feel almost inclined to say that it is worse than useless: the pressure, (which is usually more energetic than there is any occasion for,) provided it be properly applied, is often attended with

considerable pain; but that being brief, and of little moment in comparison with the object in view, need form no valid objection. An assistant, however, who might be otherwise and better employed, is thus lost, as it were, and he is much in the way of those who have command of the flaps. Notwithstanding these observations, I doubt not but that most surgeons will still consider it a safe and almost necessary precaution; I cannot say that I discountenance it altogether myself; but I hope that what has been stated, will show the propriety of grasping the vessel in the axilla, immediately above where it is about to be divided.

With flaps, such as I have described, for the left shoulder, the stump should be similar to that represented in drawing 130, taken from the person of a young man, whose arm I removed at the articulation, in consequence of a severe railway injury.

Fig. 130.



I think it of consequence to caution the young surgeon against expecting a very handsome flap, from any part of the circumference of

the joint, more particularly from the axilla: here the surface is so irregular, that the wound must invariably be more or less puckered; but this need cause no annoyance, nor must he imagine that, in consequence, the operation has been improperly performed. By attention to the dressing, the stump will speedily assume the resemblance of the figure; all projections and puckerings will disappear, and a uniformly smooth surface will be the result. It will be observed that the acromion projects considerably; but, so far as I have seen in these stumps, it is productive of no inconvenience. Were this the case, it might easily be removed, and a portion of the clavicle with it; but this I think should not be done, unless it is positively required, as the deficiency of breadth of shoulder, already so conspicuous, would thereby be rendered more apparent.

Occasionally in amputations at the shoulder-joint it is requisite to remove parts of the clavicle and acromion, and probably more or less of the glenoid cavity or body of the scapula. No certain rules can be laid down for the performance of these additional steps, and the operator must therefore be guided by the nature and peculiarities of each case, and by the knowledge which he may possess of the relative anatomy. The celebrated instance recorded by Cheselden, of Wood the miller, who had his right arm and scapula torn off by machinery, and several of a similar kind which have been seen and recorded by Carmichael, Dorsay, and others, have exhibited the wonderful powers of nature in sustaining life, even after such frightful and extensive mutilations. Some years ago, during my connexion with the Royal Infirmary in Edinburgh, a boy about thirteen years old came under the care of Mr. Lizars, with the extremity, scapula, and one half of the clavicle, torn off by machinery; the skin on the side was also extensively removed. The axillary vessels and nerves hung loosely from the wound, but the bleeding was inconsiderable, the main artery being stretched, lacerated, and filled with clots. There was no shock; a single ligature was placed on the subclavian, immediately outside of the scaleni, where it pulsated, and contained fluid blood; the skin from before and behind was drawn as well together as its laxity would permit, and a rapid recovery ensued.

In the museum at King's College there is a preparation from which the figure (131) on the next page was taken. The patient, a lad fourteen years of age, was under the care of Mr. Cartwright, late surgeon to the Middlesex Hospital, and made a good recovery.

So far as the mere shock produced on the system by operations for removal of so large a portion of the frame is to be taken into account, the surgeon may be amply justified in resorting to their performance; but it behoves him to consider well the nature of the case, before he proceeds to use the knife. It may be requisite, on some of these occasions, first to amputate at the shoulder-joint, and afterwards proceed with the removal of diseased portions of bone; or the surgeon may possibly make a laudable attempt to save the ex-

tremity, by operating on clavicle or scapula, as the case may demand; and it is on such occasions as these that forethought and presence of mind are of so much importance.

Fig 131.

In 1808 Mr. Cuming removed the whole of the scapula, with the upper extremity, in a case of gun-shot injury. In 1830 Gaetani-Bey, at Cairo, performed a similar operation (reserving, however, one half of the clavicle), in a boy of fourteen years of age. The case was one of extensive injury: after amputation at the glenoid cavity, the scapula, being shattered, was cut away, and then the clavicle, being found to project too much, was partially removed. The patient made a good recovery.

In the descriptions of amputation at the shoulder-joint above given, I have supposed the parts around to be in a natural condition; but

it will be apparent that on all occasions the two methods especially mentioned cannot be put into execution. In gun-shot injury of the shaft of the humerus, or in compound fractures occurring in civil practice, the bone cannot be used as a lever, by grasping it immediately above the elbow; and under these circumstances the operator must raise or pull the upper fragment out of the way, in any manner he may find most convenient. In such examples he ought always to reserve his left hand free, so that after the first flap is raised, he may be enabled to use it to the best advantage in disarticulating the head of the bone. On certain occasions, when the soft parts are much injured, some ingenuity may be requisite to preserve a sufficiency of textures to form a good covering to the glenoid cavity, and in such examples the removal of the acromion may, possibly, be advantageous; but the skin in front, behind, and below the armpit is usually so extensible, that however limited the flaps may be, I should not fear that a good stump would be the result; and the best proof I can give on this subject is the case related at p. 135, in which, though the loss of skin was so great as to expose a large extent of the serratus magnus muscle, the cicatrix ultimately appeared very small. In amputating at the shoulder, too, for large tumours in the humerus extending close to the joint, the surgeon must so divide the soft parts, that, whilst he gives himself sufficient space to dissect out the diseased mass, he takes care to leave such an amount of them as will afterwards form a proper covering to the scapula. The common catlin will not be available on such occasions, as the operation partakes more of the character of a dissection for the removal of a large tumour than an amputation. A scalpel or bistoury will be the most efficient instrument. For my own part, I should prefer the latter; but I have seen a very large tumour of the kind alluded to, with the whole arm, most successfully amputated with a common scalpel. In this instance, the surgeon (Mr. Syme, of Edinburgh) in a very early stage of the proceedings, placed a ligature on the axillary artery; but were I ever to undertake a similar operation, I should prefer disarticulating first, and leaving the division of the soft parts in the axilla for the last movements with the knife.

PART III.

OF THE INFERIOR EXTREMITY.

CHAPTER I.

DISSECTIONS.

THE back of the foot and upper surface of the toes may be first dissected. The subject being placed on its back, an incision should be made through the skin, a little above the ankle joint, from one side of the leg to the other; the knife should then be carried from the centre of this along the upper part of the foot, as far as the nail of the second toe. The skin and subcutaneous cellular texture should be turned to each side, a transverse incision being made at the root of each toe. Along the upper surface of the great toe another incision should be made, as far as the nail, and if the skin is taken off this and the second, there is no occasion to meddle with the others. Branches of veins will be found on the upper surface of the foot, which may be traced leading, on each side, towards the saphena major and minor. There are small twigs of nerves here also, but none of these are considered of much surgical importance. This stage of the dissection will have exposed the anterior annular ligament and the transverse fibres which bind the extensor tendons on the dorsum of the foot. By cutting through the ligament and fibres these tendons may be traced to their respective attachments, as far as the state of the dissection on the toes will permit. The anterior tibial artery will be observed between the tendons of the extensor proprius pollicis and the extensor longus digitorum. The vessel should be traced upwards as far as the dissection extends, and downwards until it disappears between the metatarsal bones of the first and second toe. Several branches will be observed passing from it, above and below the ankle, to supply the lower part of the leg and dorsum of the foot; but none of them are of such surgical moment as to require especial notice. On the outer surface of the os calcis, below the malleolus externus, an artery of considerable size may be discovered: it is, in general, a continuation of the fibular, and will be found to anastomose on the outer margin of the foot, with some of the tarsal branches of the anterior tibial.

The leg cannot be so conveniently moved as the upper extremity, and it will, therefore, be best to examine the whole anterior surface before turning the subject. With this view, an incision should now be made through the skin and cellular membrane, which should extend from the transverse cut below, along the anterior surface of the leg, over the patella, and three or four inches up the thigh. At this part a transverse division should be made, and the skin dissected to each side of the leg and thigh, so as to expose the aponeurosis underneath. On the inner flap branches of veins will be observed passing to join the saphena major, which itself may be traced in the subcutaneous cellular texture as far up as the dissection extends. After due notice has been taken of the aponeurosis on the anterior surface of the leg, an incision should be made through it, from the head of the tibia as far down as it happens to be entire; this incision should be about midway between the tibia and fibula, and the membrane should be turned off from the muscles towards each bone. Above, it is firmly connected with the subjacent muscles; below, these parts are only attached by loose cellular texture. The point of the finger or handle of the knife should now be carried between the muscles, and the course of the anterior tibial artery traced. In the upper part of the leg it will be found between the tibialis anticus and extensor communis; lower down, where the extensor longus pollicis intervenes, it will be found between this muscle and the common extensor, and just above the annular ligament it is crossed by the tendon of the extensor proprius. Two small veins accompany it, and, from the middle of the leg downwards, a branch of the fibular nerve will be found on its outer margin. The artery lies deep throughout its whole course, (particularly its upper third,) until it gets in front of the ankle and on the dorsum of the foot, where it is so superficial that its pulsations in the living body may be felt with the finger. The course of the vessel will be best seen if the tibialis anticus muscle be raised from its attachments above, when its proximity to the head of the fibula as it passes through the interosseal ligament, and its close attachment to this membrane throughout a great part of its course, can be made out. Whilst raising the above-named muscle the extensor communis and extensor longus pollicis had better also be raised from their position, and each should be cut across a little above the ankle.

Before making any examination of the knee, where it is already in part exposed, the anterior surface of the thigh had better be fully dissected. For this purpose an incision should be made from the anterior superior spinous process of the ilium in a line with Poupart's ligament, as far as the tuberosity or spine of the os pubis, and another from the middle of this, down the anterior part of the thigh, to the transverse wound already made above the knee. The skin should then be dissected to each side, so as to expose the aponeurosis (fascia lata) on the anterior surface of the thigh. In doing so some small branches of nerves (from the lumbar plexus chiefly) will be found in the subcutaneous cellular texture on the outer and anterior

aspects of the thigh, and on the inner side the internal saphena vein (major) must be traced upwards from the point where it has already been dissected. At the lower part of the thigh, this vein will be found on the inner surface of the limb; but higher up, it gets more to the front, where it dips through the fascia to join the common femoral, about one inch and three-fourths below Poupart's ligament. The position of the upper end of this vein, its relation to the fascia, and the appearance of this membrane in the upper and anterior region of the thigh, require to be carefully attended to, as they are all of importance with reference to femoral hernia, and for a more minute description of these parts I must refer to the latter pages of the volume, where the anatomy of this kind of hernia is described; indeed, by far the best proceeding would be to make such a dissection in the upper region of the thigh as is there recommended, previously to commencing the examination of the whole of its anterior surface. In elevating the upper angle of the inner flap of skin the loose inguinal glands may be raised at the same time, and such of them as lie in the hollow between the iliac and pubic portions of the fascia lata, with the surrounding fat and cellular membrane, may either be raised at present or afterwards with the fascia. The aponeurosis should next be examined. An incision about two inches long should be made through the skin over the crest of the ilium, so as to allow the integuments to be more fully dissected towards the outer surface of the thigh, and thereby to expose a greater extent of the aponeurotic membrane. This texture will be observed to be firmly connected above to the crest of the ilium, to Poupart's ligament, and to the os pubis, and below it will be found attached, along with the tendons of the extensor muscles, to the patella and upper part of the tibia and fibula. Notice should be taken of its strength and thickness on the outer side of the limb, and of its weakness and tenuity on the anterior and inner aspect. Over all the surface its fibres are most distinct, though it often happens that portions of it are raised by a careless dissector, who, in consequence, supposes that it cannot be readily made out.

The fascia lata may now be raised from the subjacent parts. An incision should be made through it, from the middle of Poupart's ligament down the front of the limb, over the patella and its ligament, as far as the tuberosity of the tibia; another should traverse it, immediately below and parallel with Poupart's ligament, and one portion may then be dissected inwards, the other outwards, so as to display the muscles and other organs with which it is in contact. At the lower extremity of the thigh it will be somewhat difficult to separate the membrane from the patella and its ligament, and also from the tendons of the vasti muscles, more particularly from the broad tendon of the vastus internus. In raising it from the patella, or perhaps in taking off the skin, a bursa will be observed in most subjects: the latter is variable in size, and usually irregular on its inner surface. In dissecting at the lower third of the thigh, little care is required further than to cut, as much as possible,

in the course of the fibres of each muscle; but at the upper region some additional caution is necessary. Immediately below Poupart's ligament, the fascia is loose in its texture, being thin, and perforated with numerous small apertures for the passage of blood-vessels and nerves; towards the inner margin of the groin, the incisions must be carried deep, so as to raise this membrane from the pectineus muscle; and, previously to doing so, the saphena vein should be cut across about an inch before it joins the femoral. At the outer end of Poupart's ligament, below the crest of the ilium, the aponeurosis will be found very thin where it covers the tensor muscle; indeed, here it seems to be merely a slip of it, as the lower part of this muscle is attached to the outer surface of the main portion of the membrane.

As the relative anatomy of the femoral artery and its main branches forms one of the principal objects of investigation, the dissection should now be conducted in the following manner:—The sartorius muscle should be carefully cleaned, and each of its margins made distinct; the cellular texture surrounding the femoral vessels, forming their sheath, should be removed, so as to expose their course between Poupart's ligament and the inner margin of the sartorius. In making this dissection, the incisions should commence over the common femoral artery, as it passes under Poupart's ligament, where it will be found about midway between the superior spine of the ilium and tuberosity of the pubes, being, however, a little nearer the latter part than the former: here, in removing the sheath from the artery and vein, notice should be taken of the little slip of cellular tissue which passes between these two vessels, and at the lower part of the dissection the small nerve (n. saphenus) which lies on the sheath under the inner margin of the sartorius should be carefully preserved. The adductor longus and pectineus muscles should now be cleared, as low down as can conveniently be done, without disturbing the vessels or the sartorius from their natural position; the portions of the psoas magnus and iliacus internus muscles on the outer side of the common femoral artery should also be clearly made out, and the anterior crural nerve, lying in the fissure between them, with its branches a little lower down, as well as the deep femoral artery and its branches, should likewise be displayed. The upper part of the thigh will now appear thus: the common femoral artery, lying upon the inner margin of the psoas magnus muscle, will be seen passing from under Poupart's ligament, nearly midway, as already stated, between the two points of bone to which this ligament is attached; about two inches lower down, it will be observed dividing into the deep and superficial branches, the latter of which passes downwards, under the sartorius muscle, whilst the former speedily divides into its different branches; the common femoral vein will be seen on the inner margin of the artery, and a little lower down the vein corresponding to the superficial femoral artery will be observed to occupy a similar position; but where these two vessels lie behind the sartorius, the vein will be nearly covered by the

artery; the anterior crural nerve will be seen, dividing a little below Poupart's ligament into its numerous branches, one of which, the nervus saphenus, will be noticed on the outer margin, or perhaps in front of the superficial femoral artery; the crural nerve will be observed to be separated from the main artery by a portion of the psoas; part of this muscle, and also of the iliacus internus, will be seen, and it will be further observed, that the whole of these textures are situated in a kind of triangular space, the three sides of which are formed by the sartorius muscle, the adductor longus, and the ligament of Poupart.

The dissection should now be conducted, so as to display the continuation of the superficial femoral vessels. The outer margin of the sartorius, about the middle of the thigh, should be slightly drawn towards the inner side of the limb, when, after a little dissection, between this muscle and the vastus internus the superficial femoral artery will be found on the anterior surface of the adductor longus; the inner margin of the sartorius may then be turned outwards, and it will be found as easy to reach the artery on this side as on the other. The sartorius, which has as yet not been disturbed from its natural position, excepting as above directed, should now be raised throughout its whole length, and turned to the outside, when the main vessels may be traced in their entire course on the anterior aspect of this part of the limb. The sheath should be raised from the artery, from where the vessel has already been uncovered, as low down as the aperture in the adductor magnus. Above, the sheath will appear as condensed cellular substance merely, but below it will be found to be formed of an aponeurotic expansion from the adductor longus muscle. The vein will be found behind the artery, and the saphenus nerve will be either on the sheath in front, or within it, in close contact with the artery. The anastomotica magna is the only branch of considerable size which is given off by the artery in this part of its course, and it will be noticed a little higher up than where the main vessel perforates the adductor magnus. If the sartorius muscle is now replaced, it will be observed to cover the superficial femoral vessels throughout a considerable part of their course.

The superficial femoral has on several occasions been observed to divide into two branches, as noticed by Sir Charles Bell, Dr. Houston, and others; but such an irregularity seems to be remarkably rare.

The common femoral vessels and the anterior crural nerve should now be cut across a little below Poupart's ligament, and turned downwards, when some of the branches of the deep femoral can be more clearly made out, particularly those which perforate the adductor muscles: by cutting these across and raising the superficial femoral vessels, the attachments of the adductors to the linea aspera can be examined, as also those of the psoas and iliacus to the trochanter minor. The gracilis muscle, and as much of the adductors as can conveniently be got at, should now be cleared, and after this has been done, and a glance taken at the rectus femoris, and the other extensors,

the examination of the anterior part of the thigh may be deemed completed.

The subject should now be turned on its face, to allow of the examination of the sole of the foot and posterior surface of the lower extremity. An incision should be made through the skin, from the heel along the sole, midway between its margins, as far as the root of the second toe, or, what will be better, as far as its point; another should be carried from the posterior extremity of this, three or four inches up the leg, over the tendo Achillis; a flap should then be dissected towards each side of the foot, and raised so as to show the posterior and lateral parts of the ankle, as well as a portion of the tendon above-named; the lower surface of the first and second toe should also be exposed, and a transverse incision made at the roots of the others, to allow the outer flap to be sufficiently turned aside: an incision beginning near the anterior extremity of the one along the sole of the foot, and ending at the point of each toe, will allow of the exposure of its lower surface. The skin on the inferior part of the os calcis and at the anterior extremity of the sole will be found remarkably thick and firm in its texture; these peculiarities being chiefly in the cuticle. The principal feature in the dissection will be the plantar aponeurosis, which will be observed to extend from the os calcis to the roots of the toes, where it is lost, much in the same way as is the palmar aponeurosis at the roots of the fingers. The membrane will be found of great strength about the middle of the foot; and at each side, though much thinner, it can readily be made out, covering the muscles connected with the great and little toe. In raising the skin from the os calcis towards the internal malleolus, some aponeurotic fibres will be remarked extending between these two parts, and if these be cut across about midway, the posterior tibial artery with its accompanying veins, along with the nerve which lies nearer the heel than the vessels, will be easily discovered after a few touches with the scalpel.

The plantar aponeurosis should now be raised by cutting it across a little in front of its attachment to the os calcis, and turning it towards the toes. In the first part of this dissection the aponeurosis will be found closely connected with the flexor brevis muscle; towards the middle of the foot, however, the two can be readily separated. The aponeurotic fibres, towards the outer and inner margins, can scarcely be raised along with the more fully developed fibres in the centre; they may, therefore, be removed separately.

The posterior tibial artery should now be traced into the sole of the foot: between the malleolus and os calcis it will be observed to be covered only by the integuments and the transverse fibres already alluded to; but in the sole, it is covered by the flexor brevis digitorum, which should, therefore, be cut across at its connexion with the os calcis, and turned towards the toes, so as to allow of the branches being distinctly made out. At the inner margin of the flexor brevis, the vessel will be seen dividing into two,—the external and

internal plantar: the former will be seen passing obliquely towards the outer margin of the sole until it gets between the flexor brevis and abductor minimi digiti muscles, where it alters its course, and passes obliquely towards the inner side, to join the anterior tibial between the metatarsal bones of the two innermost toes; the internal plantar will be observed to pass along the fissure between the flexor brevis communis and the muscles of the great toe, and will in general be found to give off, in addition to small twigs in its course, branches to supply the lower surface of the great toe, and the inner margin of the second. The external plantar artery gives off numerous branches in its course, and, from the convexity of its arch, those arise which form the digital twigs of the small toes. When the foot is minutely injected the arteries in the sole appear very numerous, and of considerable magnitude; many branches can be dissected in the dense granular substance between the skin and aponeurosis; these anastomose freely with each other,—with some from the upper part of the foot, as well as with others, deep in the sole, and if care be taken to preserve a number of them, this part of the body may be made to appear as if covered with a meshwork of arteries of a somewhat formidable-looking character. With the exception, however, of the posterior tibial and its two plantar branches, the vessels in this situation are of little or no surgical importance. The further examination of the foot may be postponed until the dissection of the posterior surface of the leg is completed.

An incision should next be made along the mesial line of the posterior surface of the thigh and leg, from opposite the middle of the femur as low as that already made over the tendo Achillis, and the skin with the subcutaneous cellular membrane should be turned to each side, so as to expose a portion of the aponeurosis of the thigh and that of the leg. In raising the skin from the latter part, the posterior saphena vein will be remarked extending from below the malleolus externus as high as the popliteal space; in the lower end of its course a small nerve (communicans tibialis) will be discovered near it, which may readily be traced, with the branches of the vein, below the outer ankle upon the back of the foot. In elevating the inner flap small veins may be noticed passing to join the internal saphena, and this vein itself may now perhaps be more completely seen than hitherto, as it courses along the inner and upper part of the tibia. The aponeurosis of the leg will be remarked to be continuous with that of the thigh; and both will be observed to be of considerable strength, more particularly the latter. An incision should next be made through these sheaths to the same extent as that originally made through the skin, to allow their being turned to each side with that texture.

Attention should first be directed to the popliteal space, which, when the aponeurosis is raised, will be more distinct than it has hitherto appeared. The tendon of the biceps, which has been in some degree obscured by a very strong portion of the aponeurosis, will be observed on the outer side of this space; the tendon of the

semi-tendinosus, part of the semi-membranosus, of the gracilis, and of the sartorius muscles, will be seen to form its inner margin: above, the space is bounded by the apposition of the biceps, semi-tendinosus, and semi-membranosus, and below by the junction of the two heads of the gastrocnemius externus. On raising the fat and cellular substance which partly fill up this hollow, the first important texture met with is the popliteal or posterior tibial nerve, which will be found passing nearly in the mesial line from above downwards, throughout the whole space: if a slight dissection be made on the inner margin of the tendon of the biceps, the peroneal nerve, which, a little below, forms the anterior tibial, will readily be displayed: these two nerves will probably be found in close contact in the upper end of the space; at the lower part the posterior tibial passes under the gastrocnemius muscle; the anterior passes along the inner and posterior margin of the tendon of the biceps, behind the outer head of the gastrocnemius, and perforates the peroneus longus immediately below the head of the fibula.

The next objects of importance in the dissection of the ham should be the artery and vein, which will be found nearly in the middle of the space, lying considerably deeper than the posterior tibial nerve: the vein will be first noticed; it is in close contact with the artery, and both are surrounded by condensed cellular membrane. These vessels may be traced as far up as the aperture in the adductor magnus muscle; and, in the present stage of the dissection, as low down as the gastrocnemius, where they disappear with the posterior tibial nerve. In the above dissection several lymphatic glands will perhaps be observed, the junction of the posterior saphena with the popliteal vein may be noticed, and several small arteries and veins (the sural) may be traced from the main vessels into the gastrocnemius muscle. The articular branches will be better seen at a future stage of the dissection; at present the superior only can be made out; and these may be observed passing in contact with the femur above the condyles, each to its own side of the knee.

The gastrocnemius and peroneus longus muscles should now be dissected throughout their course, and the two heads of the former being then cut across, its fleshy belly should be turned downwards, so as to bring the soleus into view. The tendon of the plantaris gracilis will be met with between these two muscles, and should also be cut across. The soleus should now be dissected, and the extent of its attachment to the tibia and fibula examined; the tendinous structure on the upper margin of the muscle midway between the two bones of the leg, with the continuation of the popliteal vessels and nerve, passing under or in front of it, must also be observed. The course of these important structures may now be more completely perceived, the gastrocnemius muscle having been raised, which, as will be remarked, covered them for some distance. The posterior tibial nerve will be seen in close contact with the vessels, though a little on their outer side, and the artery, still covered by the vein, will be found lying upon the popliteus

muscle: the two inferior articular arteries may now be readily made out, and by turning the main trunk a little to one side, the articular branch which passes into the back part of the joint may also be seen. The soleus muscle should next be raised, by cutting its attachments to the tibia and fibula, and turning it downwards. The deep fascia will thus be brought into view; at its upper part it is but thin; but in the lower-third of the leg it is of considerable strength. This membrane should now be raised by cutting its attachment to the tibia and turning it outwards, when the deep layer of muscles, with the posterior tibial vessels and nerves, will be exposed. The division of the popliteal artery into the anterior and posterior tibial branches should now be made distinct; the former should be traced forwards between the bones, to the part where it has already been dissected (p. 239), and the latter should be traced as low down as the ankle; it will be accompanied with two veins, and the nerve will be found on its fibular side throughout its whole course. The fibular artery will be observed passing from the posterior tibial, a little below the division of the popliteal; it soon arrives in contact with the fibula, when it passes under the flexor longus pollicis, which muscle must either be raised at its inner margin and turned outwards, or, what will be better, cut through at its attachment to the fibula, to permit a full view of this vessel. The tibialis posticus, flexor longus communis, and flexor longus pollicis muscles, should now be separated from their connexions with the bones and interosseal membrane, and then cut across a little above their respective tendons; the gastrocnemius and soleus muscles should also be cut below their junction; the peroneus longus and brevis should then be dissected from their connexions with the fibula, and divided two inches above the lower end of this bone; and the remaining anatomy of the foot may either be examined now or after the dissection of the upper part of the thigh and hip; but as the tendons and ligaments are less perishable than the remaining soft textures; and as it may be of moment to examine the muscles, and other soft parts, in a fresh condition, the dissection of the back of the thigh had better now be continued.

An incision should be carried up the thigh, from the upper end of that already made for the display of the ham, in the mesial line as high as the trochanter major; the knife should then be turned towards the sacrum, and the incision brought to terminate over the lower extremity of this bone; the instrument should next be carried from this point upwards and forwards along the crest of the ilium, as far as the anterior superior spinous process, when, by dissecting the skin to each side of the thigh and hip, the remainder of the aponeurosis may be displayed. This membrane is so thin over the gluteus maximus, that it will probably be raised with the skin; but between the large trochanter aud the anterior part of the crest of the ilium it is remarkably strong, and gives a dense covering to the gluteus medius. The fibres of the gluteus maximus should now be cleaned, and the fascia removed from the muscles in the back of the thigh. The gluteus

should next be cut through within an inch of its attachment to the pelvis, and turned downwards and forwards; the handle of the knife with a few touches of the blade will readily separate it from the subjacent parts: the extensive attachment of the upper portion of the tendon of this muscle to the aponeurosis of the thigh should be noticed, and the large bursa under that part of the tendon which covers the trochanter major also deserves attention. The various important structures under this muscle should now be examined. The loose cellular texture over the posterior margin of the gluteus medius should be raised, and, in order to get a complete view of the whole outer surface of this muscle, the portion of aponeurosis connected with it in front should be dissected off; the connexion between the two will be found most intimate. Immediately below the posterior margin of this muscle, the pyriformis will be observed; a little dissection will display the latter through all its course outside of the pelvis; the point of the finger may be run between the two muscles, and at the upper extremity of the division the gluteal artery will be easily discovered. The course of the great sciatic nerve may next be examined. It will be found passing out of the pelvis under the pyriform muscle, extending down the back of the thigh nearly in the mesial line. Some small branches of nerves will be found passing from under the pyriformis at the same part; these come from the main trunk a little higher up, and proceed to the skin in the neighbourhood: the sciatic artery will also be found in the same situation. The gemelli muscles, the tendon of the obturator internus, and the quadratus femoris should next be displayed; the conjoined head of the biceps and semi-tendinosus, and the semi-membranosus muscles, should also be made distinct. The gluteus medius muscle should now be dissected from the os innominatum, when the gluteus minimus will be brought into view; a large branch of the gluteal artery will be found between these two muscles, and if a little dissection be made at its origin, a more perfect view of the main trunk, where it is passing out of the pelvis at the upper part of the sacro-sciatic notch, will be obtained. Lastly, the common pudic artery may be displayed on the posterior surface of the spinous process of the ischium, where it runs, for a space, outside of the pelvis.

The hamstring muscles should now be cut through in the middle of the thigh, when the posterior surface of the adductor magnus will be more completely exposed; the attachments of this muscle to the pelvis and femur having been examined, and notice taken of the tendinous aperture through which the superficial femoral vessels pass, as well as of those smaller ones occupied by branches of the deep femoral, an incision may be made through the different textures surrounding the middle of the femur, and the bone divided with the saw.

The upper half of the femur can now be conveniently moved at will, and the examination of the remaining anatomy of the hip should be completed. The large glutei muscles should be cut away, and the

loose ends of the various muscles which have been divided should also be removed or cut short; the upper part of the adductor longus, the adductor brevis, and the pectineus, should now be cut through, either at their attachments to the pelvis or the femur, and then the obturator externus may be dissected; the quadratus femoris must also be divided ere the tendon of this muscle can be traced to the digital fossa behind the trochanter major. The tendons attached to this fossa should next be divided, when the posterior part of the capsular ligament of the hip-joint will be brought into view: the gluteus minimus should be raised so as to display the upper part of the capsule, when by turning the subject, and dividing the iliacus internus and psoas muscles a little below Poupart's ligament, the anterior surface of the capsule will next be exposed. In dividing the two last-named muscles, a bursa of considerable size will be noticed between them and the margin of the pelvis; in some instances a communication exists between it and the interior of the joint. The attachment of the capsular ligament to the margin of the cotyloid cavity and to the neck of the bone should next be displayed; the knife should then be carried round the head of the femur through the capsule, when it will start out of its place, being no longer connected with the pelvis, excepting by means of the round ligament, which will be seen attached by one extremity to the bottom of the cotyloid cavity, and by the other to the central depression on the head of the bone. The section of the capsular ligament will show that it is of great strength at the upper and outer parts of the joint, and the reverse at the lower and inner sides. The round ligament being divided, the prolongation of the synovial membrane on the neck of the femur should be examined, and the manner in which this portion of the bone is covered by a strong fibrous texture, apparently a reflection of part of the capsular ligament upwards, should also be carefully observed. When these instructions are followed out, and a glance taken at the cotyloid cavity,—due notice being taken of its additional depth in consequence of the presence of the ligament which encircles its margin,—the examination of these parts may be deemed complete for the purposes in view.

The remaining portion of the lower extremity must now be referred to, and the articulations will chiefly demand attention. As it is of little consequence which of the joints is first dissected, that of the knee may be selected.

The popliteal vessels and nerves may first be removed; and, in doing so, the branches given off by the artery in this situation may be traced. The main trunk will be observed to lie on the posterior ligament of the articulation, and this band of fibres will be seen to be a reflection of a portion of the tendon of the semi-membranosus muscle: in addition to this structure, however, the synovial capsule will be observed to be covered with additional ligamentous fibres, passing in various directions from one bone to the other. The ligament of the patella, the anterior surface of this bone and the tendon of the rectus should next be cleaned; the tendinous expansions of the vasti mus-

cles should then be taken off the anterior and lateral parts of the joint; the lateral ligaments should then be displayed; the inner one will be easily dissected, as will also be the long external one; the short fibrous structure a little behind the latter cannot on all occasions be clearly discerned, however, and at best the display of a second external lateral ligament requires a very artificial dissection. The point of the knife, and then the finger, may be pushed across behind the ligament of the patella, and notice should be taken of the considerable quantity of fatty substance lying between the ligament and synovial membrane. The interior of the joint should now be exposed by dividing the tendon of the rectus, the crureus, and sub-crureus, about an inch above the patella: here, in all likelihood, a large bursa will be found between the sub-crureus and the femur, which may communicate with the synovial membrane; the knife should be carried downwards through the capsule on each side as far as the lateral ligaments, when on throwing down the patella a large extent of the interior of the joint will be exposed, more particularly if it be put into a state of flexion. Whilst in this position, a portion of the synovial membrane, which will be seen attached to the femur in the hollow between the condyles, may be observed passing forwards and expanding on the inner surface of the fatty substance between it and the ligament of the patella, forming on each side of the mesial line a transverse margin, which projects in the space between the femur and tibia:—these are the ligamentum mucosum and the ligamenta alaria. By cutting these textures away, and bending the knee to its greatest extent, the anterior surface of the crucial ligaments may be exposed: if the dissector wishes to see them from behind, the posterior ligament of the joint must be removed, and in order to get a more complete view of them, the lateral should also be cut through, so as to leave the femur and tibia connected by the crucial ligaments only. The two bones may now be separated by dividing these textures, and after an examination of the semilunar cartilages, and the transverse band of fibres between their anterior extremities, (which is far from being regular in its appearance and size,) attention may next be devoted to the ankle.

The various tendons which pass along the ankle-joint should now be more carefully examined than in the early stages of the dissection. Those passing in front, and the manner in which they are bound down by transverse fibres (anterior annular ligament) may be first noticed: the tendon of the extensor proprius pollicis, and those of the extensor communis and peroneus tertius, will be observed to pass in pretty close contact with each other, whilst that of the tibialis anticus runs in a distinct and separate sheath. On the inner and posterior side of the joint the tendons of the flexor longus pollicis, flexor communis, and tibialis posticus, will each be found in a separate groove, bound down by strong fibres: at first, however, the two latter tendons run in the same groove. On the outer side, the tendons of the peroneus longus and brevis will be found behind and below the malleolus externus; and on the posterior part of the joint, but about an inch se-

parate from it, the tendo Achillis will again be noticed passing to the posterior and upper part of the os calcis.

The further course and insertions of these tendons may be examined either at present, or after the ligaments of the ankle have been dissected. For the latter purpose they must all be turned aside. The internal lateral ligament (deltoid) will be found passing from the apex of the malleolus in a radiated manner downwards, to be attached to the astragalus, and partially to the os calcis; it will be observed to be of very considerable strength in its middle and back part, and anteriorly it will be seen to extend some distance forwards on the astragalus. The three external lateral ligaments will be found attached separately to the extremity of the fibula, the anterior of the three being connected to the astragalus, the middle to the outer side of the os calcis, and the posterior spreading out to be attached in part to the tibia, astragalus, and os calcis, forming an irregular fibrous covering to a considerable portion of the back of the ankle-joint. A few additional fibres may be noticed on the posterior aspect of the joint, covering the loose synovial capsule, and a few may also be made out on this membrane on the fore part of the articulation. The different ligaments and synovial capsule should now be divided, when the manner in which the astragalus is locked into the space between the malleoli will be noticed.

The foot being now separated from the bones of the leg, the attachments of these to each other should next be examined. The interosseal ligament, as the dissection has previously been conducted, will require little additional cleaning. The aperture in it, through which the anterior tibial artery passes, will now be more fully brought into view. A few fibres will be seen on the anterior and posterior aspects of the articulation of the head of the fibula to the tibia. The best method of examining the interior of this joint will be to cut the fibula across with the saw, and then carry the knife from below upwards between the bones; when the fibula is almost separated, the thin partition between the articulation and that of the knee will be remarked: the synovial membrane of the latter joint passes so far down on the outer side of the head of the tibia, and that of the joint now under examination is in such close contact with it, that the partition between the two is formed solely by the junction of these membranes. Occasionally a communication exists in this part between the two articulations. The lower extremity of the fibula is much more firmly connected with the tibia; a strong broad band of fibres can be made out in front, and another of almost equal strength and dimensions behind, and, in addition, if the two bones be separated by cutting from above, they will be found firmly adherent, by means of numerous short and strong transverse fibres situated between them.

The articulations in the foot may now be dissected. The various tendons, which were laid aside previously to the dissection of the ligaments of the ankle-joint, should first be traced to their attachments (if this has not already been done), when the ligaments can next be

displayed. On the upper part of the foot the bones of the tarsus are joined to each other by numerous short ligamentous fibres, of no great strength, however, compared with those on the lower surface of the arch. In this situation a strong fibrous structure will be found, passing from the anterior and lower part of the os calcis, to be attached to the cuboid, and to most of the other tarsal bones. This ligament runs in close contact with the arch, and all the tendons and other soft structures are below it (*i. e.* nearer the skin), with the exception of the tendon of the peroneus longus, which is kept in the groove in the cuboid bone by some of its fibres, which in this situation may be traced forwards, to be attached to the metatarsal bones of the three outermost toes. On the inner margin of the tarsus, a strong band of fibres will be observed between the scaphoid and internal cuneiform, apparently a continuation of part of the tendon of the tibialis posticus, and on the outer a tendinous structure may be seen, stretching from the tubercle on the posterior part of the os calcis to the projecting extremity of the metatarsal bone of the little toe. This structure may either be considered as a part of the abductor minimi digiti, or as a ligament. The fibrous bands on the upper and lower surfaces of the articulations between the tarsus and metatarsus, should next be examined; and when this is done, the different bones should be separated from each other. The metatarsal bones should first be cut for those of the tarsus, and the oblique course of this line of articulations, with the projection of the internal cuneiform bone, should be carefully noticed; the scaphoid and cuboid bones should then be divided from the astragalus and os calcis, and each bone may then be separated from the others. A very strong ligament will be found between the lower surface of the astragalus and the upper surface of the os calcis, and the other bones will be found to be connected by numerous fibres, which, however, are too small to be described as separate ligaments.

The articulations between the toes and metatarsal bones should next be dissected. The sesamoid bones, lateral ligaments, synovial membranes, and fibro-cartilaginous texture under each joint, will appear, in most respects, like the corresponding parts in the hand, and it may now be remarked how very long the small toes appear when contrasted with their condition previously to dissection, the whole of the proximal phalanx having been actually covered by the soft tissues.

The phalanges of the toes will be observed to be attached to each other in a similar way to the corresponding parts in the hand.

CHAPTER II.

DISLOCATIONS.

DISLOCATIONS of the lower extremity may now be taken into consideration. Such injuries are of rare occurrence in the toes or between the metatarsal bones, and, indeed, even in the tarsus the only displacement that can be looked upon in this light is when the astragalus is thrown out of its natural position,—an accident which, comparatively speaking, is but rarely met with. Separation of the articular surfaces from each other is by no means unusual, but in general the destruction of the soft parts, as also of the bones, is so great, that the injury should with propriety be looked upon as a contusion of a most serious character, which may endanger the safety of the foot, and possibly necessitate amputation.

The great toe and its metatarsal bone are liable to a kind of displacement of a slow and gradual character, constituting a condition whose real nature has occasionally been overlooked. The disease is termed "Bunion." In some individuals the distal extremities of the metatarsal bones have a considerable tendency to separate from each other; and as more latitude of movement is permitted on the outer and inner margin of the foot than in the other bones, any inconvenience which may result therefrom is experienced in these situations. The distal extremity of the metatarsal bone of the little toe is occasionally somewhat prominent, but seldom causes much inconvenience; in the great toe, however, the spreading out of the foot causes the end of the metatarsal bone to appear so prominent, that this condition is often mistaken for an organized tumour on the inside of the articulation. The swelling is occasioned almost solely by the end of the metatarsal bone, whose projection inwards is rendered more conspicuous by displacement of the toe itself, which slopes off from the metatarsal bone towards the other toes, so as to make the distortion more prominent. The feet of the female opera-dancer are always distorted in this way; the displacement being, doubtless, occasioned by the frequent habit of poising the body on this member, and thus producing a "fantastic toe," of a very different description from that to which the phrase usually has reference. The skin over the projection is generally thinner than in the natural condition, the internal lateral ligament more elongated, and in some instances the head of the bone is enlarged; it occasionally happens, however, more particularly during inflammation of the surface,—a condition to which it is remarkably subject, in consequence of pressure,—that the soft parts actually seem to be thicker than in the natural state. The inflammation may be in

the skin only; it may, however, extend to the joint, or in some instances its effects may be most conspicuous in a bursa, which is sometimes present in this situation. The disease is exceedingly troublesome, more particularly if ulceration is present,—an event which is by no means unusual,—for then even the slightest pressure (which is at all times annoying) cannot be borne; but unless the joint becomes permanently affected, no active surgical means beyond those usually adopted in local inflammations are required; rest and the horizontal position will be of the utmost consequence if the latter disease be in a state of activity, and, under ordinary circumstances, a shoe made of soft upper leather, and so constructed as to save the part from pressure, should always be worn; no further special instructions seem necessary here, and I will therefore only caution the young surgeon not to mistake a swelling of this kind for a tumour of another character, and resort to an operation for its removal, which will reflect great discredit on his professional character.

The drawing (fig. 132) exhibits an example of the kind of swelling referred to. The tumour in this case was slightly inflamed, but there

Fig. 132.

was no ulceration present. There are few feet where such a projection is not more or less conspicuous, and that here exhibited is below the average size of what is so familiarly known under the title of bunion; it seems, therefore, sufficiently strange that the true nature of the disease should ever be mistaken; for in many instances the skin over the end of the metatarsal bone is actually so thin as to permit the outline of its shape to be most distinctly felt, when the fingers are placed over the part.

The phalanges of the toes are liable to various forms of displacement and distortion, from the pressure of overtight shoes, for which no remedy but that of avoiding the cause will be of any avail; indeed, in

most instances the cause is overlooked, and continued until its avoidance will not be of much benefit. One of the most troublesome displacements caused in this way is that when the toe next the great one forms a sharp angle upwards, and the skin over it becomes affected with a corn, which is even more troublesome in this situation than on other parts. The projection is usually seen at the junction between the two proximal phalanges; it seems to occur most frequently in the originally well-formed foot, in which this toe is a little longer than the others; and though I believe that a short shoe is generally the cause of the displacement, I imagine that there is a natural tendency to it, from the slender shape of the part and the influence of the flexor and extensor muscles. The latter seem to draw the distal extremity of the first phalanx upwards and backwards, whilst the former apparently have most effect on the furthest end of the toe, and, by drawing it downwards, increase the displacement. It is seldom that the surgeon is consulted in cases of this kind; the operation of dividing the flexor tendons immediately under, has been proposed, and I believe the anticipated results might be greatly facilitated were the extensors also cut across above the root of the toe. By using a small knife, such as that afterwards depicted, and taking care to avoid the joints, no danger can result from such operations. Two months ago I was consulted in a case of this kind, which the patient himself (a legal gentleman) considered congenital, his father's foot being affected in a similar manner. I divided the flexor tendons, with the knife referred to, immediately under the proximal phalanx, put a small piece of wood below the toe, and with some turns of a narrow slip of adhesive plaster kept the two united, when, in a few days, the part was as straight as that on the other foot, and the cure was complete. Sir Astley Cooper refers to a case of a similar kind. The greatest trouble with the toe in this condition is commonly from the pressure of the upper leather of the shoe; but I have seen the part so much bent under the foot, that the patient requested amputation of the offending member, which was accordingly performed.

The astragalus is occasionally thrown out of its position, under the influence of a similar kind of force as that which would, in other instances, produce fracture of one or both bones of the leg, or displacement of the whole foot at the ankle-joint. Perhaps in general a greater power is required to detach this bone from its strong connexions with the os calcis, and force it from under the tibia and fibula, than would occasion any of the injuries alluded to; yet I have known it driven partially from its position, by a degree of violence which was supposed to have caused merely a simple twist or sprain. The bone is almost invariably thrown forwards, in front of the external malleolus; in some rare cases, the integuments are not wounded, but in general a portion of the bone projects, and sometimes it is, in a manner, completely detached from all its connexions. In the museum at King's College there is an astragalus preserved, which was thus forced out of its situation, and the surface is completely divested of

all fibres and ligaments, as if the dissector had carefully removed them with a knife.

From the manner in which the bone is protected by the malleoli, it is barely possible that displacement outwards or inwards can occur, and it is very unusual to see it backwards. Mr. Benjamin Phillips has related two cases of the latter kind in the fourteenth volume of The Medical Gazette, and I have myself met with one instance. At first it was treated as a severe contusion of the ankle, and it was only after the swelling had partially subsided, and at a period when it was too late to make any attempt, with propriety, to replace the bone, that this feature in the case was discovered. An effort was subsequently made by a charlatan to put matters right by force, but it nearly cost the patient his foot. The bone projected so far back as to touch the tendo Achillis; yet although he was exceedingly lame for many months after the accident, I observed a gradual improvement, and have since heard that he has, in a great degree, recovered the use of the foot and ankle. There is a cast of this foot in my part of the collection at King's College: at a first glance it is difficult to perceive that anything is wrong; but, on a more careful inspection, the fulness in front of the tendo Achillis becomes apparent.

Dislocation of the astragalus, in any direction and under any circumstances, must be looked upon as a very serious injury; for although many instances have been seen where life and limb have been preserved, even under great disadvantages, it must be admitted that such satisfactory results have not always followed the praiseworthy attempts of the surgeon to avoid amputation.

Under ordinary circumstances, and if the case is seen soon after the accident, an attempt should be made to replace the bone, by pushing it with the thumbs into its natural position, whilst extending force is applied by pulling the foot downwards in the long axis of the leg; and should the effort succeed, the treatment may afterwards be conducted as if the case had been one of severe sprain: leeches, rest, warm or cold applications, anodyne, and stimulating liniments, with bandages towards the latter part of the attendance, may one and all be requisite, and probably the bandage with starch (to be afterwards more particularly alluded to) may be highly serviceable.

When the integuments are extensively wounded, and much stretched, as happens when the bone is thrown forwards, it may be a question whether an attempt should be made to push it into its natural position, or that it should be entirely removed. I should be inclined, under such circumstances, to adopt the latter practice, more particularly if the bone seemed but loosely connected to the neighbouring parts; indeed, it is scarcely possible to imagine it being otherwise; and were it replaced, it might act more as a foreign substance than in fulfilling the object to be kept in view, viz., that of bringing the ankle as much into its natural condition as the nature of the accident will admit of. The removal of the bone in the state of the

parts above described can be attended with little or no difficulty, and I believe that there will be more likelihood of saving the foot by this proceeding than by replacing it. The success of this practice has been so frequently proved, that in any instance of displacement of the bone, where the skin and other textures happened to be extensively stretched, although not torn or wounded, and where I found it impossible to reduce the dislocation, I should consider that there would be less risk were the bone cut down upon and removed, than if it were left in its new and unnatural position, more particularly if immediate union of the wound were effected, and great care were taken to subdue the inflammation likely to result from such an extensive injury.

I have met with one example of an unreduced dislocation of the astragalus forwards; the accident had occurred many years previously, and the person, an active old soldier, had regained a tolerable use of the foot and new ankle-joint, which was formed partly on the upper surface of the os calcis and posterior portion of the displaced bone; he required the use of a stick, however, and walked on the fore part of the foot, which was pointed downwards, like a person who has recovered from hip disease after dislocation of the femur, of which distortion there is a good illustration in page 268.

Dislocation of the foot at the ankle-joint is more frequently met with than the cases last alluded to; the foot may be thrown backwards or forwards, and in either example there can be no difficulty in perceiving its nature, by the increase or the diminution of the projection of the heel.

The first of these is represented in this sketch, (fig. 133,) in which

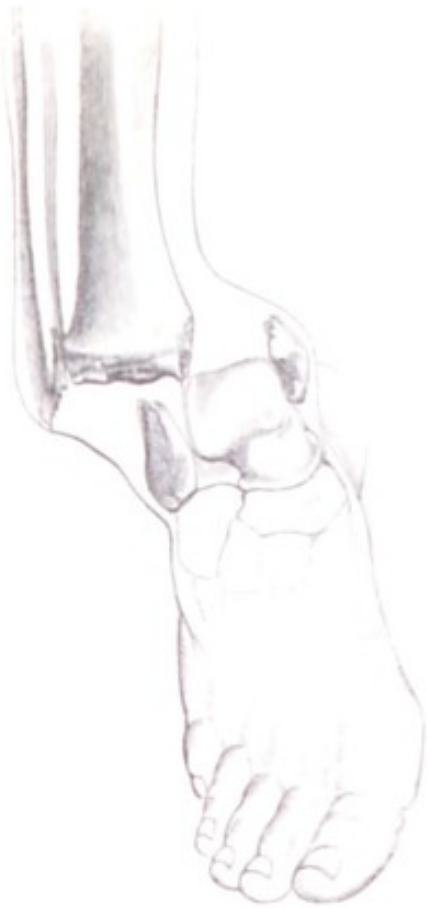
Fig. 133.

the distance between the ankle and toes is diminished, whilst the heel is more prominent than natural. The fibula is fractured above

Fig. 134.

the malleolus, and it will rarely be otherwise. Figure 134 shows the displacement of the foot forwards, the tibia resting on the upper and back part of the os calcis, the fibula being broken in this instance also. In both of these drawings the attitude is such as would most probably be present, although it might vary in many respects, which, however, require no particular comment at present.

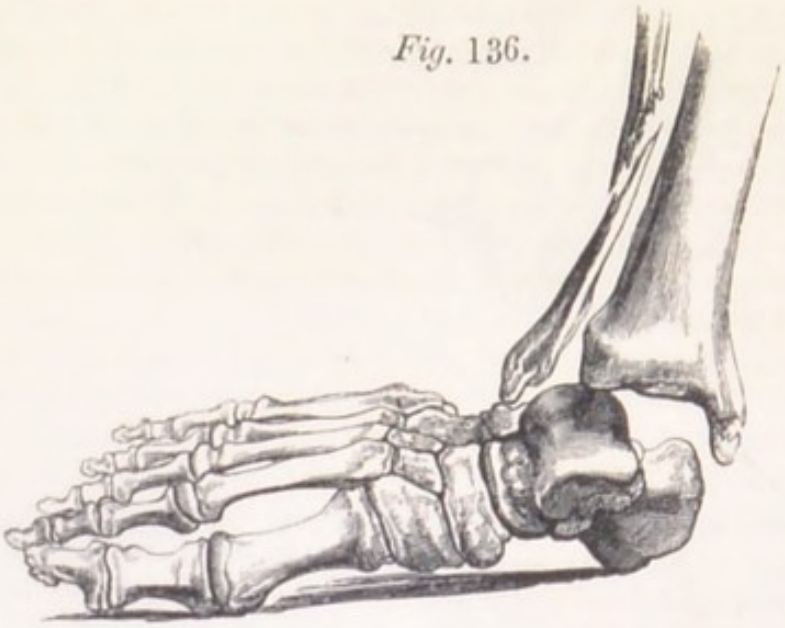
Fig. 135.



Such displacements as those above delineated are comparatively rare, and the same may be said of that of the foot inwards, the fibula and tibia being thrown to the outer side of the tarsus. In this case the malleolus internus will, in almost all instances, be broken; and in all probability the fibula will have suffered in the same way. The sketch at the side of the page (fig. 135) gives a kind of diagram of such a case, although were the parts so much displaced as is here represented, there would doubtless be wounds in the integuments, through which some of the fragments would project.

The most common kind of dislocation at the ankle, viz., that wherein the foot is thrown outwards, whilst the bones of the leg glide inwards, is represented in figure 136, in which, for the sake of distinctness, the distortion is made to appear more conspicuous, and the

Fig. 136.



separation greater, perhaps, than might be in reality: here it will be observed, that the fibula is broken higher up than in the preceding figures ; such an injury invariably happens in cases of this description (indeed it is not unusual to speak of the case more as one of fracture than of dislocation, however palpable the latter may be), and the malleolus internus is almost certain to be separated from the tibia. In the drawing it is represented as being still attached to the bone, though there is a slight fissure, but in reality it would probably be retained in its natural position below by the deltoid ligament.

The common principles of surgery will indicate the necessary proceedings in all these lateral dislocations at the ankle. Gradual extension, the foot being held at a right angle with the leg, with gentle movements at the joint, will enable the surgeon to effect reduction ; and the ordinary precautions to avert or subdue high inflammation being carefully attended to, the parts will, after due time, in a great measure recover their original power of resisting the varied and complicated influences under which the ankle-joint is exposed to injuries of the most serious description ; but I shall not dwell longer upon these cases at present, as I have again to allude to them in the chapter on fractures, to which I must refer the reader for further information.

Even in most instances of compound dislocation this fortunate result may be looked for, though in occasional examples of the kind the destruction of parts seems so great, and other circumstances are so unfavourable, that amputation appears the safest measure for the patient.

The great mass of evidence collected by Sir Astley Cooper seems to settle the line of practice to be followed in by far the greater number of injuries of the ankle-joint; whether the case be one of simple or of compound dislocation, or the latter, complicated with extensive wound of the skin, contusion, and laceration of the other soft parts, and even severe fracture of the bones in the vicinity, the surgeon is fully entitled to give the patient a chance of having his foot preserved. The pulleys may be applied to facilitate reduction, where much difficulty is experienced; loose portions of bone must be picked away; projections may be cut off with the saw or pliers, or the aperture in the skin may be enlarged with the knife; in short, any reasonable expedient may be resorted to in order to save the foot, which, whatever be its after condition, will in general be preferred, by most patients, to any artificial substitute.

Fig. 137.

In the example here represented (fig. 137), it was deemed expedient to remove the foot, in consequence of the apparent extent of injury to the soft parts in front of the joint; but the practice may seem very questionable, when, in the evidence above referred to it is proved, in some of the cases, that the patients actually stood and walked on the protruded end of the tibia, and yet most satisfactory recoveries followed. I fear, however, that in the attempts which have been made to save the foot, the results in all the cases have not met with the same publicity; that the instances where amputation has afterwards been necessary, or where death has been the consequence, have not also been recorded; and from what I have myself seen, I would caution the inexperienced practitioner from being over sanguine in anticipating a happy result in every example. Mr. Pott, in referring to fracture of the fibula, with displacement of the foot outwards, and protrusion of the end of the tibia inwards, has

stated that "when this accident is accompanied, as it sometimes is, with a wound of the integuments of the inner ankle, and that made by the protrusion of the bone, it not unfrequently ends in a fatal gangrene, unless prevented by timely amputation, though," he adds, "I have several times seen it do very well without."

In severe injuries of the ankle, the fibula has been separated from the tibia, but the accompanying fractures and dislocations have always formed the most conspicuous and serious features of each case. The upper extremity of the fibula has occasionally been separated from the tibia, but the accident is so rare, and being at the same time in all likelihood accompanied with fracture, that no separate comment upon it is here required.

The bones of the knee-joint may be displaced, in almost any direction. The patella will be drawn upwards, in the event of the accidental division or rupture of its ligament; and when the tibia and femur are thrown out of their natural position, this bone will also be more or less displaced. In some individuals, a very trifling force will cause the patella to slip in front of either condyle of the femur, parti-

Fig. 138.

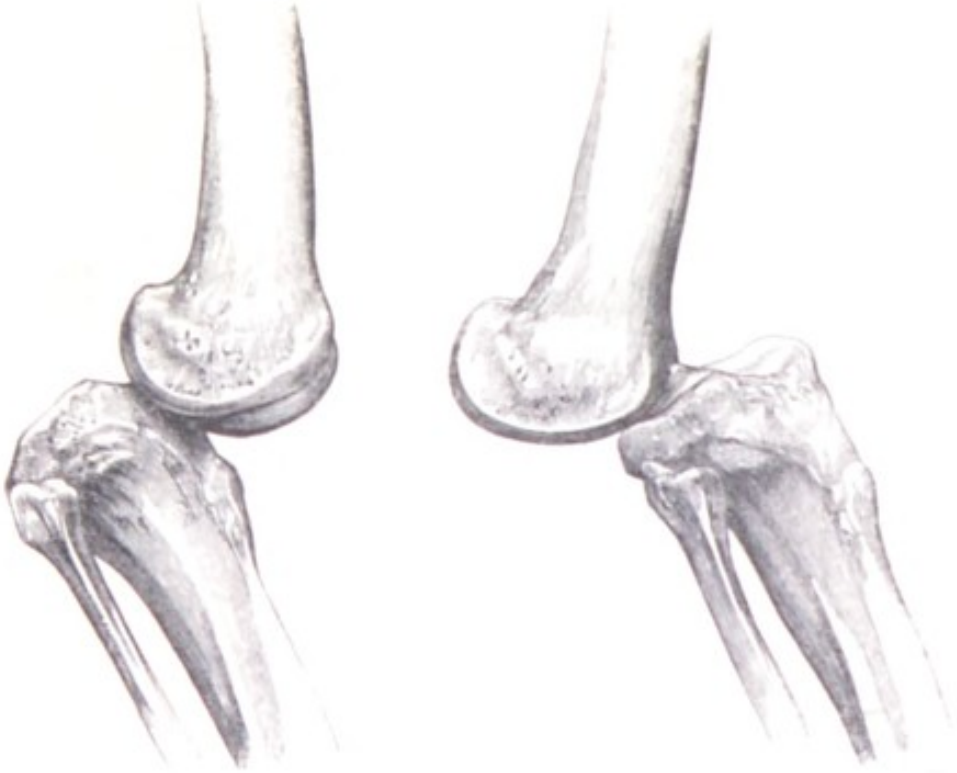
Fig. 139.

cularly when the limb is in a horizontal position, with the muscles on the fore part of the thigh in a relaxed state; I have known displacement occasioned, under these circumstances, by a child resting its foot on a person's knee, in stepping across to get out of bed. The drawings (figs. 138 and 139) exhibit the lateral displacements above

referred to; and unless there be great swelling, the nature of either case must be easily detected, in consequence of the prominence of the bone; nor is there much difficulty to be looked for in replacing it,—an operation which is accomplished chiefly by the thumbs, with which the surgeon forces the bone over the margin of the articular cartilage into its natural position. The necessary manipulations will be greatly facilitated by bending the body forwards, which will relax the rectus femoris muscle.

It has been found in instances where these simple means have failed, that violent flexion of the knee has brought the patella downwards from the external condyle on to the articular surface of the femur, when it has been immediately drawn into its natural position by the action of the quadriceps extensor. In a case of extreme obstinacy the ligamentum patellæ has been divided, but the operation did not seem to favour the desired result; however, a good anatomist, in any similar example, might resort advantageously to some subcutaneous section.

Fig. 140. *Fig.* 141.



The head of the tibia is occasionally driven off the condyles of the femur in a lateral direction, but seldom to any great extent, and when dislocation between these bones does occur, it is generally either backwards or forwards. It is hardly possible to state which is the more severe injury, both being certainly of the most serious description; perhaps that with the tibia forwards is the worst, as in addition to the

extensive laceration of ligaments and other textures which happens in either instance, the projection of the lower part of the femur backwards may overstretch and lacerate the popliteal artery. I have seen this happen in one instance, but in that case the displacement was such that the condyles of the femur were forced through the skin of the ham. The preceding figures (140 and 141) exhibit the displacements backwards and forwards, and those which follow (142 and 143) display the partial luxations laterally. The large bones have alone been displayed, as, if the patella had been left, or any of the soft parts, the young student might have had some difficulty in appreciating the nature of each. The limbs are here represented in almost straight positions, but in such extensive injuries it will not be difficult

Fig. 142.

Fig. 143.

to understand that the knee may be greatly bent, as is conspicuous in one of the casts at King's College.

In reducing dislocations of the head of the tibia, the extending force, whether by means of the hands or the pulleys, should be applied to the upper part of the leg, and it may be advantageous to fix the counter-extension on the pelvis, so as to avoid pressure on the muscles of the thigh, which might thereby be prevented from being relaxed or elongated, or perhaps might even be irritated into contraction. The difficulty in effecting the object of the operation will not in general be very great ; and, provided there has been no serious injury of the soft parts, or, in other words, no extensive displacement, a

recovery may reasonably be anticipated. The utmost care, however, will be required to avert injurious inflammation, which may, nevertheless supervene and terminate, as I have seen, in the loss of the limb or death of the patient. Indeed, when we consider the extent of injury, even in what is called a simple dislocation, and the dangerous nature of inflammation of this joint,—a process which must inevitably result from the accident, the question of immediate amputation may be very seriously entertained; and in most examples of compound dislocation, I think there can be little doubt that the safety of the patient is endangered by delay: the alternative is dreadful; but in my opinion, amputation is the least formidable of the two. Even in some instances of compound luxation of the knee, it may be reasonable to attempt to save the limb; and in partial displacements with no external injuries, a judicious surgeon would not for an instant entertain the idea of mutilating the body, until, in the progress of the case, circumstances should arise to compel him to adopt this last resource. Some years ago, I was consulted in a case of partial dislocation of this joint, which had occurred simultaneously with a fracture in the lower end of the femur. At first the injury was treated merely as fracture; in about six weeks, when the splints were removed, and the swelling had greatly subsided, the knee was observed to be remarkably stiff, and, for the first time, the inner margin of the head of the tibia was felt to project half an inch within the level of the corresponding condyle of the femur. Figure 143 shows such a displacement, although here the tibia projects a little more than in the case alluded to. I deemed it too late to attempt the reposition of the bones, but noticed in the course of time that the patient regained a fair use of the joint.

In some instances suspicions have been entertained, that pain and difficulty in moving the knee, accompanied with the feeling of something being between the bones, have been occasioned by displacement of one of the semilunar cartilages. Such cases have been described by Mr. Hey, Sir A. Cooper, and others; I have myself seen several supposed cases of the kind, and have observed an instance in the dissecting room, where one of these cartilages had been torn from its connexion with the tibia, throughout its whole length with the exception of its extremities, so that during flexion and extension, it occasionally slipped behind the articular surfaces; and this happening during life, as undoubtedly it did, must, at the very least, have caused considerable annoyance. The cartilage was flattened on its outer margin, and, when it passed behind the condyle of the femur, seemed to fit to the articular surfaces almost as accurately as the internal concavity does in the natural position of the parts. Such a displacement might possibly occur in some slight injury or awkward movement of the joint, (indeed, the cases which have been seen in the living body have usually been caused in some such way,) or it might happen with dislocation of the tibia; and, were the surgeon to detect its nature, the most reasonable treatment would consist in first endeavouring to

cause the cartilages to slip forwards, by moving the joint (flexion and extension); and, this being accomplished, restraining for a considerable time further extensive motion, by means of a bandage or leather cap, so as to give the moveable object a chance of becoming again fixed in its proper position.

Notwithstanding the vast natural strength of the hip-joint, as evinced in the shape of the bones and their adaptation to each other, the depth of the socket, and the great power of the surrounding muscles, dislocations are by no means uncommon in this articulation. The head of the femur may be thrown upwards on the dorsum of the ilium, or it may pass backwards, and rest on the margin of, or actually in, the sacro-sciatic notch; in other instances it may pass forwards and inwards so as to rest on the body of the pubes; and in some cases it passes forwards and downwards into

Fig. 144.

the obturator foramen. The precise spot on which the head of the bone rests is seldom the same in any two cases: upwards, for example, it has been found to range, in different instances, throughout every point between the anterior spinous processes and the sacro-

sciatic notch, and in the other directions, considerable differences in position have been remarked; in one example, the limb will appear much shorter, compared with its fellow, than in another: again, the toes or foot may be more pointed inwards or outwards in one patient than another, and all these circumstances, it will be perceived, indicate corresponding varieties in the position of the head of the bone.

Figure 144 exhibits the skeleton of the displacement upwards and backwards: the shaft of the bone (at the trochanter) would probably lie more completely over the acetabulum. Here the head may be in some cases a little nearer the anterior part of the crest, — perhaps immediately under the anterior spine, — possibly a little more forwards, or it may be further backwards, and either more downwards or upwards; of which, however, though examples of all such cases have been seen, I do not think it necessary to give pictorial illustrations.

Fig. 145.

Drawing 145 shows a rarer kind of displacement: here the head of the bone is hooked, as it were, upon the horizontal ramus of the pubes, having passed partly into the pelvis; but in luxation in this

situation, too, there may be some little variety, and in all probability the head will not in general be driven so deep.

In design 146 the head of the femur is lodged in the obturator

Fig. 146.

foramen; and here, perhaps, there is less difference in position observed than in the preceding examples: it may, however, not be so close on the pubes as here represented, but may occupy the opening more completely than it does in the drawing.

Some of these dislocations will be further illustrated in the succeeding pages.

In general there is little difficulty in detecting the nature of such injuries; nevertheless, either through ignorance or neglect, they are occasionally overlooked until it is too late to remedy the misfortune. Most surgeons must have seen deplorable cases of the kind, and I have met with many. In one instance the accident (a dislocation on the dorsum ilii of a very palpable kind) was complicated with fracture in the lower third of the femur; the case was treated as one of fracture, and the dislocation was not detected for some considerable time. After the fragments had united, several attempts were made to replace the head of the bone, but to no purpose, and the shortening of the

limb, between the dislocation and fracture together, was such as to render the patient very miserable, and unfit for all active pedestrianism. It may be doubted whether in this example the dislocation could have been reduced at the first, in consequence of the injury in the lower part of the thigh; yet it would have been creditable to surgery had its nature not been overlooked, and had some reasonable attempt been made to remedy the aggravated evil.

Fig. 147.

In the dislocation upwards on the dorsum ilii (fig. 144) the head of the femur is thrust under, into, or, it may be through, the substance of the gluteus minimus muscle, and rests about one inch and a half or two inches above the margin of the cotyloid cavity; the distance being in one example greater, in another less. The figure (147) gives a correct representation in outline, of the distortion of the limb, which appears shortened and bent at the joints, with the thigh sloping towards its fellow, the knee touching its lower third, and the great toe in contact with the metatarsal bone of that of the opposite side. The shortening of the limb will vary according to the position of the head of the femur; and though it is very characteristic of the accident, particularly when concomitant with the attitude here delineated, it should not always be relied on as a positive indication of this kind of displacement. The hip itself should be most carefully examined; and if the injury be such as that under consideration, it will readily be perceived that the trochanter major is nearer to the crest and anterior and superior spine of the ilium, than the same process is on the opposite side; and possibly the head of the bone may be felt in its new position: it will be observed, also, that all movements of the thigh on the pelvis are attended with pain and accomplished with difficulty, and that a slight degree of force will neither suffice to extend the limb to the length of its fellow, nor alter the apparent distortion of the hip. The contrast between this injury and that of fracture in the neck of the femur may be fully appreciated by a reference to one of the drawings illustrative of the latter subject, which will be seen in a future

page. Mistakes occasionally occur in the diagnosis between these accidents; but however discreditable and injurious they may be, the ignorance or oversight is less reprehensible than that which leads to the treatment of a disease of the hip-joint, as if the case were one of dislocation. Many instances of this description have come to my knowledge, and though they have in general occurred in the practice of the bone-setting charlatan, it is with regret that I cannot exculpate every member of the profession. I have known the mistake committed in the early stages of hip-disease, where there is scarcely a trace of resemblance between the cases; and if it takes place under such circumstances, it must be allowed that it is much more likely to happen at that period of the disease when luxation has actually occurred: indeed, so far as the shortening and attitude of the limb are concerned, and also the alteration in the shape of the hip itself, there is a great similarity: yet the points of difference are so glaring, that it is barely possible to imagine a surgeon being so much at fault. The distortion resulting from disease is not usually so much referred to as that occurring from violence: the accompanying drawing (fig. 148), from a cast in our collection at King's College, gives a good example of the kind, and though the subject of morbus coxarius does not come within the scope of this work, I conceive my present observations by no means irrelevant. Before the age of puberty, dislocation of the hip-joint from violence is an exceedingly rare occurrence, and hip-disease leading to displacement is equally rare after this period of life; even the affection itself is comparatively unusual after this age; but a knowledge of such matters should not induce the surgeon to form a hasty conclusion, as cases illustrative of the converse are sometimes met with.

Fig. 148.

I have lately had under treatment the most palpable case of sponta-

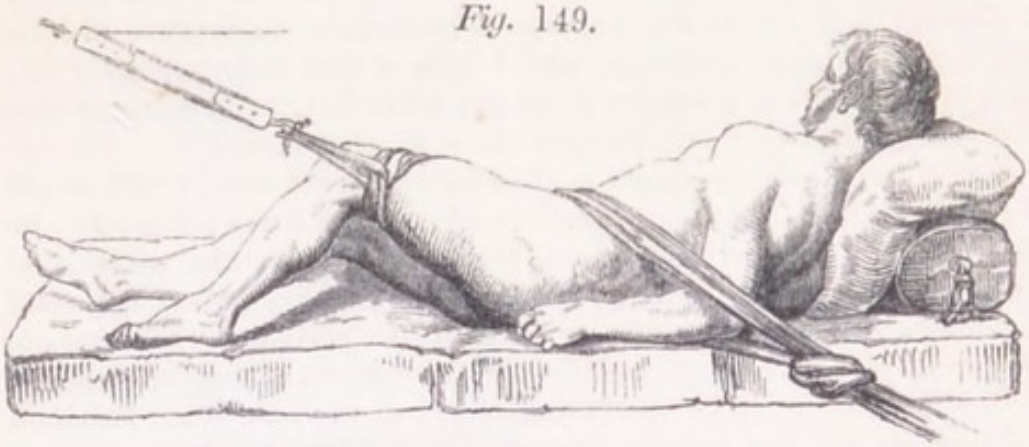
neous luxation in hip-disease which has ever come under my notice. A remarkably muscular man, about twenty-five years of age, had a large deep-seated abscess in the hip, which there was reason to suppose was connected, by an opening in the sacro-sciatic notch, with inflammation in the iliac fossa. In the course of three months, during which time he was confined to bed, several openings were formed in the loins to permit the escape of matter, and, latterly, the skin between the lumbar region and upper and back part of the thigh seemed one bag of fluid. For three weeks previous to death, he had suffered greatly from pain in the region of the hip, and would not allow the part to be touched;—indeed, he was so much exhausted that there was no inducement to make any attempt to examine the condition of the joint: during the latter period he lay with the thigh more bent upon the pelvis than ever, and the knee rested on the sound thigh fully four inches above the condyles of the femur; the trochanter appeared much nearer the anterior part of the crest of the ilium than previously, and a fulness on the dorsum ilii became remarkably distinct before his death. On examining the body afterwards, these latter features were all most conspicuous: and when the skin was elevated, the head of the femur was found in the situation represented in figure 144: the round ligament was softened and torn across; the capsular —or rather what remained of it—and also the gluteus medius and minimus, with the smaller rotator muscles, were soft, pulpy, broken up, and so infiltrated with pus, that they could scarcely be recognized, and the head of the bone, saving that the cartilage was absorbed, was otherwise as entire as if the displacement had resulted from accidental force. The cotyloid ligament had disappeared, but the margin of the cavity where the head had slipped upwards, although in a state of caries, was as prominent as in the healthy condition. It is usually considered that the bones undergo considerable changes ere dislocation occurs in such instances, and I believe that they generally do: most preparations in museums prove the latter fact, but I imagine that such examples as that just detailed are somewhat rare.

There are palpable features in the history of each case, which ought at once to lead to a correct estimation of its true nature; thus, in hip-disease, the patient will have been bedridden for months, perhaps for years, a sufferer from severe pain, which will have rather increased than otherwise from the commencement to the period of examination; the illness will have come on without any apparent cause; for although it may by the friends be attributed to a fall or some other accident, the surgeon will feel certain that immediate displacement could not have been produced thereby; on the other hand, in dislocations resulting directly from force, the person will have been exposed to some great violence, which has caused immediate lameness, and all the other symptoms of dislocation: if he has been neglected at this period, his sufferings, after the first few days, will have gradually diminished; and though the distortion will still remain as apparent as at first, (perhaps even more so, as the extremity becomes thinner, which it will

eventually do,) he will, in some measure, have acquired a slight use of the member,—at all events, he will not suffer as a patient with hip-disease does when the limb is moved, nor will he exhibit the extreme emaciation, and other marks of long-continued irritation, so characteristic of the sufferer from diseased joint; then, there will have been no suppuration, no sinuses, as in the case of spontaneous affection;—but I shall pursue the subject no further at present; and were it not that I had repeatedly seen instances where the wretched victims of hip-disease had been subjected to all the horrors and violence of attempts to return the femur to its proper position,—as is done with propriety in common luxation from force,—I would not have dwelt so long on a subject with which every tyro should be conversant.

Reduction of dislocation on the back of the ilium is seldom attended with great difficulty, though in general a powerful force is required to effect it; in addition, it may be well to relax the muscular action by administering a solution of tartarized antimony, while the patient is kept in a warm bath for half an hour before the operation is commenced, and during the period of extension the sudden abstraction of fifteen or twenty ounces of blood from a vein in the arm will greatly facilitate the object of the surgeon. One or more of these auxiliary measures may be omitted if the accident is of recent date; but if reduction is attempted after the lapse of several weeks, they ought invariably to be resorted to. If the pulleys are at hand they ought always to be applied; for, though manual efforts alone may suffice in some instances, the whole proceedings will be more satisfactorily conducted under the steady force which can be brought into play by such a powerful apparatus. The patient, as here represented (fig. 149),

Fig. 149.



should be laid on his uninjured side, on a hair mattress placed on the floor; a table-cloth folded lengthwise should be passed under the perineum, and its two ends should be fastened to some firm object in the floor or wall, so as to be somewhat below the level of the patient's body. To prevent galling, a folded towel should be put between the cloth and the perineum. Another table-cloth, similar to the above

should now be fixed by its middle to the lower part of the thigh, (and here also, to prevent mischief to the skin, a few turns of a roller should be previously made round the limb,) and its ends should be joined by a firm knot. The cloth will most likely be too thick to be received into the hook of the pulley, and some smaller object, such as a towel, handkerchief, or bit of strong cord, should be linked on, to which the pulley may be fastened. Instead of a table-cloth for the thigh, an apparatus of iron and leather (the zonula of Hildanus) has been constructed for the purpose of giving attachment to the pulley; but I recommend in preference to either the skein of worsted spoken of at p. 166. When this is properly fastened by the clove-hitch (p. 153) to the thigh, a little above the knee, the hook of one pulley should be attached to it, and that of the other to some holdfast in the wall, directly opposite to the fixed extremity of the cloth under the perineum, in a line parallel with the long axis of the thigh, which will consequently cross obliquely that of the body, as seen in the drawing. I have recommended that the stay under the perineum should, at its extreme point, be fastened below the level of the hip, and that the end of the pulley most distant from the body should be fixed somewhat higher, in order that extension may be applied without disturbing the oblique line into which the femur has been thrown by the injury. The manner of fixing the two extremities of the whole apparatus is of more importance than some may imagine: thus, if that connected with the thigh is too low, when the extension is applied, the pelvis is forced towards the floor; and on the other hand, if too high, the trunk is actually raised from the mattress, so as to form, as it were, part of the cord between the two fixed points. Nothing can be more unpleasant than to perceive the body of the unfortunate patient swinging to and fro during the efforts of the surgeon; but yet this condition is not so objectionable as the other. I prefer having the patient near the floor, but the same proceedings may be conducted on a firm table, in which case the fixed points must be high in proportion. In private practice it may be difficult to procure those fixed points in an apartment, and I must, therefore, beg attention to my remarks on this subject at the chapter on dislocations of the shoulder; indeed, so requisite do I consider these *points d'appui*, that the pulleys should not be considered complete without some such contrivance as the staple or screw, of either of which a couple should be as regular an accompaniment of the pulleys as is the cord.

In the theatre of a hospital the case is different; a variety of rings, placed in the walls at different heights and at different sides, are essential appendages, and I have not seen anything more ingenious for this purpose than the plan in King's College Hospital, where two of the pillars at opposite sides of the area of the operating theatre are of iron, square in shape, and notched on one side; a ring is attached to the pillar by means of a kind of sheath, which can be slid up or down at pleasure, and, being accurately fitted to fill up each or any

notch into which it is desired to put it, can be fastened in an instant by slipping a little iron wedge between it and the smooth side of the pillar opposite to the notches. Each pillar is about an inch and three-fourths in diameter; it is fastened to the floor below and a strong rail above, and can withstand any reasonable degree of force; and as it occasionally happens during the reduction of a dislocation, that it is necessary to move the ends of the apparatus upwards or the reverse, the movements can be much more readily accomplished with this mechanism than by undoing one or more knots, as would be required, if a rope or towel were made use of.

The apparatus for extension and counter-extension being adjusted, the surgeon, having desired his assistant to commence, places himself at the patient's pelvis, and, by frequent examination with his eyes and hands, ascertains the progress of the attempt. As the assistant continues to pull, the trochanter major, or perhaps the head of the bone, can be perceived gliding gradually downwards, and the descent will be greatly facilitated by moving the thigh in a rotatory manner on its long axis, which can be readily accomplished by laying hold of the leg at the ankle, and carrying the foot upwards and downwards. In most examples that have come under my notice, I have observed that the extending force alone has been sufficient; but in some I have seen advantages derived from passing a long towel under the upper part of the thigh, with which the surgeon has endeavoured to raise the head of the femur over the margin of the cotyloid cavity, by pulling in a transverse direction to the force already in use, at the same time placing his foot on the pelvis by way of counter-extension. I believe that this method, in some instances, facilitates reduction; but feel satisfied that continued extension at the same time is necessary, and I have less faith in sudden and eccentric movements producing benefit in this dislocation than in most others. The sudden snap, jerk, or shock which, when the reduction is accomplished, usually is observed by both patient and surgeon, sufficiently indicates the success of the effort, and if, when the apparatus is slackened, the movements at the joint can be easily effected,—the distortion has disappeared,—and the opposite sides are symmetrical, there need be no further doubt; the patient should then be carried to bed, and kept quiet for several weeks, until the parts have adhered and regained some considerable strength.

In some instances, where the displacement has existed several weeks, I have known it necessary to repeat the attempt at reduction, the first having completely failed; and though I have frequently seen them to be equally useless, I have in some observed the most happy results. A surgeon, therefore, when he can reasonably hope to benefit his patient, should not at once give up a case as beyond his power merely because he fails in the first trial: circumstances may be more favourable on a second attempt a few days afterwards; indeed, I may say a few minutes in some cases, as I have known an effort succeed, with the hands alone, within the lapse of a short space of time

after the pulleys had been used to no purpose. The muscles in some individuals will make greater resistance to extension than in others, and the patient seemingly either cannot or will not relax them; in almost all, however, long-continued or repeated extension will at last prove superior; and in some persons, after the pulleys have been used for a considerable time, and when perhaps the rope has been relaxed in despair, a kind of collapse will supervene, when the muscles will become so flaccid, that a very slight degree of force, compared with that previously applied, will produce the desired effect.

The dislocation of the head of the femur into the sciatic notch, differs in no material practical point from that last referred to: it is caused by much the same kind of violence: the attitude and appearance of the limb are in many respects similar, the chief difference being, that the shortening is not so great, though the limb is shorter than its fellow by half an inch or more; that the trochanter and head, especially the latter, are not so distinguishable, or, if they are, they will be perceived to be a little further backwards and downwards than in the other instance; and that in the effort at reduction the transverse force is particularly requisite from the commencement, to facilitate the escape of the head of the bone from the notch, as also to assist in raising it over the margin of the acetabulum. I know of no better method of applying this force than by using a long cloth, which, when passed under the thigh, should, with its ends fastened, be slung round the surgeon's neck, whilst he is in a stooping posture, so that, if he rests his foot on the pelvis and gradually raises his shoulders, his whole strength will, in a manner, be available, if required. I need scarcely point out to my readers that much violence is often necessary in these attempts, and I think it would be incorrect to conceal the fact; for, however easily reduction may be accomplished in some instances, it must have been observed by all who have had much experience in such practice, that in the majority of cases big drops of moisture have stood on the brow of every one actively concerned, before success has been attained.

When the head of the femur rests on the pubes (fig. 145), the whole limb is everted, the knee is slightly bent, the trochanter is less prominent than natural, and the displaced part can be distinctly felt in the groin under Poupart's ligament. One would imagine that a displacement of this kind could scarcely be overlooked, yet specimens of false joints formed in such cases are to be found in every museum, and afford convincing proof, either that such injuries are neglected by the patient, or overlooked by the surgeon.

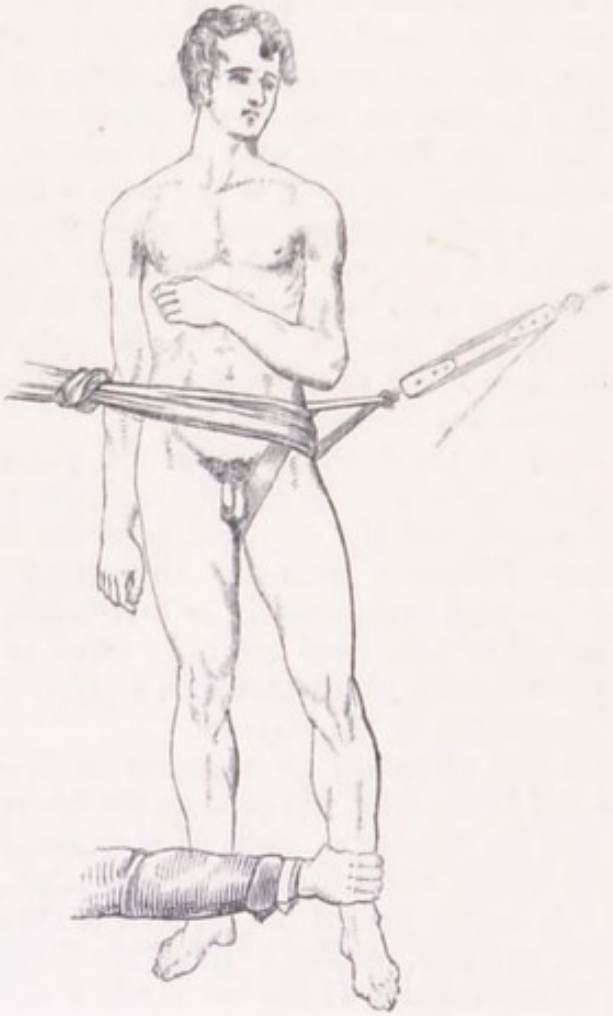
The apparatus and extending force applied as described for dislocation upwards and backwards, will produce the desired effect in this instance also; and the transverse force, as recommended to assist in raising the head of the femur from the sciatic notch, will here be of equal service; for, as the patient lies on his side, the thigh-bone requires to be lifted upwards, perhaps even a little forwards, as may be imagined from an examination of the cut referred to, into its natural

position, and indeed, perhaps, this force is more essential in such a case than extension.

The displacement into the thyroid foramen is probably the most rare that occurs at this articulation; like the rest, it too seems to be overlooked in some cases.

The attitude somewhat resembles that of the kind last referred to; but the limb is more bent on the pelvis, considerably elongated, and, as it were, thrown downwards and forwards. The flatness of the hip, the sinking of the trochanter, and the natural condition of the pubes, contrasted with the dislocation last-described, will sufficiently indicate the true nature of the case; and besides, as was very distinctly observed in an instance that occurred to me in Edinburgh, a degree of swelling may be noticed in the upper and inner part of the thigh, occasioned by the head of the bone in its new situation. Extension can scarcely be deemed requisite in effecting reduction in this case: I am inclined, however, to recommend a slight degree of it, as the patient's body can thus be kept more steady. Transverse force must then be applied in the manner above-described, and in all likelihood the parts

Fig. 150.



will speedily be adjusted; far less energy being seemingly required in this case than in any of the others. If the head of the bone cannot be raised by the single efforts of the surgeon, he may either employ additional hands, or, what will be better, apply the pulleys, in the manner represented in figure 150. The strap on one side serves to fix the pelvis, whilst that on the other, when the pulleys are in action, answers the double purpose of raising the head of the bone and of a fulcrum, on which, by carrying the limb towards its fellow, the femur is moved as a lever, whereby the desired object is facilitated. Occasionally, instead of keeping the patient's limb in an extended posture, it may be advisable to bend the thigh upon the trunk, or to make him sit upright, as used to be done by Kirkland and Hey, with the body so placed against a bed-post or upright pillar, as to constitute a fixed point or fulcrum in the perineum, around which the displaced bone may be so twisted as to cause its head to slip backwards into its natural position. I have seen an upright pin, like the remora of Hildanus, or the scalmus on the scamnum of Hippocrates, nine inches long, placed in a stout table intended to be used for such purposes, and I find that, at the London Hospital, where these injuries occur more frequently than at most other similar establishments in the metropolis, it is customary to fix a pillar of wood into the floor, (a hole being provided for its reception,) which is used in the manner above referred to.

These observations are intended to convey an outline only of dislocations of the hip, and the methods of reduction; but as the nature of this work will not permit me to dwell at greater length on the subject, it is to be hoped that, combined with a knowledge of anatomy, which will point out the kind of resistance to be overcome, and a moderate share of mechanical knowledge, which will indicate the natural direction of the force required to cause the head of the femur to retrace its course, little difficulty will be experienced in making up such deficiencies as must be the necessary result of these brief descriptions.

For the hip there have been fewer different methods described than for the shoulder; and this may, probably, be accounted for by the fact, that until towards the end of last century, little accurate knowledge obtained of such cases; Wiseman wholly denied and disbelieved in such luxations; and although Heister quotes Hippocrates and Zwinger on the subject, and describes the method of reducing the different kinds—"upward, downward, backward, and forward," he evidently had no clear ideas between the displacement in hip disease, and that resulting from violence. I cannot quit this subject, however, without calling attention to my remarks on the various means of reducing luxations of the head of the humerus. I would not have the surgeon invariably to persist in one mode for each kind of displacement; he ought here also to be guided by that common-sense, which is so essential a feature in the practice of good surgery.

Although I have strongly recommended the pulleys in such cases, I do not deem them absolutely necessary in all; indeed, as already stated, I have known the hands of the surgeon alone succeed, when other and more violent means had failed; I am therefore not surprised at the proposal of M. Colombot to reduce such luxations by the hands only, although I shall take leave to express my doubt as to the superiority of the practice. This gentleman places the body and limb in a favourable position for relaxing, as much as possible, all the muscles which may be supposed to oppose or prevent the return of the head of the bone, and then by using the femur as a lever, and moving the limb in all directions, the reduction, during some fortunate chance, is accomplished. A similar method is known to have succeeded in the shoulder; and it has been affirmed, too, that an accidental twist of the thigh, received by a person falling over the gunwale of a boat, has caused the head of the bone to pass into its natural position, after dislocation had existed for more than a year.

With reference to the most distant date at which it will be proper to attempt these operations, I shall here also call attention to my remarks on this subject, in regard to the shoulder. I have myself seen attempts made in various instances of old standing, but have not witnessed a successful effort beyond the period of three weeks. Sir Astley Cooper has described instances of a more fortunate kind, after the lapse of four, five, six, and seven weeks; and I should certainly deem it quite correct to make trial of all reasonable means, at a much longer date than this, although, after two or three months, I should not be at all sanguine of a favourable result.

I purposely omit any particular allusions to congenital luxations of the hip, as not coming, strictly, within the scope of this work.

CHAPTER III.

FRACTURES.

FRACTURES of the lower extremity are, generally speaking, more serious in their nature than those of the upper, being accompanied with more danger to limb and life, and much more trouble in their treatment.

In the foot such injuries are comparatively of rare occurrence; and when they do happen, the destruction of the soft parts is usually so extensive, that each case must be considered more as a contused and lacerated wound of all the textures around, than as a fracture, whether simple or compound. One or more of the toes may be thus injured by heavy weights, as may be noticed in coal-heavers, quarrymen, stone-masons, and others similarly exposed; and, as amputation is the only reasonable resource in most of such cases, the question of greatest importance for consideration will be with reference to the seat of operation. Unless the tarsus be involved in the injury, the idea of amputating the foot ought not to be entertained; and as a general rule, applicable here as in most other parts of the body, the smallest possible degree of mutilation ought to be inflicted, consistent with the object of the operation, which is, to remove such parts as are irrecoverably injured, and, at the same time, leave a properly-formed stump. In instances of fracture in the foot where there is no necessity for resorting to the knife, it is scarcely requisite to use any apparatus to keep the fragments in apposition; in the toes the phalanges are so short, that if properly adjusted at first, they will remain so, unless the patient injudiciously bears his weight on the foot at too early a period; even in the longer metatarsal bones, I have not found it necessary to apply splints; leeches, with warm fomentations at first, and complete rest of the foot for twenty days afterwards, having constituted the most important parts of the treatment.

The bones of the leg are greatly exposed to all injuries likely to produce fractures, and such cases form a large proportion of those that are met with in ordinary practice.

It is not usual to find the fibula broken, and the accident unaccompanied with other injuries; such cases occur occasionally, however, and I have seen a well-marked instance of the kind where the bone was broken about four inches below its head, by the person falling against the margin of a step, so as to squeeze the outer part of the leg forcibly against it. In such a case there is little or no displacement, and the fracture can be discovered only after very careful manipulation; there is no necessity for splints, as the tibia gives the most complete support, provided the patient is careful to give the limb sufficient rest. The fibula is sometimes broken in the lower third,

whilst the tibia remains entire, and the injury is often attended with severe contusion; but experience testifies what the relative position of the bones sufficiently denotes,—that unless a fracture or displacement of the tibia exists at the same time, there cannot be much separation between the fragments of the fibula. The most common seat of fracture in this bone is about four inches above its lower extremity; and here the displacement is generally considerable, as the accident is almost invariably attended with dislocation of the tibia inwards on the astragalus, or, as the injury is sometimes called, luxation of the foot outwards. The kind of injury referred to will be best exemplified by figure 136, in the preceding chapter; the displacement is commonly occasioned by the weight of the body pressing the tibia downwards after the fibula has been broken; and the internal lateral ligament of the ankle-joint giving way, allows the malleolus to project, although in some instances this process is broken off close to the shaft of the tibia, and remains nearly in its natural position. In the latter event, however, the distortion is less remarkable than is represented in the cuts. In either case the injury is a complicated one, as the ankle-joint is involved: yet it is satisfactory to know that serious results rarely follow; for, with the exception of a certain amount of thickening and stiffness, with perhaps a slighter degree of prominence than that represented in one of the sketches, p. 304, no ultimate inconvenience remains.

The tibia, notwithstanding its great proportionate bulk, is, from its functions and more exposed position, much more liable to fracture than the fibula; and, though I believe it is less frequently broken by itself than some imagine, this injury will, doubtless, constitute the most important feature in the case. The bone may give way in any part of its extent; the malleolus internus may be broken off by itself, as usually happens in the different displacements of the foot already described, or it may be complicated with fracture of the fibula, as already explained, and is here well illustrated in figure 151. Sometimes it is shattered into various portions in its lower third, as was the case in the next example (fig. 152) taken from a patient of mine who died from the effects of a severe fall some days after the accident. Maceration caused the fragments to separate, but during life there was no such displacement, and the annoyance did not seem greater than might have been expected from a violent sprain. The preparation was kept chiefly with the view of satisfying certain sceptics, who, without such a proof were put before them, might contend that a vertical fracture cannot take place, although such an occurrence here, as well as in the upper end of the bone, at the condyles of the femur, and, indeed, in almost every bone, must be admitted by every one in the least acquainted with the pathology of such injuries. In one instance the fracture will run straight across, or in another it will be more or less oblique; sometimes the skin and other soft parts will be lacerated, and the bone laid bare, or a fragment, usually the upper one, will project through the surface; again, the contusion and destruction of

all the textures may be such as to render recovery impossible; and the ankle-joint, as has already been stated, or even the knee-joint itself, though this happens but rarely, may be implicated. I have said that in a fracture in the leg, where the solution of continuity is disco-

Fig. 151.

Fig. 152.

vered to be in the tibia, it will constitute the most important feature in the case; and, indeed, unless the fracture in the fibula be very palpable, I deem it cruel towards the patient to make any particular examination, which may put him to additional pain, to ascertain the fact; for a knowledge that this bone is also broken will not make the case appear much more serious in the eyes of the surgeon, nor will it cause any material difference in the method of treatment. I have often heard the question put, "if," in a case of fracture of the tibia, "the fibula was also broken?" and I have not deemed the parties who had set the limb less skilful nor less worthy of confidence because they could not give a precise answer; undoubtedly the tibia may be broken

whilst the fibula remains entire, but in such a case there evidently cannot be much displacement; and in the majority of fractures in this situation, I believe that both bones give way, the fractures being either opposite to each other as is seen in figure 153, or at a considerable distance, as in figure 154, where the tibia is represented as

Fig. 153.

Fig. 154.

broken a few inches above the ankle, and the fibula near its upper extremity. It is in such an example as this last that the difficulty of detecting the injury of the latter bone is found to be greatest; and here, too, it may at once be perceived that the accident to the fibula bears a very trifling proportion to the more palpable and formidable fissure in the tibia; indeed, in this instance the condition of the fibula was not known till examination after amputation, which I performed many weeks after the accident, in consequence of the injurious effects of phlegmonous erysipelas. Figure 151, on the preceding page, was considered a simple fracture above the malleolus externus; gangrene su-

pervened, and it was only after amputation that the tibia was discovered to be injured. In the case illustrated by figure 153, the fracture besides being compound was otherwise so palpable, that there was no doubt that both bones had suffered, and that, moreover, amputation was imperatively necessary. These cases occurred in my own practice years ago in Edinburgh, and, with others illustrating the same subject, now form part of the collection at King's College.

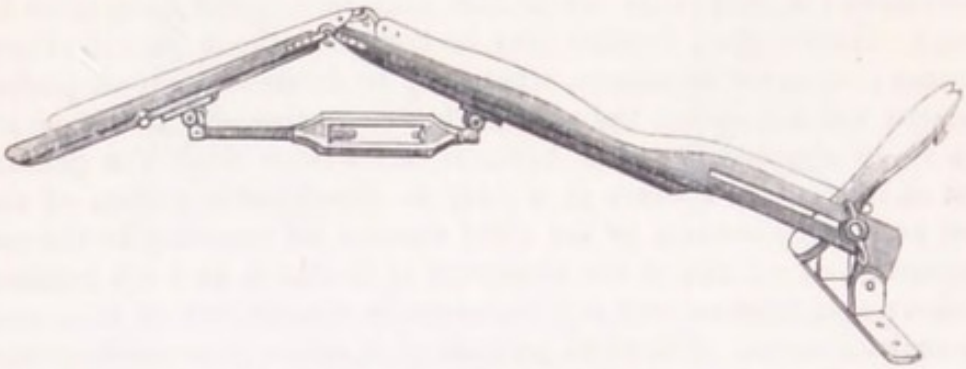
Many different methods have been devised and recommended for the treatment of fractures in the leg, and each plan has had its advocate as being superior to all others. Experience, if common reflection does not, will point out to the young surgeon, that what may answer well in one case will not do so in another; and, indeed, the circumstances are so different, in the various cases of this kind which may come under his treatment, that he will soon have reason to feel astonished that certain methods should have been recommended in preference to all others, as being best adapted for the treatment of all fractures in this part. In one instance he will find that the treatment may be conducted satisfactorily without the slightest trouble, and in another he may discover that all his care and ingenuity cannot avert unpleasant or unfortunate results: there may be serious contusion and injury of the surrounding soft parts; there may be laceration of the skin, and compound fracture; the fissure in the tibia may be oblique, and the fragments, two or more, may have a constant tendency to become displaced; there may be great irritability of the muscles, particularly during the early part of the treatment; great restlessness of the patient, or unwillingness to submit to the requisite confinement,—in short, a vast variety of circumstances likely to cause difficulty in the treatment, or, at all events, to induce an unprejudiced practitioner not to persist in any individual method, when common sense, or the ordinary principles of his profession, (the two ought to be deemed synonymous,) should point out to him that some other plan must be pursued. Sometimes a fracture may be treated without the aid of any appliance; on other occasions, what may be deemed the most perfect apparatus will not enable the surgeon to be so successful in his treatment as he could wish; and here, in accordance with the general object of this work, I deem it a duty to direct the attention of the junior part of my readers to the chief reasons for resorting to the use of apparatus, or splints, in the treatment of fractures, as I am inclined to believe that false notions are occasionally entertained of their real purposes and value. The chief purpose of a splint is to enable a surgeon effectually to keep the fractured surfaces of a broken bone in the closest apposition during the time requisite for reunion, and its value will consist, in a great measure, in the manner in which it does so, and in the protection which it gives to the limb against the various casualties to which the latter may be exposed during the treatment, either from muscular contractions, from sudden and unexpected movements on the part of the patient, or from external sources. The daily practice of surgery, or a slight acquaintance with pathology, points

out that the fragments of a broken bone will unite without the aid of splints; but a conclusion should not be drawn from this, or from the fact that instances may be frequently seen where fractures in the leg are treated without them, that all cases of the kind should be managed in the same manner; nor, on the other hand, should it be supposed that such a machine has any other effect, when properly applied, than the purposes briefly pointed out above. It may perhaps appear supererogatory to remind even my youngest reader, that nature alone effects the formation of callus and the union of the fragments, and that a splint is of no further value than what has been already stated, or, in other words, than in giving that degree of rest and security to the fragments, which experience has proved to be so essential to the well-doing of a fracture: I have been induced, however, to be thus explicit, as it has occasionally appeared to me that some parties, (even in the profession, I am sorry to say,) have had no very clear notions of the actual, and merely mechanical utility of such apparatus.

In all fractures of the leg, whether of the fibula or tibia individually or of both; whether there is displacement, or not even an inclination to it; and whether the fracture be compound or simple;—in short, if the limb be in any condition such as to induce the surgeon to make an attempt to save it, I decidedly give the preference to that form of apparatus so ingeniously improved by Mr. Amesbury, by the late Mr. M'Intyre, of Newcastle, and to the still more simple form recommended by Mr. Liston, which latter seems to me well calculated to supersede all methods hitherto in use in the treatment of such injuries.

The splint (fig. 155) consists of a thigh and leg piece of sheet iron,

Fig. 155.



and a foot-board of wood; the former are joined to each other by a couple of hooks, and a screw, which is so placed that the two plates can be set to any angle at which it may be desirable to bend the knee, and the foot-board is affixed in such a manner that it may be slid upwards or downwards to suit the length of the limb, and fastened by a side-screw in any position that may be desired. At the lower end of the machine, there is a cross plate of iron, which is so

attached that in the event of the foot being raised or depressed, it will always rest flatwise on the mattress, or a board placed at the foot of the bed, for the purpose of supporting it. In treating a fracture of the leg with this apparatus, the patient must be kept in bed for three or four weeks at least, however favourably union may seem to go on, and due regard should therefore be paid to his comfort during this irksome confinement. With a down or feather bed it will be almost impossible to keep the limb and body in a satisfactory position, and a hair mattress will be found best suited to the object in view.

Previous to placing the limb on the splint, the latter should be covered on its upper surface with a folded towel, of a corresponding breadth, which should extend from the point of the foot-board to the extremity of the thigh-piece: a thin wool or hair cushion may be used instead; the object of either being to protect the skin from fretting. The limb, slightly bent at the knee, may now be placed on the splint, with the ham resting opposite to the junction of the leg and thigh plates, care being taken to apply such a degree of extending force as shall bring the fragments into the most favourable position: these things being done, the foot-board should next be placed against the sole, and fastened at the most convenient angle; a calico bandage should then be applied so as to fix the foot, leg, and thigh, to the whole apparatus; and in doing this it may be necessary to stuff in little pads of tow, lint, cushions of hair, or folds of cloth, between the towel and the splint, or to place some of these in front of the leg, to facilitate the proper adjustment of the fragments.

If the pads and cushions can be dispensed with, the handiwork will always look neater, and possibly, too, the surgeon will have less trouble in the re-adjustments, which their presence will almost always render frequently necessary: in many instances, however, they seem absolutely required, not only to assist in keeping the fragments in proper apposition, but also to prevent partial pressure, either from the weight of the limb, or the tightness of the bandages.

In some examples it is desirable to leave that part of the skin over the injury uncovered for a time, probably eight or ten days; and in all cases of compound fracture, where suppuration may be expected, this is clearly requisite; indeed, in many examples the surgeon must be guided more by peculiar circumstances which may require corresponding treatment, than by any general rules which can be set down in such a work as this.

By comparing the limb with its sound neighbour, a tolerably correct idea may be formed as to its shape; and, when once all the parts are properly adjusted, it rarely happens that much future trouble is experienced: on this score, however, much will depend on the nature of the fracture, the patient's condition and constitution, as well as upon those exigencies and casualties to which every one is at all times more or less exposed, and which, one and all, may serve to make the treatment difficult, to retard it, or even to set at nought the best efforts of the surgeon.

From day to day the position of the fragments must be carefully examined: occasionally a bandage must be loosened or tightened, or some little change may be necessary to obviate undue pressure on any particular point. The heel suffers most in this respect, and injury is best obviated by a just adaptation of stuffing under the lower third of the leg, by which the weight of the limb is diffused over a great extent of surface, instead of being allowed to press upon one part only. It is customary to keep the knee slightly bent, this attitude being most agreeable to the patient; but it will occasionally be perceived that the broken end of the upper fragment has a tendency to rise, and, by fretting the inner surface of the skin, endangers the safety of the limb by exciting suppuration and ulceration. I have known simple fractures thus converted into compound ones, and in several instances have seen the worst possible results ensue.

To obviate the dangers above alluded to, the foot should be placed nearly on the same level as the knee; the leg, from the knee downwards, should be kept a little above the level of the sound limb by placing a square block of wood under the lower end of the splint; or it may be found most convenient to keep the latter almost straight, and allow it to rest on the mattress. In the early years of my practice I was induced, from education and example, to consider the double-inclined plane as the most eligible method of treating all such fractures as have lately been referred to; within these few years, however, I have often had good reason to doubt the advantage of this system in all cases, as well as to admire the comparative comfort afforded to the patient, by placing the whole limb, from the hip downwards, nearly on the same line with that of the sound side. The apparatus above recommended will answer in any attitude which will be found most convenient, whether as a double-inclined plane, as a horizontal plane from the knee to the foot, or from the hip downwards: the screw will regulate the relative positions of the leg and thigh plates, and by having the foot-board so constructed that it can be made, at the will of the surgeon, to slope outwards or inwards, in either of which positions he can counteract any tendency to displacement or twisting in the opposite directions, the apparatus seems to me as simple and efficient as any with which I am acquainted. I have often thought that an erroneous idea is too prevalent that such a splint can only be used with propriety when the knee is kept in the bent position; but, from what has been stated, it will be observed that it may be used under any circumstances.

In certain fractures it will be found difficult, with the ordinary foot-board, to prevent the toes turning outwards or inwards, particularly in the latter direction; but with one, such as has lately been adapted to this splint, having a kind of hinge near the heel, which permits of lateral movements, these difficulties will be more readily overcome than by the usual means of pads placed alongside of the foot, which here, as in other parts of the limb, always convey a certain

aspect of clumsiness and insecurity by no means agreeable to the eye of the practised surgeon. I have now made use of this foot-board for some time at King's College Hospital, and deem it a considerable addition to a splint already so generally efficient. In most examples of fractures of one or both bones of the leg, little or no trouble is experienced in keeping the foot in its natural position, as it may be but slightly, if at all, distorted; in many, however, and more particularly if the distortion is chiefly occasioned by actual dislocation at the ankle, it may be very troublesome indeed to prevent the toes from turning inwards or outwards. With the common foot-board, a pad on the inner or outer margin of the foot is, with the additional aid of the roller, the only means in the surgeon's power to keep the foot aright; but, without meaning to deny that the best of cures may be accomplished in this way, I am inclined to think from my own experience, that lateral movements in the foot-board will be found highly advantageous, when there is great disposition for the toes to turn inwards or outwards, to counteract such tendency.

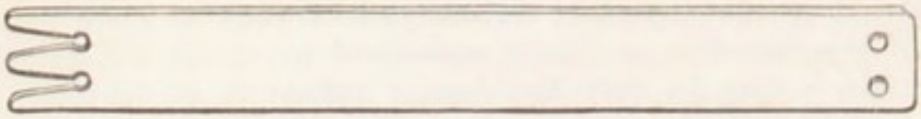
In fractures of one or both bones of the leg, accompanied with partial or complete dislocation of the foot at the ankle, as described in previous pages, the above apparatus with the common foot-board, or that just recommended, will almost invariably produce every good result which the surgeon could desire. Notwithstanding the utmost care, the malleolus internus will sometimes be found to project considerably inwards, after union has been completed; and this condition may be attributed in some degree to the deficient means of extension afforded by the ordinary splints in use: but on this subject I must refer to the description, in a future page, of a form of apparatus which will in a great measure, in my opinion, obviate all further difficulty on this score.

With slight modifications in the adjustments, all fractures of the leg, whether with or without dislocations at the ankle, may be most efficiently treated as directed above; and although, from my own experience, I give these means a preference, it must not be concealed from the young reader, that there are many others in constant use among different surgeons, which at the end of the treatment evince the skill and tact of the practitioner in a manner equally satisfactory. As it is not within the scope of this work to describe, or even to enumerate, all these methods, I must refrain from doing so, even were it in my power, or within the compass of my knowledge, to point out all the little differences in apparatus and in treatment which may be witnessed in a cursory glance at hospital or private practice in different parts of the country. I cannot, however, omit referring particularly to two other plans, which the surgeon may occasionally, from necessity or desire, resort to with every prospect of advantage.

The splint above described may not be at hand, but a very simple substitute may be provided with little difficulty. A piece of

wood, cut in this shape, (fig. 156,) forms the splint, which proved so efficient in the hands of Dupuytren: its length should be such as to

Fig. 156.



extend from the knee to four inches beyond the foot: its breadth about three inches,—thickness about half an inch. When properly laid along the inner or outer margin of the leg, it gives a sufficient support to the fragments; and, being placed opposite to the side on which the foot is thrown, the distortion can be remedied with a few turns of the bandage between the foot and the projecting end of the splint. A thick cushion is required between the leg and board, particularly towards the ankle, both to fill up the natural hollow on either side of the limb here, as also by separating it from the foot, to give a better purchase over the distortion. The limb may either be kept straight, or it may be bent at the knee, as was particularly recommended by Pott.

A surgeon may often find it convenient to use a splint of this kind, and the ample experience of Dupuytren sufficiently attests its utility; but it must be allowed that the fragments cannot be considered so securely placed as when the injury is treated on the machine first recommended. I have occasionally seen in using this board that it was difficult to keep the lower fragment and the foot in a proper position, and it has seemed to me that, either in the bent or extended position of the limb, there has been a disposition in the fragments to project forwards at the seat of fracture, over which it has been difficult to exercise any sufficient controul.

Within the last ten years, many surgeons, more particularly among our continental neighbours, have advocated a method of putting up fractures of the leg, by means of bandages and starch, in such a manner as to obviate the necessity for any of the ordinary splints or other more cumbrous apparatus. The fragments being properly set, the limb is enveloped, from the toes to the knee, by many turns of a calico roller, which is wetted with a thick solution of starch: when the latter becomes dry, a firm case is thus formed around the leg, which fits it accurately on all sides, and, provided it be sufficiently thick, prevents any future displacement. The chief advantage claimed for the plan, I believe, is, that, instead of the patient being kept in bed during four, five, or six weeks, as in the ordinary method of treatment, he can be allowed to move about the apartment almost as soon as the starch is dry.

In instances of simple fractures of either bone, I have occasionally given this method a trial, and entertaining, as I do, the idea that the treatment in many instances may be conducted without a splint at all, although I by no means advocate such a plan, I cannot but admit that a fracture may be admirably treated in this way also: it is difficult, however, to imagine that the practice will be either safe or efficacious in all instances: it seems to be little in vogue amongst British surgeons, and my own experience of it is scarcely sufficient to warrant my saying more in its favour than I have done, viz., that fractures in many instances will unite as well with this treatment as with any other. It is evident that it is not applicable in all cases, and the merits claimed for it seem so slight in comparison with the manifold advantages of other plans, that I cannot at present admit its superiority. The method is but little used by surgeons in this country excepting in the last stages of treatment, when it affords a valuable and safe means of abbreviating the tedium necessarily attendant on the operations of nature. In a simple fracture of the leg, when three weeks have elapsed during the use of some other plan; when all chance of severe inflammation and further swelling has gone off; when the first effects of contusion and laceration have subsided; when the fragments have got in a manner fixed; and when the patient is getting weary of confinement in bed,—there will be every reason to feel satisfied with such a measure, and, instead of keeping the patient the full term of five or six weeks in bed, I strongly recommend the adoption of this practice.

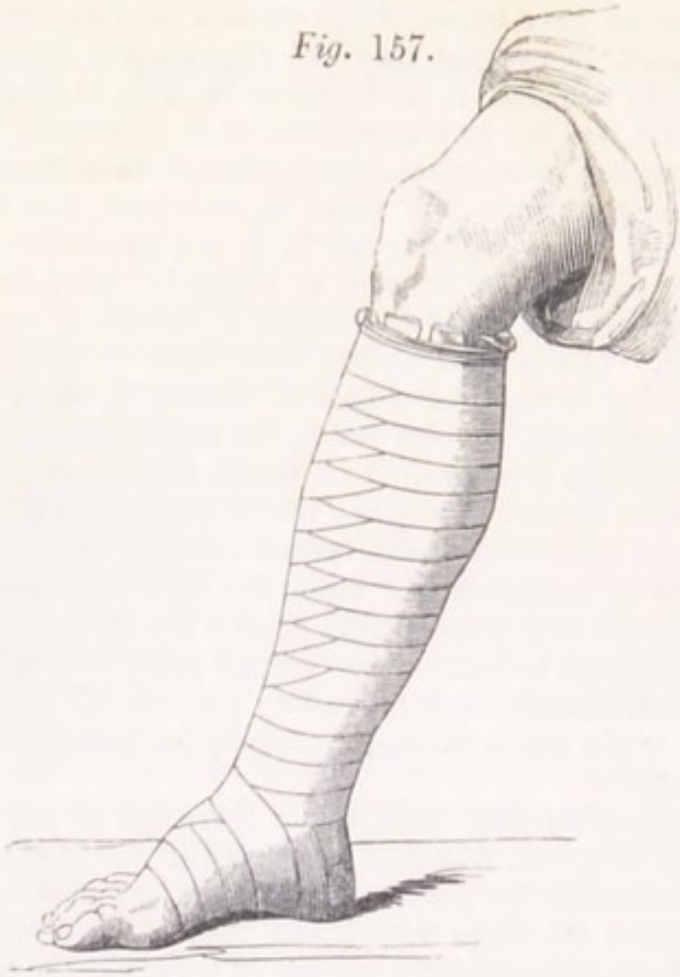
The next drawing (fig. 157), taken from one of my patients in King's College Hospital, will show the appearance of the leg in such a case: in this instance the person was kept in bed with his limb on a M'Intyre's splint for three weeks, and then allowed to move about the ward and out of doors, with the aid of crutches, for the next fortnight, when the case was taken off, and a simple roller used instead for a short time further. In several instances where there seemed but little disposition to ossific union, the patients have been permitted to move about with greater freedom than usual, with the leg thus enveloped, and desired at the same time to put the foot pretty firmly to the ground, and I have been well pleased with the result.

I have still some further remarks to make regarding fractures of the leg, but shall reserve them until other fractures in the lower extremity have been referred to.

The patella is frequently broken, the injury being in general the result of violent action of the muscles in front of the thigh, as when a person endeavours to prevent himself from falling forwards whilst the knees are bent: if, at this time, the bone comes in contact with any opposing object, fracture is very likely to occur. It is often difficult, however, to account for the exact cause of fracture, though the nature of the injury is very readily appreciated. The bone may be broken into various portions, or merely divided into two; the fissures may be perpendicular, oblique, or transverse: in the former instance there is

seldom much displacement; but in the latter the space between the fragments may be from half an inch to an inch, and, if the treatment be neglected, even this distance may become much greater. In the

Fig. 157.



vertical fracture, the fragments are not under the direct influence of any muscles, unless it be from a few fibres of the vasti, so that whatever displacement there may be, must arise chiefly from the force which may have occasioned the fracture, or from the effusion into the joint which usually follows this injury. In the transverse fracture the lower fragment keeps its natural position, whilst the upper is separated by the action of the quadriceps extensor: here, too, the separation is often made more extensive by the increase of fluid within the joint.

The next drawings exhibit two examples of fracture of this bone. Figure 158 shows a transverse fissure, such as that where separation may become extensive, and the other (fig. 159) is partly oblique and partly vertical. In this specimen ossific union had occurred.

Though in these cases the lacerated wound of the joint is always followed by considerable inflammation, swelling, and effusion, it rarely happens that it is permanently disabled; and, so long as there is no external wound, there need be little fear of the result. It will be ob-

Fig. 158.

Fig. 159.

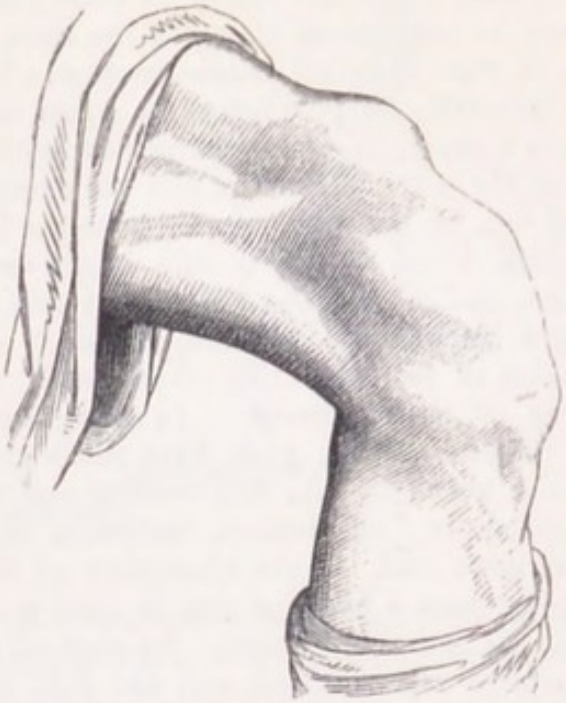
served that division of this bone, even when the skin over it is entire, cannot altogether be considered as a simple fracture, for the injury is complicated with division of the synovial capsule; but fortunately it is rarely followed by very severe consequences: even in the event of solution in the skin also, unless the injury be otherwise very formidable, some hopes may be entertained of saving the limb.

The treatment, in what is called simple fracture, which, in my opinion, may almost invariably be pursued, is to place the limb upon a M'Intyre's splint in a complete state of extension, with the foot raised a few inches above the level of the hip, and the shoulders and trunk somewhat elevated too, in order to relax the rectus femoris as much as possible: a folded towel should be laid lengthwise between the skin and the splint, and for the first few days it may not be deemed requisite to apply a bandage of any kind, unless in instances when, from the restlessness of the patient or other causes, there is a risk of the limb falling off the apparatus. In this way all movement at the joint is prevented, and the parts kept much more steady than even on the hardest mattress. At first leeches and warm fomentations may be applied, or cold lotions, according to the apparent extent of inflammation; and, as the absorption of fluid within the joint begins and progresses, a bandage may be used to restore the displaced fragment to its natural position. As soon as it is perceived that acute inflammation has subsided, and the fluid within the capsule has diminished, a simple roller must be carried round the limb and the splint, from six or eight inches above the knee, as low as the tuberosity of the tibia: to effect more complete downward pressure on the upper fragment, it will be well to place a pad of lint along the lower part of the rectus. As the effusion subsides, the bandage must be tightened from day to day, until, probably on the tenth or twelfth, the fragments will be brought into approximation, without occasioning the slightest pain,—and now the pressure by the roller may be made of a firmer and more permanent kind.

In this way I have placed the fragments in a transverse fracture in the closest apposition; and, though I will not assert that bony union has been the result, I can affirm that no appreciable space or fissure could be detected, nor could the slightest movement between the different portions be discovered.

I cannot say that such good results have invariably followed, having met with examples where it was found impossible in any way to get such close union: but, after all, it seems to me that surgeons have made a kind of bugbear of the bad results attendant upon non-union of a broken patella; for the dissecting rooms and daily practice afford ample proof that, although the upper fragment be separated from the lower for an inch or more, the loss of power is wonderfully little. These observations are not made by way of sanctioning any carelessness in the treatment, but rather to prevent the young practitioner giving himself much distress because he cannot bring about a close approximation of the broken surfaces. Some little time ago we had a patient in King's College Hospital, whose limb is accurately represented by the accompanying figure (160); even here, though the condition was

Fig. 160.



the same in both limbs, the person seemed not to be conscious of much inconvenience; but it was apparent that he had not the same muscular power in his thighs as he must have had at an earlier period of life before the injuries happened. The ligament which forms between the fragments in these cases becomes remarkably strong, more so to all appearance than even the ligamentum patellæ. I have lately had under my care, in our Hospital, an unusual case of fracture of this bone. About five years ago the patient broke the patella, and the fragments remained an inch separate: on being brought into the house for an injury of the same knee, it was found that the lower fragment was broken transversely, whilst the newly formed ligament above was uninjured.

In fractures in other parts of the extremities, I am an advocate

for replacing the fragments at the earliest possible date, instead of waiting until the inflammation and swelling have subsided; but in fractures of the patella, as the chief resistance to approximation seems to arise from the presence of fluid in the joint, I prefer waiting until it is removed. There are some instances where the disturbance within is so little, that a tight bandage may be applied almost immediately after the accident.

In compound fracture the injury is sometimes so great that the surgeon cannot hesitate about the necessity for amputation: occasionally, in giving the patient a chance to save the limb, the extent of inflammation, and its consequences—suppuration and ulceration—are ultimately such as to demand this last resource, though it will happen in such instances that a fitting time for its performance may never occur, and the patient sinks; but, on the other hand, the most happy results will sometimes follow this complicated injury. Shortly before I left the Royal Infirmary of Edinburgh, a patient came into the house under my care with a compound fracture of the patella, occasioned by being blown down in a violent gale of wind, and striking the knee against the sharp corner of an iron lamp-post. She was immediately conveyed home, and the edges of the wound in the skin were brought together with adhesive straps, whilst the limb was placed in the extended position. The accident happened about eight o'clock P.M., on the 8th of February, 1840, and on her admission next day, at one P.M., her pulse was slow and feeble, her extremities cold, and there was great general depression. On examination, the patella was found to be fractured transversely about its middle, and there was a wound on the surface, about an inch and a half in length, running in the same direction a short way below the fracture. On percussion, a considerable quantity of air was detected in the joint, in consequence of which the wound, which had partially united, was opened, and the air was pressed out. The limb was then placed on a straight M'Intyre splint, the heel raised, and cold applications made to the wound. A thin fluid like synovia continued to ooze out for many days. This patient (aged about forty) had considerable fever, and smart local inflammation, for the first four or five days, but ultimately made an excellent recovery: on the fourth of March the fragments were in good apposition, and in eight days more she was dismissed cured.

Towards the end of treatment in a case of fractured patella, when the patient is allowed to stir about on crutches, the movements of the knee should be restrained with bandages or other convenient apparatus. In private practice, nothing will answer better for this purpose than the laced knee-caps, which, now-a-days, are so admirably constructed from caoutchouc in its different forms.

As somewhat analogous to the above injuries, I may here refer to rupture of the ligament of the patella, and also to that of the united tendons of the rectus and crureus muscles. The former, I believe, occurs very rarely, and, indeed, I may say the same for the latter,—an example of which, however, came under my notice some time ago in the person

of a young gentleman, eighteen years of age, who, in saving himself from slipping backwards on the pavement, felt a sudden snap at the knee, and was immediately after unable to extend the leg excepting with great pain and a severe effort. On examination about an hour after the accident, I could distinctly feel a space about an inch and a half above the patella, where the separation existed. A splint of wood was adapted to the back of the limb to keep the knee extended, and care was taken in applying a roller to place a pad along the fore part of the thigh, so as to keep the end of the rectus as low down as possible. The recovery was more rapid than after fracture of the patella, and the limb ultimately became as strong as its fellow. In such a case, or in the instances where the ligament of the patella is injured, the practice should resemble that which is required in fracture of the patella,—the extended position and rest being the main features.

Fig. 161.

The femur may be broken in almost any part of its extent; and, as in other long bones, the fissure may be transverse, oblique, or nearly perpendicular; the fracture may be simple, compound, or complicated, and the bone may be divided into two, or there may be many fragments. Perhaps the most common seat of fracture is about the middle, as here represented (fig. 161), and in this situation the fissure is usually transverse. The bone at this part is so covered on all sides, that compound fracture occurs rarely in the middle of the thigh: the femur from which this sketch is taken was thus broken, however; but, although compound fracture is occasionally seen still higher up, it most generally happens towards the lower extremity of the bone; but, upon the whole, the accident is rarely met with, compared with the frequency of the simpler form, occurring in any part of its shaft, from one end to the other. If towards the lower extremity, the condyles may be so separated from the shaft, by oblique or perpendicular fissures, as to involve the knee-joint, and thus render the injury complicated; and if at the upper end, the head may be so divided from the neck and shaft that ossific union can scarcely occur, and the limb can therefore never again acquire anything like its original strength: —but before alluding particularly to fractures in the neck of the bone, I shall treat of those lower down, which, if not of more

frequent occurrence, are, at all events, more worthy of the surgeon's consideration, from the circumstance that they usually happen at that period of life when active exertion is of more subsequent consequence than in the individual of advanced years, in whom the neck of the bone is so apt to give way, but whose physical capabilities have already been well nigh exhausted.

Fracture in any part of the femur below the trochanters is of most common occurrence during those periods of life when man may be said most to require the full use of his limbs, and it therefore becomes of vast importance to effect a cure with the fragments so adjusted, that there may be the smallest possible extent of either deformity or loss of power. The fractured thigh is almost invariably shorter than its fellow: in a simple transverse fissure immediately above the condyles, the surfaces are so extensive that their complete separation is of rare occurrence; but in oblique fracture, and in any instance in other parts of the bone, the displacement is such that the lower fragment is drawn upwards, and shortening is conspicuous. From the multiplicity of forces which may occasion fracture, the rough ends of the fragments may pass in any direction: if the displacement be not great, the limb may be merely bent at an obtuse angle at the point of division, with the part below slightly twisted outwards or inwards; but, perhaps, the most frequent kind of displacement is that where the end of the lower fragment passes behind the upper, when the latter is usually said to ride over the former. Perhaps the particular cause of fracture, the weight of the limb, (as the person is being carried after the accident,) and muscular action, may all conduce to this form of displacement. I believe the latter influence is most at work, for, in addition to the effects of the psoas magnus and iliacus internus in raising the upper fragment, the long muscles extending between the pelvis, and the lower end of the femur and upper part of the leg, along the back of the thigh, are most likely to act with great force on the lower fragment in drawing it upwards and backwards,—a force against which the powerful muscles in front, from their less advantageous position, offer but a feeble resistance. The lower fragment does, however, sometimes pass in front of the upper; it may, indeed, go in any direction, but it is most frequently as I have described it.

If there is displacement, in whatever direction it may be, and whatever may be the amount of distortion, one of the first and grand objects of treatment should be to bring the fragments as nearly into their natural position as circumstances will permit: if this is done, and due care taken to keep them thus, the rest of the sanative measures may be left to nature. Numerous methods have been followed by different practitioners in the treatment of these fractures. It is seldom that there is any difficulty in extending the limb sufficiently, provided this be done soon after the injury has happened, before inflammation has begun, and the muscles and other textures have become in some degree habituated to their new and unnatural conditions. Sometimes, however, and more particularly in the upper third of the

thigh, when there has been extensive effusion of blood, it is difficult to draw the limb to a proper length, until part of the fluid has been absorbed and the swelling has somewhat subsided. I have seen some instances where eight or ten days have elapsed before sufficient extension could be made, and remember one example of fracture below the trochanters, where probably some of the perforating arteries had been torn through, and where the tension of the skin was so great from the amount of effusion, that no attempt could reasonably be made to bring the limb to its proper length until after such a lapse of time as rendered any interference useless. Coaptation is generally more difficult and more troublesome to accomplish than mere extension: after reduction has been effected there is a constant tendency to distortion, and it is almost certain to occur unless the surgeon adopt efficient means to prevent it, and have a careful watch over the appearance and attitude of the limb for the first ten or fifteen days of treatment.

The knee may be kept either bent or straight, and if the first position is preferred, the treatment may be conducted either according to the method so strenuously advocated by Mr. Pott, or that subsequently recommended by Sir Charles Bell. In the former, to use Mr. Pott's own words, "the position of the os femoris should be on its outside, resting on the great trochanter; the patient's whole body should be inclined to the same side; the knee should be in a middle state, between perfect flexion and extension, or half bent; the leg and foot lying on the outside also should be well supported by smooth pillows, and should be higher in their level than the thigh; one very broad splint of deal, hollowed out, and well covered with wool, rag, or tow, should be placed under the thigh, from above the trochanter, quite below the knee; and another, somewhat shorter, should extend from the groin below the knee on the inside; the bandage should be of the eighteen-tailed kind; and when the bone has been set, and the thigh well placed on the pillow, it should not without necessity (which necessity in this method will seldom occur) be ever moved from it again until the fracture is united." Sir Charles Bell's method consisted of the double inclined plane, and the apparatus which he recommended has since been extensively used, more particularly under the improved shapes which I have referred to in treating of fractures of the leg.

In my early years of attendance at the Edinburgh Infirmary, the practice of Pott was occasionally followed, but latterly it was seldom resorted to, and, excepting in fractures very low down in the femur, I may say the same for that of Bell. By either plan most excellent cures may be effected: but in Pott's there is considerable risk of shortening, and of the lower part of the limb being everted; whilst in Bell's, though the toes may be kept in their natural line, the limb may also be shortened, owing to the difficulty of restraining the movements of the upper fragment during the motions of the patient's body. If the fracture is near the trochanters, it is almost impossible to fix the upper fragment against the thigh-plate, and at the same time keep up

that degree of extending force which is of service in preventing retraction. I have used both plans, and with fair success; but, notwithstanding Mr. Pott's very ingenious and often-quoted arguments in favour of the bent position, I give a decided preference to the straight in most fractures of the thigh-bone, and to the use of such an apparatus as shall keep all steady from the loins downwards, and at the same time permit of that continued extending force being applied, which I deem of so much consequence in all fractures of the thigh showing the least tendency to displacement and shortening.

The splint of Desault, so particularly recommended by Boyer for continued extension in the lower extremities, furnishes the means of accomplishing all these objects, and the simple modification of this machine, which has been so strongly and ably advocated by Mr. Liston, will be found equally efficacious. The former, with its shoe, accompanying smaller splints and pillows, is somewhat cumbrous, and even complicated:—the latter has scarcely any of these objections, and having used it, and seen it used most extensively for the last ten years, I have no hesitation in giving it the preference. The splint consists of a piece of wood similar to that referred to at p. 286, but longer, and, it may be, broader and stouter, according to the bulk of the limb on which it is to be placed: it ought to reach from the last rib four inches beyond the foot: a pad of folded cloth, or cushion of horse-hair, should extend along one side nearly its whole length. The fracture being set, coaptation properly produced, and the patient extended on a hard mattress, the splint, with the cushion next the skin, should be laid along the outer side of the broken limb; then, with some turns of a roller, the foot and ankle should be fastened to the notched extremity below, the surgeon taking care that the limb is in a natural position, with the toes turned neither too much out nor in (the appearance of the other foot always guiding him in this respect); next a folded handkerchief, with perhaps a little tow or hair wrapped up in it, to prevent its galling the skin, should be so applied, that, whilst its centre rests in the perineum, one end passes under the hip and the other in front, both meeting at the two openings in the upper end of the splint: when passed through these, a noose should be cast, and, by tightening it, the splint, with the lower part of the limb—which has already been fixed to the board by the bandage round

Fig. 162.

the ankle,—will be thrust downwards, the pelvis being the fulcrum, and thus will the extension be kept up during the after treatment by occasionally tightening the handkerchief: the next and last step in the proceedings is to apply a roller from the ankle upwards, when the limb will present the appearance just represented in fig. 162, taken from one of the patients in our hospital.

Sometimes it may be advantageous to place a short wooden or pasteboard splint along the inner side of the thigh, and, if the fracture be low down in the femur, there is not much occasion for the band under the perineum, as the purchase of the splint and bandage on the upper fragment is sufficiently complete to keep all steady.

In fracture of the lower third of the bone or in the upper or middle part of the tibia, I have seen a method like the following answer most excellently: being in the country, and asked to see a case of the kind, I have in my younger days (being then an adept with the saw and plane) gone to the nearest carpenter's shop, and cut out a couple of splints similar to those above referred to; I have then, after setting the limb whilst the patient was in bed, rolled them up in each side of a doubled tablecloth, until there was just space enough left in the middle to contain the limb, which was next placed between the boards, and retained steadily by bringing the splints up on each side, and keeping them there by means of a sufficient number of stout tapes. This method I first saw used by my friend, Mr. Stuart, of Kelso, a most excellent practitioner; and, having since tried it frequently, can speak most confidently in its favour.

Fractures of the neck of the femur have been distinguished into those which occur within the capsular ligament, and those which take place outside, and the principal point of difference between the two is this, that in the latter the fragments may be expected to unite by bone, whilst in the former such an event rarely happens. There is no part of Sir Astley Cooper's admirable work on Dislocations and Fractures more worthy of notice than that which relates to this subject, and his experience and investigations have been such, that, coupled with the additional observations of the editor of the last edition, Mr. B. Cooper, it is scarcely possible to refer to any feature in such cases which has been omitted to be mentioned.

Between fractures outside of the capsular ligament, and those in other parts below, I cannot see any great practical distinction: undoubtedly they happen more frequently in the person advanced in years than in him who is under the middle age; yet, as I have myself seen, they may occur at the age of twenty-two, and in no respect need their treatment be different from what might be deemed requisite in that part of the bone below the trochanters,—the object being, in either case, to keep the limb at a proper length, in good position, and to procure ossific union. Though all these ends cannot be accomplished in every instance, it is, in most, quite proper to keep them in view; but the leading features of practice may be different in the other case, (*i. e.*

within the capsule,) and hence the necessity of forming an accurate diagnosis before the treatment is actually begun.

Although age is by no means a certain criterion of judging of the exact position of a fracture in the upper part of the femur, either within or without the capsular ligament, and though Mr. Stanley has recorded a case of fracture of this bone, within the hip-joint, at the age of eighteen, it must be admitted from all evidence and experience that fracture in the shaft of the femur happens more frequently in the upper third than in any other part of the bone, after the middle period of life; and that those in its neck, particularly within the capsule, are of rare occurrence under the age of fifty. Out of two hundred and twenty-five cases which Sir A. Cooper calculated he had seen in public and private practice during a period of thirty-nine years, he had only seen two cases of fracture in the neck of the bone within the capsule under fifty years of age, and during the same period he had only once seen a dislocation of the thigh at the age of sixty-two. These statements, then, ought to be very conclusive on this point; and when a person above the age stated, and more especially above sixty, and being of the female sex, has met with an injury of the hip attended with symptoms of fracture, the chances are that it is within the capsule.

The injury is usually the result of a fall, and may be appreciated with tolerable accuracy by the following circumstances and symptoms: the advanced period of life, the patient having pitched on the trochanter or hip, and being immediately afterwards unable to move the limb without great pain, are all sufficient to excite suspicion of what has happened: when he is laid in bed, the toes seem much pointed outwards; the whole limb upwards to the trochanter major is everted; it is half an inch, an inch, or more, shorter than its fellow; the trochanter is less prominent than on the other side; and, besides being further back than its natural position, is also nearer to the crest of the ilium; if the limb be turned inwards, it will of its own accord soon resume its everted position; the knee is usually straight; the whole muscles of the member seem to be paralysed; the patient makes no effort to move the part; and, if desired, seems incapable of raising the thigh by calling the psoas and iliacus into action; if, added to all these, there is crepitus, there need be little doubt about the nature of the injury. Crepitus is not easily felt on all occasions, even when there is fracture: the manner in which it can be best detected is by desiring an assistant to draw down the limb, a proceeding which is very easily accomplished, and then, by pushing the trochanter towards the acetabulum, and rotating the femur on its long axis, the rough surfaces can be felt grating against each other. It must be confessed, however, that this sensation is often detected only after considerable manipulation and much pain to the patient. The absence of, or difference in, one or more of these symptoms, should neither lull suspicion nor alter the diagnosis: thus, shortening of the

limb is not always present, as there may be fracture without displacement. There is in my collection a fracture through the cervix femoris, yet during life there was no shortening, no eversion, and, moreover, no crepitus. Sometimes, instead of eversion, there has been inversion; but this is exceedingly rare, and occasionally, though, perhaps, with equal rarity, the toes have been seen at one period turned out, and at another turned in, in the same case.

Most of these symptoms are equally apparent in fractures through the trochanters, and also in the neck of the bone immediately above, as in instances within the capsular ligament; and if there be great obesity, or much swelling from effusions and inflammation, it will be impossible to detect the exact seat of fracture: but in some cases, as with thin old women immediately after the accident, the shaft of the bone can be so distinctly traced, in its entire condition, to the top of the trochanter, that, if there be fracture at all, it must be near the head; and if the circumstances and symptoms are as I have stated them above, there can scarcely be a doubt that the injury is within the capsule:—I say *within*; for, though it may be entirely outside, or partly within and partly without, and whether or not the fragments are still held together more or less firmly by the reflected ligament within the capsule, the practical deduction should be, that the fracture is one which in all likelihood will never unite by bone.

I know of no authority so much to be relied on for the truth of this doctrine as that of Sir Astley Cooper, who, in referring to his own vast experience ranging over a period of forty years, after having seen two hundred and twenty-five cases of supposed fracture in the neck of the thigh-bone, and examining many preparations of the kind obtained from his own practice and that of others, states, that in these examinations he had only met with one example in which a bony union had taken place in transverse fracture of the cervix femoris entirely within the capsular ligament. Sir Astley, like other good authorities, though he does not deny the possibility of union in such a case, doubts its probability; and the truth of the latter circumstance is so incontestably proved by numerous specimens in our different museums, that it seems almost wonderful how so much should have been said and written to make the fact apparent. Like many of my contemporaries, I have seen several well-marked examples of ossific union in the neck of the femur; but there is always a doubt whether, in these cases, the fracture was entirely within the ligament or only partially so; and whether, even in bearing the marks of having been in such a situation, the reflected ligament and periosteum had been entirely divided. In the event of either of these membranes being more or less entire, it will be perceived that there is more chance of union, than when they are completely torn through; for, in the latter event, the only remaining course for circulation in the head of the bone is through the round ligament, and the vessels in this narrow channel may be deemed as only of sufficient size to support the vitality of the part, but not to add new growth.

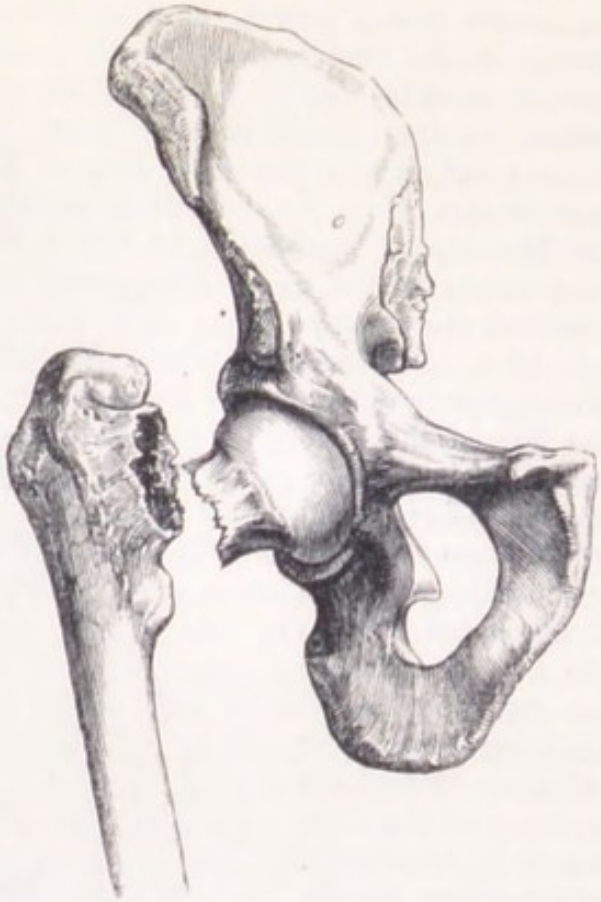
The remarkable frequency of these injuries in aged females, compared with their occurrence in man, must have been observed by all who have had much experience. It is usual to attribute the facility with which the fracture happens to the natural change in the direction of the neck of the bone, which is the result of advanced years. In youth it shoots obliquely from the shaft, but in old age it passes off from between the trochanters, almost at a right angle; sometimes the trochanter major is actually above the level of the head of the bone, and it is by no means uncommon to find the neck shorter, and even less in diameter, than in the early or middle periods of life. It is evident that in the erect position the weight of the trunk must, in the young person, be transmitted through the femur more directly in the long axis of its neck, and that under such circumstances it must be capable of supporting a much greater weight than when passing horizontally between the trochanter and the acetabulum; but at any period of life, so far as I know, the fracture never occurs when the patient is upright; it happens during a fall on the hip or trochanter, at which time it may be supposed that the weight of the pelvis is supported more directly in the long axis of the neck than at any other period; I have, therefore, often doubted whether or not these alterations in the line of the bone have much influence in the production of fracture, and have been more inclined to attribute their frequent occurrence in old age to the friable state of the bones at this period, as also to the circumstance of the neck, from its thinness and cellular character, being the weakest part: and if in all these views I am correct, the frequency of the accident in females may be reasonably attributed, *cæteris paribus*, to the greater projections of the trochanter in them, from the width of the pelvis, than in the male subject. If, however, the fracture occurs in consequence of the limb being twisted under the other, as it generally is in a fall on the trochanter, then, of course, the altered line of the neck of the bone above referred to must render the part particularly liable to the injury.

Fig. 163.

The diagnosis of fracture in the upper part of the femur, or in the

neck of the bone, is usually so clear, that one cannot but be astonished at the occasional mistakes which are made, by confounding such injuries with dislocations at the hip. The sketch on the preceding page (fig. 163) gives a fair illustration of the most conspicuous appearances; the aspect of age, compared with that at p. 267, of a figure with dislocation on the dorsum ilii, at once points out one of the most distinctive features between them; and a slight study of each figure, with the symptoms peculiar to each, will show how wide the differ-

Fig. 164.



ences are. Drawing 164, which exhibits a fissure through the neck of the bone within the capsule, and also the displacement of the shaft, both upwards, and as regards eversion, will give further illustration on this subject.

The treatment of this kind of fracture may be conducted with the thigh bent at the hip, or in a straight position; the latter plan seems most in repute, and, as in fractures in other parts of the limb, I generally give it the preference. The splint, bandages, and manner of setting the limb, are all such as have been described and exhibited at p. 295, in treating of fractures of the bone lower down. It is not, however, in all instances that the subsequent course should be the same: in very aged persons, and when there is but little displacement,

it may be doubted whether or not a splint should be applied at all; in fractures of the shaft of the bone, no such doubt can or should be entertained, for ossific union is almost certain to follow, and a splint is of infinite service in keeping the fragments in their proper position; in the neck of the bone, however, no such union can reasonably be expected; and as any kind of apparatus, such as splints and tight bandages, may be exceedingly troublesome to some parties, nay, actually productive of harm, and as no ultimate benefit can be expected from a persistence in their use, the propriety of applying them at all may well be taken into consideration. For my own part, I am an advocate for the use of a splint in the early stages of treatment. I believe that the shortening of the limb, which is the inevitable result of these injuries, is less when a splint is used during the first eight or ten days, than if none be applied; after this period, however, it may be doubtful if restraint will be of much further service. At first the shortening and continued disposition to an increase of it, as also the tendency to further eversion, may be efficiently counteracted by a splint; but after the parts have set, as it were, in this way, and after the acute pain and inflammation,—the necessary result of the injury,—have subsided, the sooner a little movement is made, the earlier will a false and callous joint be formed, and the patient begin to make some use of the limb.

When the splint is removed, the knee and hip may be slightly bent, and a pillow put under the former, to give it support; as soon as the patient is inclined to leave his bed, he may be permitted to do so: at first he must support himself with crutches; by and by a stick may be substituted; and, with the additional aid of a high-heeled shoe, he may afterwards move about with great ease and security. In such instances, as I have had frequent opportunities of witnessing on inspection after death, the fragment of the neck nearest the trochanter becomes absorbed to a greater or less degree; becomes hard and enamelled on the broken surface; the textures around thicken, and form a kind of new capsule; occasionally even a little bone is deposited on various parts in the vicinity; and the obturator externus and other muscles attached to the digital fossa, behind the trochanters, become considerably increased in bulk and strength.

The above method cannot be accomplished in some cases, and in others it would not be correctly applicable; thus in certain individuals the tightness of the bandage around the ankle is sufficient to threaten or induce sloughing, and in others similar effects are produced by the band under the pelvis; sometimes there may be positive objections to this plan, from the state of the ankle or perineum; again, if the patient is very aged, and otherwise infirm, and likely to be little capable of using or requiring the limb in any active exertion at a future period, it may not be thought proper to harass him with any incumbrances, or at all events the advantage gained (if any) will not be equivalent to the vexatious restraint; but, on the other hand, if the patient be comparatively young and stout, and if there be the

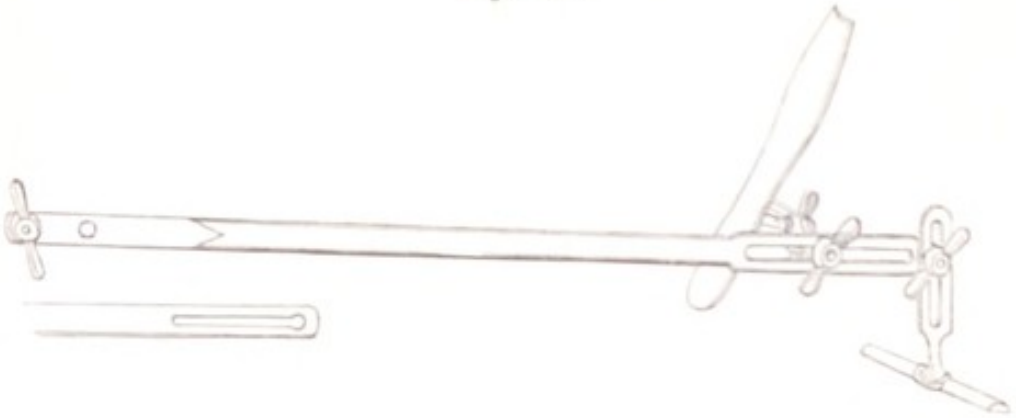
least idea that the fracture is such that bony union may be reasonably looked for (as in the neck of the bone outside of the capsule), then the use of the apparatus should be persisted in for five or six weeks at least.

The double-inclined plane has been recommended in these cases as well as others in the lower extremity, and by some it has been thought advantageous to place both limbs in a similar attitude: the angle of the two planes is made so high, or, in other words, the thigh-boards are made so long, that the pelvis hangs from the knees, as it were; and, whilst extension is thus kept up, the surgeon has the opportunity, by keeping the knees together, of ascertaining that both thighs are much about the same length. Instead of using a couple of splints, two boards of wood, of sufficient breadth to sustain both limbs, have been put together at a proper angle, and used on these occasions. The same plan has been sometimes used, too, in fractures of the shaft of the femur; but it is evident that the upper fragment cannot be considered as at all fixed by this apparatus; and when ossific union is expected, I should not be inclined to recommend it, though aware that good cures have followed this method, as well as others. I have noticed that under such treatment the feet and legs have become remarkably œdematous, unless well supported by bandages, and there has been altogether such an apparent want of comfort and security in the plan, that, excepting under particular circumstances, I would never resort to it.

It will be remarked that in every fracture of the lower extremity I have invariably recommended the straight position, which, with few exceptions, will, I believe, be found the most satisfactory method; the surgeon may, however, see good reason occasionally for rejecting it, and, it need scarcely be added, that whichsoever practice is pursued, there is much need of care, both in putting up the limb and in the after-treatment; its length, attitude, and general contour must each and all be carefully attended to; and I feel satisfied that the sooner all this is done after the injury has happened, so much the better for both patient and surgeon. In pursuing the different plans above advised, I have occasionally found difficulties to be overcome, and deficiencies in the apparatus, which must have been noticed by all who have followed similar methods of practice. For example, in fractures of the tibia, a degree of extension is sometimes required, more particularly in compound cases when the under fragment is drawn behind the upper one, which cannot be well applied with M'Intyre's splint, whether bent or straight: and, to take another case, when the long single splint is placed on the outside of the limb, it is extremely troublesome to prevent the foot turning out, or the board turning forwards. In fractures of the leg, it is also often difficult to prevent the toes turning inwards or outwards; and it seems to me that the footboard, with the lateral movement such as has been recommended at p. 284, might be advantageously combined with some such simplification of Desault's as that spoken of

at p. 295, whereby an apparatus might be produced well adapted for all the ordinary examples of these accidents in the lower extremity, whether in the bones of the leg, the patella, or femur. Mr. Weiss has lately constructed such an instrument; and it seems to me so simple, both in its form and application, and at the same time so likely to be efficient, that I think it well worthy of further trials than I have yet had an opportunity of giving it. Figure 165 presents an out-

Fig. 165.



line of this splint: the bars and foot-place consist of iron, the screws of brass; the long bar is of an average length to extend between the knee and sole of the foot; the board is so attached, that it can be slid upwards or downwards at will, and then be fastened by the side-screw; it can also be moved in a lateral direction, so as to evert or invert the toes; and moreover it can be placed at such a distance from the splint at the ankle as may be found best suited to the thickness of the patient's limb. The cross-bar below prevents the member from rolling outwards or inwards, and, by means of the screw, the side-splint and foot may be raised or depressed, as may be found most convenient. This bar can be attached to the screw at the knee, where it will sometimes be found to answer best; or two may be used, one above and one below, each being of service to raise the part above it to any required height. In the cut a small portion of another side-bar is exhibited; this is of the same size and shape as that delineated, and is intended to act as a thigh-splint, in cases of fracture here, or when it may be desired to apply extension in fracture of the leg. It can be firmly attached to the other portion at the knee; and when the upper end is fastened to the pelvis by a circular strap, and another under the perineum, as with Desault's apparatus, the whole, though apparently much more slender, is equally firm, and as secure as can possibly be required for the generality of cases. Pads and bandages similar to those applied with the splints above described must, of course, be used here also.

Perhaps I may err in my estimate of some of the advantages of this simple contrivance; yet I think they are such as deserve the consideration of many practitioners. The cost is, I believe, less than for any

other splint, excepting the simple bar of wood; the durability will be equal to that of any; it will suit either limb, or either side of it; it will answer for fractures of the leg, patella, or thigh, and, by undoing the screws, it can be put up in such small space, that it may be carried in the hand with as little trouble as the country surgeon will have in carrying his switch; and, moreover, the bars and screws are so strong, though light in appearance, that the machine cannot be looked upon but as a substantial piece of workmanship, capable of bearing any reasonable amount of fatigue. The moveable bar may be attached to the cross one on which the foot-board is placed, and thus, if it should be deemed necessary, a splint may be kept on each side of the leg.

Figure 166 is from a cast where the tibia and fibula were broken; I had it taken with the object of showing the kind of displacement which occurs in some of these cases. The other drawing (fig. 167)

Fig. 166.

Fig. 167.

exhibits the same limb two months afterwards. It is intended to show that, with care, the projection of the upper fragment may be entirely avoided, and also is a good example of what may be done with the above splint, which was used on this occasion.

In concluding my observations on fractures of the leg, I cannot omit again referring to the method of swinging the part, after it has been properly put up with splints and bandages, although it has already been adverted to in the introductory chapter on fractures. The chief advantage of the proceeding seems to be, that, when the patient moves his body in any way, as when the bed-pan is placed under

him, the whole limb hangs in such a manner that the fragments are less likely to be disturbed than under ordinary circumstances. The best plan for effecting this object, which I have seen in use, is that followed by Mr. Luke, of the London Hospital, who suspends the part from the inside of the cradle which is usually placed over an injured limb to keep the bed clothes from it. An arch is made by three or four stout semicircular rods of iron, and the suspension is effected by means of two or three pieces of strong tape attached to these rods. Mr. Luke uses a kind of box, well supplied with cushions, in which he places the broken member; the thigh is slightly bent on the pelvis, and the leg is kept in a horizontal position. A M'Intyre's splint, or one such as I have last recommended, may be used in the same way.

In fractures of the lower extremity during the period when the patient requires to keep his bed, a space seldom less than five weeks, and often much more, and when it is of great consequence to keep the fragments still, the urinal and flat bed-pan are of essential service in effecting the latter object. Some surgeons have objected even to the use of the pan, however, and beds have been constructed with apertures in the ticking and frame-work below the pelvis, with the view of permitting the patient to evacuate the bowels without the necessity of raising the body at all. Earle's bed is the most celebrated of this kind, but unless in Bartholomew's Hospital, I am not aware that it is much in use among our hospital surgeons, who, with occasional exceptions, seem mostly to prefer a well-stuffed hair-mattress, and to trust the care of the patient to the attendants.

CHAPTER IV.

LIGATURE OF ARTERIES.

LIGATURE of one or other of the arteries of the inferior extremity may be required on the living body, and such operations should be practised on the dead subject.

Spontaneous aneurism is rarely seen in a vessel of the magnitude of the anterior tibial: it may, however, be the seat of false aneurism, resulting from a wound; or, in such an injury the external hemorrhage may be great, and either example may require the interference of the surgeon. Again, it may be deemed advisable to deligate the artery in consequence of severe bleeding from the sole of the foot; or, in other instances, to restrain the growth of, or obliterate, aneurism by anastomosis in this region.

In the example of aneurism resulting from a wound, if the tumour is not large, and there be no complication or circumstance to induce the surgeon to act otherwise, I imagine there can be little doubt that cutting down to the vessel at the seat of the disease, through the aneurismal swelling, sponging out the blood, and placing a ligature above and below the orifice in the same manner as is done for varicose aneurism in the arm, is the proper practice to be pursued; but in an instance of wound of this vessel in simple fracture, as might possibly happen, such a plan would be very questionable, as the fracture would thereby be rendered compound; here ligature of the vessel above, or of the femoral, would perhaps be the best proceeding. The tumour may, however, be large, or the blood may be extensively extravasated through all the soft textures: it may be doubtful whether it will be better to cut into the swelling under these circumstances, or to restrain further bleeding by ligature above: again, when the anterior tibial is opened by wound, the injury done to the bones and other parts may actually induce the surgeon to amputate the limb.

In cutting down to the vessel in the case of a wound bleeding from the surface, or in the instance of opening the aneurismal swelling, after a sufficiently free aperture has been made in the integuments, the stream of blood will perhaps be the best guide to the bleeding orifice. It will be proper in such cases to apply the tourniquet on the thigh, and if there is any difficulty in detecting the vessel, the pressure may be relaxed, when the blood will flow. In either of these cases the incisions on the surface must be made in the immediate vicinity of the wound in the vessel; but, in other examples, the surgeon may have a choice of parts through which he may cut. Over the arch of the foot the vessel may be readily exposed; indeed, it lies so near the surface in this situation, that I have known it divided by a surgeon whilst making incisions through the skin in the treatment of erysipelas: an incision, an inch and a half or two inches in length,

should be made over the most convex part of the foot, commencing a little in front of the ankle and extending as far as the space between the metatarsal bones of the great and second toes: after the skin is divided, the strong aponeurosis immediately underneath must be cut nearly to the same extent; the tendons of the extensor pollicis and extensor longus communis muscles will now be exposed, and the vessel will be found lying between them in close contact with the bones, accompanied by a vein on each side: a slight scratch with the point of the needle will allow them to be put aside; then the ligature being carried round the artery and fastened, and the edges of the wound approximated by one or two stitches, the operation is completed. Occasionally, in this situation the vessel will not be found exactly in the space between the tendons above-named: it may take a slight turn under the common extensors ere its dips between the metatarsal bones, and it should always be remembered that it may possibly be wanting altogether.

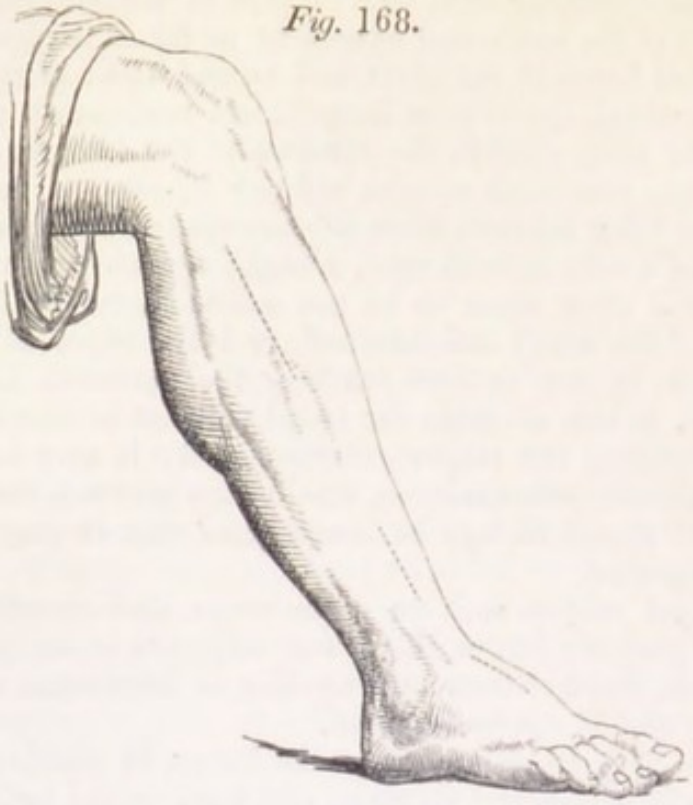
In the dead subject such an operation as that described is very easily accomplished; but in the living body, unless the parts are free from swelling, whether from inflammation or infiltration of blood, the same facility should not be expected.

The vessel may be secured above the instep, by making an incision three inches in length, and searching still between the tendons already named: if, however, the incisions be made more than a hand-breadth above the ankle, the artery must be looked for between the extensor communis and tibialis anticus; low down it lies on the surface of the tibia,—higher up, on the interosseal membrane.

In the upper third of the leg, the vessel lies deep between the two last-named muscles, and a free incision of the surface will be required to get to the bottom of the space between them: the aponeurosis of the leg offers a greater obstacle to exposure of this deep space than the integuments; it must, therefore, be divided to an equal extent, and in addition a little transverse notch in it on each side of the wound will greatly facilitate the proceedings. Throughout its course in the leg the vessel is accompanied by two veins; but here, as in the foot, the anterior tibial nerve is so far separated from it, as not to be much in the way; and, indeed, its division with the knife would be of no great consequence. The following sketch (fig. 168) exhibits the lines of incision: on the lower part of the leg the wound should be about three-fourths of an inch on the fibular side of the crest of the tibia; higher up, particularly if the subject be muscular, it should be an inch and a quarter at least from the same part, to make allowance for the breadth of the anterior surface of the tibialis anticus; and in each proceeding, especially that high up, the surgeon should not make his way between the muscles directly backwards, but should follow the line of separation between them, which leads towards the centre of the limb.

In attempting these operations it should be remembered that the artery is occasionally irregular; it may be very small, or it may be

Fig. 168.



wanting altogether: neither a bleeding wound nor an aneurism on the dorsum of the foot, though the vessel can actually be felt pultating in front of the ankle, will with certainty denote its presence in the usual situation higher up; for, when it is deficient in size or absent, there is commonly a large branch of the fibular passing through the interosseous ligament, a little above the ankle, to the fore part of the leg, which occupies the site of the anterior tibial on the foot.

The circumstances which may demand ligature of the posterior sibial artery will be similar to those requiring deligation of the anterior, and the remarks in reference to the rules of practice are equally applicable. If the surgeon has a choice of situation, he ought undoubtedly to select that part of the vessel where it lies between the malleolus and calcaneum. An incision, two inches in length, should be made midway between this process and the insertion of the tendo Achillis: after the skin has been divided, some strong aponeurotic fibres must next be cut in the same manner, and the artery will be found immediately beneath, accompanied by two veins, with the posterior tibial nerve between it and the os calcis. Perhaps, however, the vessel must be sought for higher up, and four inches above the ankle an incision may be made through the skin about three inches in length, and about half an inch posterior to the margin of the tibia. The knife should next be carried through the aponeurosis; for, in this situation, both the superficial and deep layers, if they are not actually, are so nearly, in contact, that they may be considered as one, when the artery will be found on the flexor communis and tibialis por-

ticus muscles: a vein will be perceived on each side, and the nerve nearer the fibula. Even within four inches of the ankle the soleus may be found covering the vessel, and higher up it is almost certain to do so: the muscle being irregular in this respect, the operator may be prepared to meet with some of its fibres in the lower third of the leg; but, however easy it may be on the dead subject to expose the vessel by cutting through this muscle, the operation may be found somewhat more difficult on the living body. A good anatomist can have little trouble in making an incision of three inches in length, parallel with the vessel, and half an inch behind the margin of the tibia, dividing skin, superficial aponeurosis, soleus, and deep fascia, so as to get upon the vessel as it lies on the deep layer of muscles: all this he may do with ease on the subject; but to accomplish such proceedings on the living body, he must be a cool and dexterous operator, and one not likely to be annoyed at the continued oozing of blood from the bottom of the wound, nor likely to be scared either by the deep gap in the limb, the pain to which his patient will in all likelihood be subjected, or the tediousness of the operation.

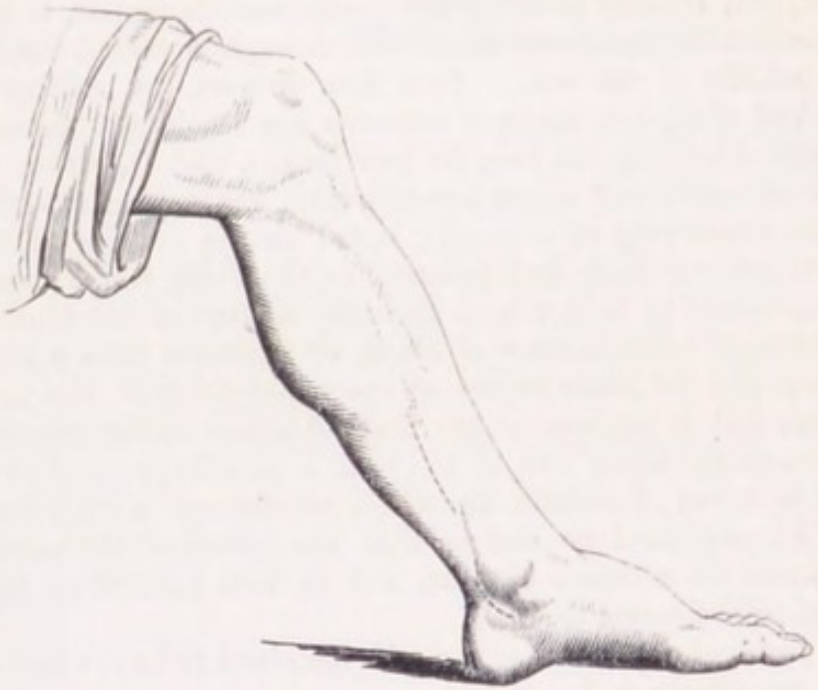
Instead of dividing any part of the soleus near to the tibia, by making the wound in the skin so close to this bone as has been directed, and thereby avoiding the gastrocnemius muscle, it has been recommended to search for the vessel through a wound made nearly in the middle of the calf. In a thin subject, by cutting in the upper third of the leg, midway between the fibula and inner margin of the tibia, dividing the skin for four inches, also the inner heads of the gastrocnemius and soleus muscles, with the fasciæ, superficial and deep, the vessel may be exposed; but I should certainly not feel inclined to attempt such an operation on the living body, even though it be sanctioned by such a high authority as that of Mr. Guthrie. In an instance of extravasation of blood, or aneurism from a wound, an attempt might be made to get at the vessel through free superficial incisions; but it appears to me that all stated above regarding the operation on the inner side of the limb is equally, indeed even more, applicable here; I cannot, therefore, recommend such proceedings; and if a vessel must be tied so high up, probably the safety of the patient, and his ultimate comfort, will be best secured by ligature of the superficial femoral artery.

The peroneal artery can scarcely be imagined to be the seat of spontaneous aneurism; and it lies so deep, and so protected by the fibula, that a wound in it must be of rare occurrence. The vessel may be reached through an incision, three inches long, and parallel with the posterior border of the bone. If the wound be made about the middle of the leg, some portion of the soleus must be divided, and the flexor longus pollicis may either be turned towards the fibula, or its fibres may also be cut across: on the dead subject, the latter may usually be preferred. The vessel is often so small, that I have again and again seen it missed in dissecting-room operations. If the incisions are made higher up, possibly some fibres of the outer head of the

gastrocnemius will be divided, as well as those of the soleus, and after the division of the latter, the deep aponeurosis alone will intervene; but it is here so thin that it may scarcely attract notice.

Considering the irregularities of both the posterior tibial and fibular arteries, I cannot but repeat my objections to attempting these proceedings on the living body, in the upper third of the leg, by the Hunterian operation,—that is, by cutting down on either of the vessels above an aneurism or wound: the necessity for doing so on the fibular is, as already stated, scarcely to be imagined, and the same may almost be said regarding the posterior tibial: indeed, I have for many years looked upon such proceedings as appertaining so much to mere dissecting-room displays, that, in my lectures, I have only referred to them because they have been described by the anatomist, more, in my opinion, to show what may be done with correct anatomical knowledge, than with reference to what might be considered good surgery. In the lower part of the course of the posterior tibial, a ligature may occasionally be required, and this sketch (fig. 169) will show the lines of incision as above directed.

Fig. 169.



Ligature of the popliteal artery is seldom, if ever, performed in the present day. Previous to the introduction of Hunter's operation on the superficial femoral for aneurism of this vessel (1785), the surgeon was in the habit of cutting into the ham, clearing out the contents of the sac, and tying the artery above and below its communication with the disease; but such a proceeding is now never contemplated for spontaneous disease; and as the vessel is so well protected against injury, it will rarely occur that the surgeon has to secure it for a

wound in this situation. The artery may be exposed by making an incision about three or four inches long, between the hamstrings, and parallel with its course. The patient should lie on his face, and the wound should be nearer the inner than the outer hamstring: its upper extremity should be about four inches above the condyles: about two inches above the innermost of these processes the artery will be found close upon the surface of the bone; but before it can be reached, after the division of the skin the aponeurosis must be cut to the same extent, and nearer to the vessel, some cellular texture, fat, and perhaps a lymphatic gland or two, must be divided or held aside. The vein and artery lie in close contact, surrounded by condensed cellular membrane, which forms a kind of sheath to the vessels: the vein lies behind the artery, so that in performing the operation with the patient on his face, it will be first encountered; perhaps a small portion of the artery will be seen on the inner side of the vein, and the latter should be slightly turned to the outside, to allow the point of the needle to be carried between the two, and round the former. The posterior tibial nerve (popliteal) lies so nearly in the centre of the ham, that if the knife be carried close to the inner boundary of this space, as just directed, it may not be met with at all, more particularly if the incisions are placed somewhat high: if it is seen it should be held to the outside. If the operation is done as now recommended, the vessel will be perceived to be at a very considerable distance from the surface; higher up the distance is still greater, and lower down it is less; but here the proximity of the posterior saphena vein, and the sural as well as the articular vessels, should induce the surgeon to avoid the part.

The proposal of M. Jobert to cut for this vessel on the inner side of the limb, a little above the inner condyle, between the vastus and the hamstrings, seems to me another of those dissecting-room speculations which I have characterised above in referring to operations on the posterior tibial and fibular arteries; I need not, therefore, dwell on its merits or demerits.

It has been supposed by some that mortification is more likely to succeed the sudden obstruction of this artery than when deligation of the superficial femoral is performed: were the old operation for aneurism done on the vessel, doubtless this would be the case; but the fact has not been proved since Hunter's operation came into practice. Perhaps the depth of the wound, and its awkward position for after-treatment, are the chief reasons why this operation is so rarely performed; but it must also be remembered that there are fewer cases in which it can be done than in the instance of the femoral, a ligature on which will effect all the good that can be expected from one on the popliteal, and is, moreover, equally applicable and useful in aneurism, as also in some cases of wounds of this vessel itself.

The superficial femoral artery may be secured with a ligature in any part of its course. It has been customary to describe the operation in two places—either in the middle of the thigh, or in its upper

third: the first of these being similar to that which was done by Hunter, and the other like that recommended by Scarpa. In either instance the patient should be laid on his back, with the leg bent at the knee, and the thigh slightly rotated outward, and also bent upon the pelvis, so as to expose its inner and anterior surface. In the middle of the thigh a wound of three or four inches in length should be made parallel with the vessel, and nearly, therefore, in the same course as regards the sartorius muscle. The skin and subcutaneous cellular texture being divided, the aponeurosis should be cut to the same extent, when the fibres of the sartorius will be brought into view; its inner margin may next be turned outwards, as was done by Hunter, or its outer margin may be turned inwards, as has since been more recommended, and at the bottom of the space between the vastus internus and the adductor longus the vessel will be found: here it is covered by a slip of the tendon of the last-named muscle, which requires to be divided, when the vessel will be found in close contact with the vein, which, however, will probably be so completely behind as to escape observation: the saphenus nerve may be seen immediately in front of the vessel, or, perhaps, it may be noticed ere the slip of the adductor has been cut, for it sometimes lies in front of this texture, and at other times in immediate contact with the artery. The point of the needle may be passed on either side of the vessel which the operator may find most convenient, and should, on all occasions be kept so close to it as not to endanger the vein. It has been said that, if this operation is done too near the aperture in the adductor magnus, there is a chance of coming in contact with the anastomotica magna, and, indeed, I have seen this vessel tied on the dead subject instead of the femoral, though I can scarcely imagine such a mistake occurring on the living body.

This operation may be somewhat more difficult than some might suppose, for no particular guide can be given, unless it be the course of the fibres of the muscles. After the skin and fascia have been divided, and some muscular fibres exposed, it may be doubtful to which muscle they belong,—whether to the sartorius or the vastus: if to the latter, they will seem to run towards the inner side of the thigh; and if to the former, they will pass nearly in its long axis. If the thigh has been placed as directed, and the first incision has been made about the middle of its breadth, the sartorius will assuredly be the muscle, and the future incisions may be made on either margin at the will of the surgeon, or if he chooses he may divide the muscle entirely; though I would not recommend such a proceeding under ordinary circumstances.

Whether it is from the comparative depth of the artery in this situation, and also the comparative difficulty of the operation, or that the circumstances demanding such a proceeding are more rare, I will not attempt to determine, but it is beyond doubt that the artery is not so frequently tied in the middle of the thigh as in the upper part of its course. In the different instances in which I have known it secured

a little above its passage through the adductor magnus, the operation has been done for secondary hemorrhage in the leg, after amputation; I know of no particular advantage in selecting this situation, unless it be that in the event of secondary bleeding at the seat of deligation, there is still another chance left for the patient of having the same vessel tied a little higher up; neither is there any great disadvantage, for I attach no consequence to the arguments that high inflammation with abscess or diffuse suppuration is more likely to follow here than nearer the groin: considering, however, that in the upper third of the thigh, the vessel is much more easily reached, that there must be less disturbance of parts, and that the operation must be equally efficient,—I cannot but recommend the selection of the operation in this situation. The circumstance of secondary hemorrhage is one of grave importance; yet, in my opinion any calculations as to its probability of occurrence should not deter the surgeon from the operation above the sartorius, which seems to me, under nearly every circumstance, that which is most eligible. Here the vessel is to be secured towards the lower angle of that triangular space so particularly referred to by Scarpa, which is described at p. 241.

The operation may be performed in this manner:—The patient being placed on his back, with the limb bent as already directed, the surgeon should feel for the anterior superior spinous process of the ilium, and for the tuberosity of the pubes; nearly midway between these points he will discover the femoral pulsating, and about two inches below he should commence his incision through the skin, and carry it downwards for three inches and a half, in a direction parallel with the axis of the limb, and consequently parallel with the superficial femoral: the skin being divided, the aponeurosis of the thigh will next be exposed by division of the superficial fascia, and here, perhaps, a few lymphatic glands may be met with; the aponeurosis being now cut through, some fibres of the sartorius may probably be seen, and the sheath of the vessels will be exposed: this latter texture being cautiously opened to the extent of a quarter of an inch, or less, the artery may be recognized, and the needle passed around it from within outwards.

If the first incision is placed as above directed, and if the operator takes care to go neither to one side nor the other, the vessel can scarcely be missed; yet I have known a surgeon pass an inch deeper on its inner side. The pulsations of the artery will form a good guide in general; and when there is any difficulty, a reference to the sartorius muscle will be of service, provided the incisions have been made sufficiently low to expose its fibres. In this situation, as in most other parts of the body, I believe, as has already been stated in the introduction to this work, that a knowledge of the appearance of textures is of the greatest value in enabling the surgeon to complete the operation in a safe and satisfactory manner.

The internal saphena vein may possibly be seen in the first inci-

sions, and should, of course, be carefully avoided; but the wounds, either in the upper or middle third of the thigh, should be made sufficiently towards the mesial line as to avoid this vessel. The saphena nerve is generally on the outer margin of the artery, outside of the sheath, and away from the reach of the surgeon; if, however, the operation be done very close to the sartorius, it may possibly be in the way, and should therefore be held to one side. The vein is partly on the inner side of the artery, but chiefly behind it: too much care cannot be taken to avoid this vessel in using either the knife or the needle: the edge of the former should be applied cautiously in dividing the sheath, and the point of the latter, being first insinuated between the vein and artery, should be carried outwards in close contact with the last-named vessel. Many examples have been known of injury of the vein in this operation, and have been referred to by Cooper, Carmichael, and others: I have myself seen one instance where the point of the needle as it was carried round the artery was thrust through the vein; the hemorrhage was copious on the instant, but as soon as the ligature was tightened (no attempt was made to alter its position) it ceased, and though that patient afterwards died of phlegmonous inflammation and secondary hemorrhage,—and which of the two was the immediate cause of death it was difficult to say,—I cannot attribute the fatal result to this mishap, though I must, nevertheless, repeat my caution to avoid the vessel. In an instance in which Sir Charles Bell had cut down upon this artery in the usual manner, and placed a ligature upon it, the pulsations in the tumour continued, and it was afterwards ascertained that the vessel was double. No other similar case has ever been met with in practice, in so far as I know, but such an irregularity has occasionally been seen since in the dissecting-room.

Fig. 170.

The sketch (fig. 170) exhibits the lines of incisions above recommended, the under one showing where Hunter applied the knife, the upper being the situation recommended by Scarpa. For the conve-

nience of displaying the lines, the artist has kept the limb in a straighter position than has been above described.

Secondary hemorrhage occasionally occurs after ligature of the superficial femoral artery, and often, too, in instances where it might be least expected. Two examples have happened in my own experience, and in neither of these instances was the artery disturbed in an unusual manner, or divested of its sheath to a greater extent than to allow the point of the needle to be passed, nor was the ligature placed nearer than an inch to the deep femoral. In such cases a question will arise regarding the course of practice to be followed :— If the vessel has originally been tied in the middle of the thigh, I should be most inclined to place another ligature on the same vessel higher up,—that is, several inches higher, above the sartorius ; but if the operation has already been done in this situation, the question may be, whether the vessel should be again tied at the same place, or that a ligature be cast on the common femoral or external iliac.

If either of the latter operations be adopted, it will be observed that the circulation through the deep femoral will be obstructed, and that consequently there may be such a deficiency of blood in the limb afterwards as to end in mortification. In ligature of either the femoral or external iliac, as a primary operation, such an event is of rare occurrence ; but the circumstances are very different in the case at present under consideration : here not even the smallest quantity of blood can be expected to flow by the superficial femoral, supplied either by a retrograde current through its deep branch, or through the epigastric ; whilst, in a primary operation on the iliac, this may reasonably be calculated on, even in an instance of aneurism in the groin,— the current at first being sufficient to give effective assistance to the other channels of circulation which support the vitality of the limb below, but yet not so strong as to prevent the favourable changes in the tumour, which tend to the cure. In secondary bleeding from the superficial femoral, the retrograde circulation referred to above must be prevented by pressure over the bleeding orifice and the course of the main artery, otherwise, even after ligature of the external iliac, the hemorrhage, though checked in its impetuosity, might still continue to an injurious extent.

In one of my own cases, on the sixteenth day after deligation of the superficial femoral in the groin, a ligature was applied to the external iliac, and also slight pressure in the groin over the course of the open vessel, to check secondary bleeding : these had the desired effect ; but mortification of the whole limb, from the foot to the hip, speedily ensued, and death was the result. The loss of vitality seemed at first to be confined to the lower part of the limb, and I was, therefore, induced to amputate in the thigh, but the stump within twenty-four hours became similarly affected. I confess that I should feel reluctant to follow this practice in a similar case, and should be more inclined to place ligatures immediately above and below the bleeding orifice, though such

a proceeding is doubtless somewhat equivocal also. In such a course pressure should be applied by the thumbs of a steady and trustworthy assistant, then by enlarging the orifice in the track of the original wound, the artery should be exposed, separated slightly from the vein, and secured with threads. But such operations are more easily talked about, and described on paper, than done on the living subject: the person who attempted such a practice as that referred to, would require great coolness and confidence in his own resources, as well as considerable nicety in manipulation, and supposing infiltration of blood to have taken place, much difficulty might be anticipated in accomplishing the object immediately in view.

In making a selection of either course of procedure, the practitioner will assuredly feel himself in a most eventful dilemma: if the patient is let alone, loss of life must be the result; and pressure, if it be tried in such a case, is uncertain, and unsafe too; for if it be sufficient to stem the current in the artery, the vein will be compressed also: how, and what to do then, he will have difficulty in deciding, and whatever course he may think fit to pursue, the patient's safety must be considered in the utmost jeopardy.

Ligature of the common femoral artery is seldom performed now-a-days. It was done before Mr. Abernethy performed his first operation on the external iliac artery, and has since been recommended by some as a preliminary step to amputation at the hip-joint. For the latter purpose I do not consider it at all necessary, and the superiority of the operation on the iliac seems so great that there cannot be a doubt which should be selected. On the dead subject the vessel may be easily displayed by making an incision in its course about three inches long, the upper end of it being a little above Poupart's ligament: the skin and superficial fascia being cut through, the aponeurosis of the thigh should be cautiously divided about an inch below the ligament; the sheath of the vessels should next be opened with equal care, and the artery being slightly denuded, should be surrounded with the needle, the point of which should be carried from within outwards; for though there is a slip of cellular texture between the two vessels here, the vein might be injured were the instrument carried in the opposite direction. A good anatomist may make the incision so strictly over the artery, that he will probably not see the vein at all, as it lies on the inner side. The inguinal glands and the arteries connected with them may attract little attention; but on the living body, they might occasion considerable trouble, and I have known them do so in operating on the upper course of the superficial femoral, as well as on the lower part of the external iliac. The trouble arising from these sources, then, more particularly from the divided arteries, as well as the proximity of their origins to the seat of ligature, as also of the pudendal branches, the circumflex, and epigastric arteries,—the circulation through all of which might prevent the closure of the main artery, and, in addition, when it is considered that in the subsequent movements of the thigh, however slight, the

artery is likely to be considerably disturbed,—all seem to me sufficient grounds of objection to this operation, excepting under very particular circumstances, and should induce the surgeon to give a preference to the external iliac for the seat of operation.

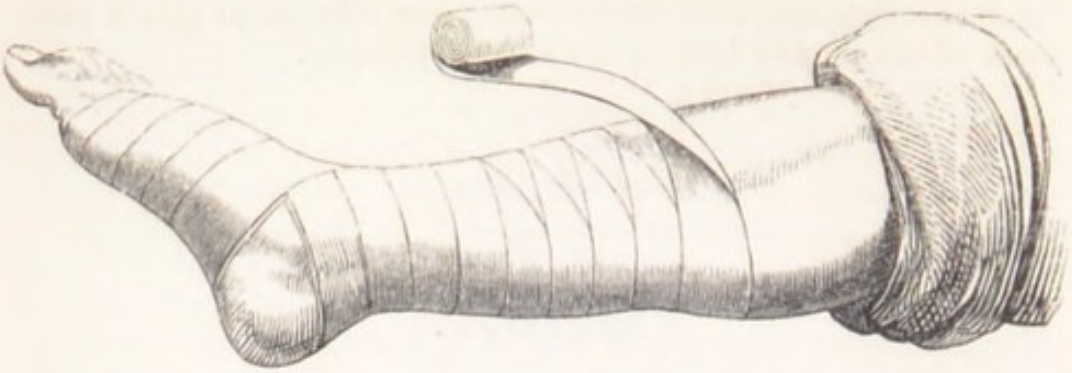
CHAPTER V.

APPLICATION OF BANDAGES AND STRAPS. OPERATIONS FOR VARICOSE VEINS. REMOVAL OF FOREIGN SUBSTANCES FROM THE KNEE-JOINT.

If the student is anxious to make the most of a single subject, he should perhaps next take into consideration certain minor operations which he will be called on to perform in practice. For example, in the treatment of ulcers of the leg, he will, even whilst a student, have to apply a roller from the toes to the knee; and should it happen that he is engaged in hospital duties, unless he is under a good-natured and indulgent teacher, he may possibly be more annoyed when he does not accomplish the proceeding in a proper manner, than he may anticipate.

For whatever object a bandage is applied, whether in the treatment of ulcers, of varicose veins, or of fracture, it is of importance to observe that an equal amount of support or pressure is afforded on all sides, and by the entire breadth of each turn of the roller. In bandaging the leg the following method should be pursued: The end of the roller should be laid on the anterior part of the metatarsus, and two or three turns should be made upon the foot as high as the instep; next a turn should be made round the leg immediately above the ankle, and round the foot again over the instep: as it is seldom thought requisite to cover the heel completely, the bandage may now be carried up the leg, turn after turn, until the limb is enveloped as high as the knee, or as far as may be required, each turn of the cloth being made to cover about a third of the preceding, and as the swell of the calf increases, the roller should be reversed, or folded downwards, as by such a movement the pressure is equally diffused over the surface, and thus no inequalities will be perceived when the bandage is removed, but it will be seen that an equal support has been given to the surface throughout. The method of applying a bandage is easily demonstrated on the body; but it cannot be so readily described: the following drawing, (fig. 171,) and a reference to that at p. 288, will probably serve to make my description clearer: the roller may be held either in the right hand or in the left, and carried from the right

Fig. 171.



side of the leg or the left, at the will of the surgeon, or as seems best fitted to the circumstances.

In old callous ulcers it may be deemed necessary to give further support to the parts, to approximate their edges, and also to apply a certain amount of stimulus, by means of straps of adhesive plaster, from an inch and a half to two inches broad, and of such a length as to encircle the limb. The middle of each strap should be placed on the side opposite to the sore, and then each end should be brought forward and crossed in a sloping direction over it. A sufficient number of straps are to be applied to cover the limb an inch or more above and below the ulcer, and over all a calico roller may be placed as above-described.

The method, by means of the roller (made of flannel, however) combined with the calamine cerate and compresses, constitutes that which was so highly extolled by Mr. Whateley, and that, with straps and the calico bandage, forms the chief feature of Mr. Baynton's practice. In modern times, cloth prepared with caoutchouc has been recommended as a good substitute for the flannel or calico bandage in such cases, and the latest fashion is cotton-thread bandage worked in a manner similar to a stocking. The latter seems an advantageous improvement, possessing greater elasticity and more durable powers than the common calico; but the former, in so far as I can perceive, has not maintained the pretensions with which it was brought forward.

The treatment of varicose veins in the lower extremity, constitutes, in the present day, more of the surgeon's duty than was formerly the case; for although at all periods of the history of the art it would appear that various operations were performed on the veins, differing in kind and in severity, from the actual cautery to the simple puncture with a lancet, little active surgical interference was resorted to in the present century, until within the last ten years, when an important change in practice, with reference to varicose veins, has been most extensively pursued. From the fatal results which occasionally followed the application of a ligature to the saphena vein, on the inner side of the knee, as practised by Sir Everard Home and others, surgeons seemed suddenly to have concluded that all interference with this vessel or its

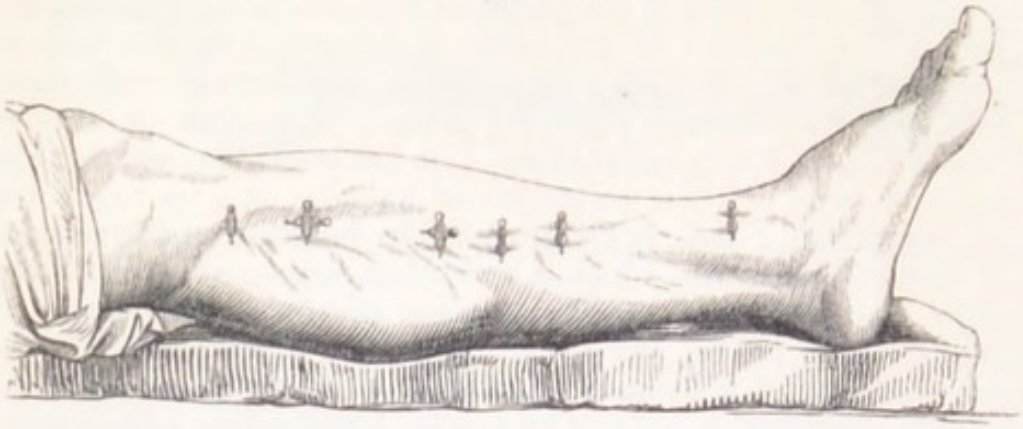
branches was fraught with the utmost danger; and notwithstanding the apparent success attending the division of these vessels, as practised by Sir Benjamin Brodie, it seemed to have become at once a settled point, that, excepting under most urgent circumstances, the chief practice to be followed with propriety in varicose veins was that of supporting the vessels and parts by means of bandages or laced stockings. Of late years, however, there has, in my opinion, been ample ground for doubting the correctness of the prevalent doctrines of modern surgery, regarding some injuries of the veins; and though I do not wish to be understood as advocating any useless interference with these vessels, or any carelessness regarding them, in operations on arteries for aneurisms, or during amputations, I do not hesitate to say that the dangers of some of these accidental or intended injuries have been much exaggerated; and, in illustration, the instances of interference with varicose veins, with which most modern surgeons are now very familiar, may be referred to. The examples afforded by the practice of Velpeau, Davat, Fricke, and many of our own practitioners, clearly evince the rarity of unfortunate results or of dangerous consequences from local inflammation, induced by surgical interference. The discussion of such matters does not come within the scope of my present object, but I trust that I have appeared sufficiently explicit in giving my opinion, that far less danger is to be apprehended from injury to varicose veins than the doctrines of twenty years back inculcated.

The method of obliterating the enlarged veins by means of needles and threads, as advocated by Velpeau, has now been extensively tried by most of our hospital surgeons; and having myself resorted to the practice very frequently, I can speak with some degree of precision on its merits. I have found it of most service in examples of enlargement of the saphena (either the internal or the posterior), and some of its most conspicuous branches; and in those instances where the disease affects many of the vessels of the leg, more particularly the minor vessels, which have their course in the cutis vera, I have observed less benefit resulting: in such cases the disease often proves to be beyond the aid of active surgical interference; but in those first referred to, it will often be found of much service, although even here success must not be invariably expected, for it will sometimes happen that some of the veins which have previously been but little affected will speedily assume the size of those already operated on, whilst on other occasions the vessels which have been under treatment, and supposed to be obliterated, will actually continue to carry on the circulation.

The operations with the needles may be performed as follows: whilst the patient is in the erect position, the outline of the vessels to be selected for the proceedings should be observed; he should then lie down, and the surgeon should pinch up a vein between the fore-finger and thumb of the left hand, with a portion of the skin, and should with his right hand pass a needle, such as that delineated at p. 34, straight across under the vessel; he should next twist a thread

around the needle, as represented on the sketch below, drawing it sufficiently tight to obstruct the circulation and to cause some little pain; he should then repeat the operation at other parts as often as may be thought advisable, and having cut off the ends of the needles, the limb will appear thus: this drawing (fig. 172)

Fig. 172.



was taken from one of my patients; and it will be remarked, that, besides a number of needles used according to the method now described, which is much the same as Velpeau's, there are some made to cross each other according to the plan of Davat. The latter consists in passing the second needle at right angles to the first: its point is thrust through the vein, above or below, then carried behind, and again made to transfix the vein in its passage to the surface; thread is then twisted around each needle, at the will of the surgeon, and the circulation in the vessel completely obstructed.

It will be perceived that in Velpeau's plan the vein is merely compressed between the needle and thread, and that in Davat's method it is twice transfixed; in the latter instance, therefore, as the injury is greater, the amount of inflammation likely to follow will be in proportion; and, as it is a principal object of the operation to induce the adhesive process in the site of the needles, the result may be more satisfactory, so long as the disease remains local. I have found Davat's method produce the supposed requisite amount of inflammation most rapidly; but the other, if persisted in sufficiently long, has been equally successful in its results. In some cases the needles require to be removed on the second or third day, and in others they seem to produce so little irritation, that they may be allowed to remain for twelve days or more. As a general rule, they should be left until they have excited considerable swelling and slight ulceration; and in some instances when the former is not very conspicuous, they may be permitted to separate by ulceration through both vein and skin. I recommend that the process of inflammation should be more implicitly relied upon than that of coagulation, either below a needle or between a couple of them; indeed, in many ex-

amples, it appears that coagulation does not occur, although, partly with a view to ascertain this, I have included an inch or more of the enlarged and distended saphena on the inner side of the knee, between two needles, and have, on withdrawing them before much inflammatory action was excited, discovered that the circulation has gone on immediately after, almost in as full a volume as before. Out of numerous instances in which I have resorted to this practice, I have met with no seriously unpleasant effects; in one case only has there been a slight suppuration around the needles; but as already stated, a cure has not been the invariable result: the practice, however, is an admirable addition to surgery; and whatever may be the opinion ultimately formed by the profession of its utility in the treatment of varicose veins, there can be little doubt of its eligibility in instances of rupture of the enlarged saphena, — an accident by no means of rare occurrence. Some months ago there was a patient in King's College Hospital, with varicose veins of the leg: she had been admitted in consequence of rupture of the saphena, in the site of a small ulcer. By rest in the horizontal position, and the usual lotions, ointments, &c., the surface healed, and the patient was dismissed cured, but she returned within a few days, the vein having again given way, and the cicatrix having burst; needles were then applied, and caused the obliteration of the vessel above and below the ulcer; when the latter was healed the patient was again dismissed, and has since remained cured.

Occasionally the surgeon may deem it requisite to cut into the knee-joint, for the purpose of removing loose cartilages; and as it is a wound which ought not to be thought lightly of, in so far as the safety of the patient is concerned, it would be advisable to try palliative measures before resorting to such a proceeding. The application of a common roller to the knee, or any apparatus to restrain the movements of the joint, or to fix the loose substance in one position, where its presence will not cause further annoyance, should first be tried; and if it is then found that something more must be done, the cartilage may be removed. The operation may be thus accomplished:—The patient's limb should be placed horizontally, and the body should be slightly raised to relax the extensor muscles in front of the thigh; by pressure with the fingers, the loose object should then be worked to one side of the patella, until it lies in front of one or other of the condyles of the femur, and the internal should, if possible, be preferred; the surgeon should then draw the skin slightly upwards, and keep the object steadily fixed between the fore-fingers and thumb of his left hand; he should next cut boldly down upon it, with an incision of sufficient size to allow it to escape, which it usually does by starting suddenly through the wound,—a movement which may be much expedited by gentle pressure with the points of the fingers. As soon as the substance is away, the skin should be allowed to resume its natural position, when the aperture on the surface will be half an inch or more below that through the synovial capsule.

A strap or a little simple dressing should be applied, and, to ensure perfect quietude for the next six or eight days, the limb should be kept steady with a splint.

I have met with a variety of instances where it has not been advisable to resort to this practice; I have, however, in four cases, cut into the knee-joint in the way described, and with perfect success; and in these examples the absence of dangerous inflammation may be attributed to the great care which was taken of each patient, both immediately before and after the operation: all the cartilages in these cases have been small,—not bigger than a garden bean; but I have seen much larger extracted with equal success, though I have known alarming inflammation follow such operations.

To obviate the dangers of a large external wound, a method has lately been proposed by Dr. Goyrand, as also by Mr. Syme, to remove these bodies from the knee, by means of a subcutaneous incision. The object being fixed as above described, a narrow knife is passed under the skin, and a wound is made in the capsule, of sufficient size to allow it to be squeezed out of the joint into the subcutaneous cellular texture; time is then given for the wound in the synovial membrane to heal, and the cartilage may afterwards be permitted to remain in its new position, or removed through an incision of proper size in the skin, according to circumstances.

Instances have been known where bullets, necrosed portions of bone, and other foreign substances have been extracted from this locality; but such proceedings are very different in character from those above alluded to, as before any thing of the kind has been attempted, the joint has been in a manner destroyed by inflammation and its consequences, and therefore they more resemble excisions of diseased portions of bone, than operations on a joint whose articular surfaces may be considered in a state of health, as is the case in the instance of loose cartilage.

CHAPTER VI.

OPERATIONS FOR CLUB-FOOT AND BENT KNEE.

THE practice of dividing tendons and other textures, for the removal of deformities, has now become so common, that it may be well to perform some of these operations on the subject. Already (p. 254), in the chapter on dislocations, I have referred to the division of the flexor tendons in a certain kind of luxation in the second toe; but distortions of a more unseemly kind—of the foot, ankle, and knee, may be treated on similar principles.

The method of dividing the tendo Achillis for the cure of club-foot, as first practised by Lorenz, in 1784, under the suggestion of Thilenius, and subsequently by Sartorius, by both of whom free incisions were made through the skin to reach the tendon, has now been superseded by the more simple, more safe, and equally efficient practice of Stromeyer, who has in various ways improved upon the operation as done in 1816 by Delpech. This latter surgeon avoided the free division of the skin, as practised before, but it remained for Stromeyer to point out clearly the advantages of the subcutaneous incision, as well as those principles of after-treatment, which, combined, have given a scientific character to the whole proceedings, which can scarcely be said to have existed before. Since 1831, when Stromeyer first introduced his operation, his plan of treatment, variously modified according to circumstances and the taste of the surgeon, has been most extensively practised in all parts of the world where surgery is cultivated, and practitioners in England have been much indebted to the labours of Dr. Little (who was himself a patient and pupil of the Erlangen professor), whose treatise on club-foot and analogous distortions has been for some time familiar to the profession.

The most common form of Talipes is either that in which the person rests on the fore part of the metatarsus, whilst the heel is raised an inch or more from the ground, or when the toes and heel are turned inwards and upwards, and the weight of the body is sustained on the outer margin of the foot; the first of these distortions is represented in the following drawings (figs. 173 and 174), being that form called talipes equinus, and the second kind (t. varus) is exhibited in figure 176, p. 327. The condition wherein the toes and heel are turned outwards and upwards, whilst the person rests on the inner margin of the foot (t. valgus), is much more rarely met with.

There are few of these cases in which the division of the tendo Achillis will not greatly facilitate the removal of the deformity; the operation is simple and unattended with danger, and may be resorted to in the earliest infancy, or in advanced years, with every prospect

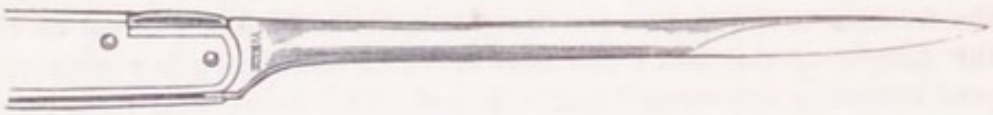
of advantage. It may be accomplished thus: The patient should be placed on his face, and whilst the heel is bent upwards, the relaxed skin over the tendon should be slightly raised between the finger and

Fig. 173.

Fig. 174.

thumb, so as to permit of the easy passage between the two textures of such a blade as this (fig. 175), flatwise; this being accomplished,

Fig. 175.



the edge should next be turned upon the tendon, which should then be put on the stretch, by bringing the heel downwards, when with a little pressure, the division may be effected. However sharp the cutting edge may be, this part of the operation will be accompanied with a grating sensation, as if it were blunt. As soon as the section is completed, the upper portion of the tendon will recede from the other, and the latter may be drawn considerably downwards, so that a space

of from half an inch to an inch may be left between them: perhaps a few fibres may remain undivided, and much on the stretch; these should also be cut across by holding the edge of the knife against them; or, if it has already been withdrawn, by inserting it again through the little orifice in the skin. Dr. Little and others have recommended that the tendon should be cut from within outwards; *i. e.* by passing the knife in front of it, and then cutting towards the surface; but such a proceeding, as well as whether the blade should be thrust in on the inner or outer margin of the tendon, are matters of no great moment, in my opinion, and may, therefore, be left to the convenience or taste of the operator. Neither do I think the shape and size of the knife of such importance as some seem to imagine, provided always that care be taken to make the external puncture very small. I have performed the operation frequently with a common narrow-bladed bistoury, and also with a small scalpel. It will be remarked, however, that in using the edge of these knives a larger wound will be made in the skin than may be wanted, and I have latterly used such a blade as that above represented, which only cuts for about five eighths of an inch from the point; and the remainder being blunt, and rounded on each side, admits of its being turned in any direction as often as may be required, without further injury to the surface.

In the talipes equinus this proceeding will be all that is necessary with the knife; but in the other forms of club-foot, the tendons of the tibiales muscles, the flexor and extensor pollicis, sometimes even the common flexors and extensors, and also those of the peronei, may require division: in addition, it is often of much consequence to divide a portion of the plantar aponeurosis by a subcutaneous incision, and occasionally also to divide the short muscles in the sole of the foot, more particularly the flexor brevis: indeed, in some instances, when the foot has been very short, and much arched, but when the heel has not been raised from the ground, and the deformity has scarcely amounted to what might be called club-foot, I have seen much benefit result from division of the plantar apeneurosis, and a partial incision of the flexor brevis muscle. There need be no set rules for such operations, nor much hesitation in dividing every texture which seems to offer resistance to the removal of the deformity: in the young subject the tendons and vessels are all so near to each other, that either of the tibial arteries may occasionally be wounded: I cannot speak positively on this subject; but my impression is, that they are frequently cut across in young children: in my own practice the point of the knife has often been carried so near to one or other of these vessels, that I have felt convinced that one of them must have been divided, in consequence of the flow of blood following the withdrawal of the blade; but I have always found that a little pressure with a pad and bandage has effectually restrained the hemorrhage. In the sole of the foot, too, copious bleeding has been noticed until pressure was applied. Especial care, however, should be taken in operating on the adult, as

division of the tibial arteries in such subjects might be attended with more trouble. Of course I do not wish it to be understood that no heed should be taken of these vessels in the child; on the contrary, the utmost care should be taken to avoid such important parts; but this cannot always be done, and it may be satisfactory to the young surgeon to know, that if such an event does happen, he need not be in much alarm on that account.

Whatever be the advantage of dividing tendons and other textures, (and there can be no doubt it is great,) the perfection of the cure depends much upon after-treatment, which consists chiefly of the adaptation of apparatus to restore the foot, in a gradual manner, to its more natural position. Numerous pieces of mechanism have been used and recommended for this object; but for general purposes the foot-board of Stromeyer, or the boot recommended by Scarpa, for the treatment of distortion of the foot, long before these operations on the tendons became so common, will be found of the greatest utility: the former consists of a board, which should extend from the ham to the heel and somewhat lower, having a foot-piece which can be moved to any angle or inclination that may be desired, and Scarpa's machine consists of a kind of shoe with a firm iron sole-plate, having a long rod of the same metal extending from it as high as the knee. Various improvements have been made on the latter by Dr. Little, Mr. Weiss, and others, which, however, need not be described here. Mr. Liston has delineated a very simple contrivance for these purposes (Practical Surgery, 3rd edition), and I believe that the splint, described at p. 303 in this volume, might be made to answer in most cases of the kind alluded to above.

With one or other of them the foot may be gradually brought to a more seemly appearance, and to a greater degree of usefulness and strength; but much patience and ingenuity will occasionally be required to effect the desired object. I have in some instances found a common pasteboard or wooden splint placed along the outside of the leg more effectual, or at all events more manageable in children, than either of them; whilst, on other occasions, I have been annoyed at the result, after the utmost patience and pains bestowed in every way.

Figure 176, represents the talipes varus, alluded to at p. 323. The drawing below, (fig. 177,) exhibits the same foot, after the successful application of the knife and other means above referred to. The patient was treated in King's College Hospital by Mr. Partridge.

It has been a disputed point of practice in these cases, whether the apparatus should be applied immediately after the use of the knife, or not until the lapse of some days, or perhaps weeks. I should deem it improper to force the foot into the wished-for position at the cost of much pain to the patient, or the probable risk of severe laceration and inflammation; but I am of opinion, that the sooner after the incisions the attempts to improve the position of the parts are commenced, the more speedily will the cure be effected. In the instances

Fig. 176.

of talipes equinus, by the application of force after the division of the tendo Achillis, the heel may be immediately brought into its proper place; but the sudden alteration in all the textures gives much annoyance to the patient, and it therefore seems better to produce the change gradually, although in such a case the extending apparatus should, in my opinion, be applied from the first.

Fig. 177.

Whilst practising division of the tendo Achillis on the dead subject, there will be good proof given of the immediate effect of the accidental rupture or division of this part on the living body: the heel can then be brought further down, whilst the toes can be more freely elevated,

and the whole foot thrown into that position characterised in the rare condition termed Talipes Calcaneus by Dr. Little, in which the foot rests upon the back part of the heel. I have known the tendo Achillis accidentally divided with a cutting instrument; but such an injury is rare compared with the frequent rupture of the part, occasioned doubtless by violent action or resistance of the muscles to which it belongs, as in dancing, leaping, moving up a stair, or such like circumstances. When the tendon is divided on the living body for club-foot, the sudden separation is occasionally attended with a slight noise, and when division is the result of rupture from violent action in the calf of the leg, the accident is accompanied with a loud snap.

The treatment of this injury consists in keeping the ends of the tendon in contact, which can be done only whilst the foot is held in a state of extension. In order to relax the muscles of the calf as much as possible, the knee should be bent, and by means of bandages, straps, or even a splint, if such should be deemed advisable, the limb should be fixed in this favourable position for about three weeks, when the union will be sufficiently strong to permit of some liberty of movement: it will, however, be many weeks before the patient can use much freedom in walking without the support of a crutch or stick; but ultimately, as I have seen even in very heavy individuals, the united part becomes as strong as any other portion of the tendon.

Sometimes a few of the fibres of the gastrocnemius give way, under circumstances similar to those which cause rupture of the tendo Achillis: I have known several examples of the kind in persons of a heavy and muscular frame. The lesion is attended with considerable pain, occasionally with swelling from effused blood, and prevents free use of the calf for some weeks after. Rest, with the limb in a bent position, will form the chief feature in the treatment, but possibly leeches, fomentations, and, latterly, stimulating frictions, may be desirable.

Division of the hamstrings for a flexed knee is of more recent date than the proceedings above referred to. In white-swelling of the joint it almost invariably happens that the part is more or less bent, and in the event of the disease being cured with the limb in this position, very considerable deformity and loss of power are the result. The practice of gradually extending the leg has often been resorted to in these cases, and occasionally with the most happy results: the proceedings being attended with benefit where there was merely stifening and alteration in the shape of the joint, but not when bony anchylosis had occurred. I am satisfied from the result of my own practice in such cases, that much benefit may be derived from the preliminary division of one or both hamstrings. The limb being conveniently placed, with the patient on his side or face, the section of the textures may be accomplished with great facility with the knife referred to at p. 324: often, in commencing the operation, the tendon of the semi-tendinosus seems the only part requiring division; as soon, however, as it has been cut, the leg straightens a little,

and the semi-membranosus then seems equally on the stretch: the knife should then be applied again, and next the biceps should be cut. The blade may be passed either between the femur and the hamstrings, or between them and the skin: I generally prefer the latter; but the difference seems of little consequence. In the young subject, with the limb much emaciated, the space between the hamstrings is very narrow, and the surgeon should not allow the point of the knife to pass so far into the middle of the limb as to endanger the popliteal vessels: the apparent carelessness with which I allude to division of the tibial arteries in the foot in making subcutaneous incisions must not be taken as the criterion here, for were the artery divided I should doubt if any other course than amputation in the thigh could be attempted with propriety. The posterior tibial nerve must also be carefully avoided: this may be readily done, but the peroneal lies so close to the biceps, that it can scarcely escape, unless great care be taken not to push the blade further than is absolutely required for the incision of the tendinous and muscular fibres. After the use of the knife any convenient apparatus may be applied. A straight piece of wood, or a portion of stout pasteboard, with a cushion, may be put on behind the knee, when, by means of a bandage the angle at the ham may be made less acute, and by careful readjustment from day to day the limb may be gradually brought into a line with its fellow. A double-inclined plane like one of Amesbury's splints for the arm will be found highly advantageous in such cases: the two portions of which it is formed can be adjusted to the limb at its natural curvature, and by means of the screw the desired extension can be gradually and efficiently applied.

The recent proposal of M. Louvrier, to stretch out the limb by actual force applied within a few minutes, is a practice which, in so far as I can judge without actual experience, is little worthy of imitation, and I cannot but express my astonishment that it should have been sanctioned, even in the most distant manner, by such authorities as Blandin and Velpeau: nor can I allude in more commendatory terms to the proposal of Dieffenbach, first to divide the hamstrings, and then forcibly to apply extension. Whatever proposal emanates from such an authority cannot be overlooked; yet I must confess my horror at sanctioning any attempt at extending the limb by laying hold of the lower part of the leg, after the knife has been used, and, after forcing the foot up against the hip, drawing it suddenly backwards again, so as to stretch or lacerate the contracted textures at the knee.

I am not aware that any British surgeon has tried either of these kinds of treatment: no one can doubt the practicability of stretching the member by such means, even in instances where there is bony anchylosis; or perhaps the femur, as has happened, will yield by fracture, to such rude force; but there must be few who would not shudder at such a proposal. Death from excessive inflammation and suppuration has occurred in some instances; amputation has been required in others; and it would appear that rapid and forcible exten-

sion has been sustained with impunity by a third class! but such practice cannot, in my opinion, be recommended; and I feel, moreover, bound to state, that even the method of gradual extension to which approval has been given, must be cautiously resorted to,—all tendency to disease must have ceased, otherwise the slight stretching of contracted textures, and altered relative position of parts, may produce alarming inflammation in and around the joint. If, however, the disease has seemingly been cured, the extending process, provided bony anchylosis is not present, may be applied in certain individuals, with great freedom. An instance has lately come under my notice, where the limb in a boy of nine years old, from having been bent at a right angle, has been brought to a straight line by gradual extension after division of the hamstrings: the tibia in this case, however, which originally only touched the back of the condyles, still occupies that situation, being now much in the same position as if displaced backwards by accident; therefore doubts may be entertained as to the future utility of the limb, and whether, with such a result, amputation would not, after all, have been the best proceeding for the patient's after comfort. The mutilation of the body should at all times be a last resource; yet, in some of these examples, when the member proves a source of annoyance to the individual, I believe that such a proceeding may, probably, even yet, with all our knowledge of what has recently been done, be most advisable.

CHAPTER VII.

INCISIONS. EXCISIONS.

BESIDES the incisions already referred to, many others are required for special purposes. The surgeon may find it necessary to remove a portion of the nail of the great toe for incurable ulceration at its root and margin. When in this painful form of ulceration (onychia—as it is sometimes called), it is found that the usual ointments and lotions, with the occasional application of lunar caustic, produce no benefit, there should be little hesitation about removing a portion or the whole of the nail, as may be required, and the proceeding may be accomplished thus:—One blade of the scissors (p. 30) should be thrust upwards between the nail and the soft parts as far as the root (matrix), and then by closing the instrument, the nail is split or cut longitudinally, when with strong rough-pointed forceps (p. 7) the free end of the part should be seized, and by a twist towards the back of the toe its removal will be effected: next, if it is necessary, the other half may be treated in the same manner. If there has been suppuration under the nail, this proceeding is simple, and attended with a slight amount of pain in comparison to the case where the horn is still firmly attached by most of its under surface. In the latter instance, however, it is fortunate that only a small portion of the lateral margin need be interfered with. Under any circumstances there is exquisite pain, and therefore the manœuvre should be speedily accomplished by a firm hold, and a somewhat rude and forcible twist and pull. The whole amount of pain had better be occasioned in an instant than by repeated trials with improper forceps, or an over-lenient use of the hand.

Incisions may be required on any part of the lower extremity for erysipelas; but these need no particular notice here, neither is it necessary after what has been stated at p. 200, and elsewhere, to refer in a special manner to tumours on the lower extremity, or the operations which may be deemed requisite for their removal. Ganglions are by no means unusual on the dorsum of the foot with those who wear tight boots, and have a high instep; but having already so frequently alluded to such proceedings as may be required for this excision, I need not do so again in this place.

The disease termed "housemaid's knee," however, is deserving of separate notice. This affection is an inflammation of a bursa, which is in front of the patella in most individuals, more especially in those who from their occupation (as paviers, sailors, housemaids, &c.) subject the parts in this situation to much pressure and friction. The inflammation is usually attended with effusion, first of serum, and then of seropurulent matter; an abscess is the result, and though in the early stages, the disease may sometimes be arrested by leeches and

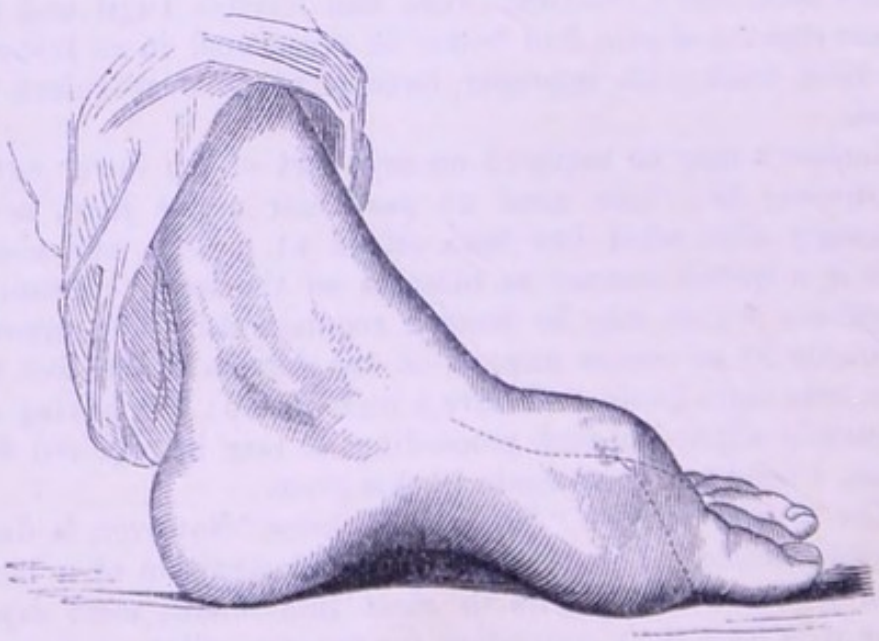
other means for checking inflammation, it happens much more frequently, that treatment similar to that required for abscess is positively necessary, and I shall therefore now refer the reader to the chapters on abscess and sinus in the introductory part of the volume, where he will be at no loss to find the practice which may be recommended in such cases.

Occasionally sarcomatous tumours form over the ligament of the patella. I have seen and removed examples of the kind. In all such a section has presented a hard fibrous aspect. Sometimes such growths have been developed in one side of the bursa,—being merely, as it were, an increase in thickness; but in most the tumour has been separated. Those which I have interfered with have been about the size of a walnut or billiard ball, and from their size have caused annoyance.

Excision of portions of bones may often be practised with great advantage in the lower extremity, whether for caries, necrosis, or exposure resulting from dislocations or fractures.

When there is caries in the toes or metatarsus, there need be no hesitation about the propriety of amputation: in the first place, supposing the point of the toe to be sound, if the part behind is removed, the remaining portion, being deprived of support, will probably be useless; and in the instance of the metatarsal bones being affected the result will be the same. The best exemplification of this remark will be to take the cases of disease of the metatarsal bone of the great toe. The condition of the foot represented by this sketch (fig. 178),

Fig. 178.



is by no means uncommon: the extent of enlargement often excites suspicion, with the inexperienced, that the disease is more extensive than it is in reality. Among numerous instances of the kind which

have come under my notice, I have seldom found that any other bone than that which supports the great toe has been affected. Within these few months I have operated on two cases of this description where the swelling was as conspicuous as is shown in the cut, and in both the internal cuneiform and the metatarsal bone of the second toe were sound. Where, then, there is evidence of the disease being limited to one bone, the rest of the foot may be saved by the resection of the affected part; but the toe should be removed at the same time. I have already (p. 221) strongly advocated the practice of saving the two phalanges of the thumb, if disease in this part of the hand be limited to the metacarpal bone: here the remainder of the organ may be of much service in future; but in the foot, more especially in the great toe, the two phalanges would be of none whatever; I should, therefore, always be inclined to amputate, instead of performing excision in such examples.

If two or more of the metatarsal bones be irrecoverably diseased, and if, in addition, in removing them with the corresponding toes, it is also necessary to take away one or more of the tarsal bones, or even portions of them, the propriety of saving the other metatarsal bones may be very doubtful, as the narrow and slender member thus left will prove but an inadequate support to the weight of the body. In such a case I have known the foot to become gradually bent up, so as to resemble the talipes varus, and the patient, from the inconvenience thereby occasioned, and there being no hope of permanent improvement from submitting to treatment similar to that pursued in club-foot, was glad to submit to amputation above the ankle.

Some further remarks on these longitudinal amputations, as they have been termed, will be found at p. 343; meantime I shall pursue the subject of excisions.

In any portion of the tarsus in front of the ankle, there is seldom a favourable opportunity given of performing excision: I have frequently attempted to save the foot by laying open sinuses, and cutting away such portions of carious bone as my fingers and instruments could be placed upon, but cannot boast of the success of these proceedings, having generally found that the wounds gradually resumed their original condition as sinuses, and on amputation it has been found, in such cases, that the whole of the caries has either not been removed, or that this disease has subsequently been re-established; and, moreover, I have invariably found the synovial membrane of most of the articulations in the vicinity so affected, as, whilst it justified the ultimate resource of amputation, showed at the same time the futility of entertaining any sanguine hopes of success from the practice first pursued. Notwithstanding these remarks, I should still deem it right, in some instances, to give this practice a trial before resorting to amputation.

When the os calcis is the seat of incurable caries much may be done to save the foot by excisions. If the disease is in or near the articulations with the astragalus or cuboid bone, it is to be feared that the results will differ little from those above referred to; but if towards

the back part of the bone, its lower, its inner, or its outer aspects, then excision may be performed with every prospect of a favourable termination. Portions of this bone have been removed at all these points, and with admirable effect: I have operated very frequently myself, and have had the satisfaction of restoring patients to excellent health, by a most simple procedure and a few weeks of subsequent treatment, who had been harassed for years before by partial disease of this bone. No set rules can be given for these proceedings, as the circumstances of each case may differ from all others. I have usually laid open the skin by a crucial incision of sufficient extent to enable me to reach the diseased bone: if possible, I have opened the chief sinus in one of the wounds, and the diseased textures have been cut away with the knife, forceps, or gouge, as might be required. On the outer side of the bone, below and behind the malleolus externus, great freedom may be taken with the cutting instruments, but on the inner surface more care is necessary to avoid the vessels and nerve.

The practicability, and also the propriety of removing the astragalus, and portions of the bones of the leg at the ankle-joint, has already been noticed (p. 255) in referring to dislocations at this part, and similar proposals have been made for the treatment of disease of the articular surfaces and contiguous textures. However, notwithstanding the success attending the two operations of this kind by the Moreaus, the practice does not seem to have had many followers in modern times. I cannot speak from any personal experience in these operations, but imagine that the cases where such proceedings could be reasonably attempted must be of rare occurrence. Moreau the father, after making convenient incisions through the skin, first cut off the end of the fibula with a chisel, and then sawed across the end of the tibia: he next dislocated the foot inwards, so as to cause the part of the tibia connected with the astragalus to project through the wound, when he dissected it away. His son seems to have removed the end of the tibia (for he left that of the fibula) chiefly with the gouge, and in both cases the astragalus was freely cut. Care was taken to preserve the tendons and vessels, and the result seems to have been very satisfactory, more particularly in one of the cases, in which it is stated that, although the limb was shorter than its fellow, and anchylosis followed the incisions, the movements of the astragalus on the neighbouring bones became so much more free than under ordinary circumstances, that the loss of the ankle-joint was almost compensated for. I should think it troublesome enough to protect the tendons in these cases, and how the anterior tibial artery escaped can scarcely be conjectured. Under any circumstances I should consider such operations extremely difficult, and in most instances more dangerous to the patient than amputation in the leg. Were such a proceeding hazarded the part afterwards should be treated in much the same manner as a compound dislocation.

Excisions of portions of the shaft of the tibia are more frequently necessary, or at all events of more frequent occurrence, than those

last referred to. In compound fracture the removal of a projecting portion of bone is occasionally of great advantage, particularly if the part be very sharp or much pointed. I should, however, be cautious about removing the whole, or nearly the whole thickness of the bone, especially in the adult, if the fibula is allowed to remain of its usual length: it is doubtful whether in all cases (if, indeed, in any where the entire diameter of the bone is cut across) a sufficiency of callus will be thrown out to unite the remaining portions, and I have known one instance, where this practice was resorted to, occurring about the middle period of life, in which, after the lapse of many months, the ends of the tibia never united, and amputation was at last resorted to, as the fibula proved an insufficient support of itself for the superincumbent weight.

In disease of the tibia these partial operations are frequently performed, and with much benefit. I have not in my own practice met with an instance of abscess in this bone where I thought it requisite to perforate the shell with a trephine or other cutting instrument, to permit the escape of matter; but I have met with many examples where abscesses have burst spontaneously, and left so much disease behind as to render a free opening absolutely necessary; and collections of matter in or about the periosteum involving portions of the surface of the bone in caries are so common in practice that little need be said regarding them here. In some instances too, ulcers of the skin extend to the osseous texture, and cannot be cured without removal of the exposed part. In the two latter examples the most casual observer, who is acquainted with the nature of diseases of the bones, will speedily perceive the cause which obstructs the cure, but he may possibly overlook the real nature of the deep-seated disease. In the ulcer the carious or necrosed portion of bone may be perceptible to the eye; and, at all events, here, as in the superficial abscess, the probe will immediately indicate the condition of the bone: not so, however, in the deep-seated affection; for often in such cases the matter makes its way from the interior, through such a narrow orifice, that the probe does not readily pass into it, and unless the surgeon has some suspicion of the real nature of the disease, he may actually overlook the presence of extensive caries or necrosis of the cancellated structure. It has often appeared to me, that the value of the cases of this kind related by Mr. Hey, has never been sufficiently appreciated by the generality of practitioners. I have myself met with various instances of the kind, and have experienced the most happy results from pursuing a practice similar to that recommended by this most valuable authority. Some years ago I was consulted by a young gentleman about a small ulcer in the skin over the upper third of the tibia, which had for three years resisted all modes of cure. Originally a small abscess had formed in the part; ever since which he had experienced considerable pain in the vicinity, and this with the continued discharge from the orifice had at last seriously affected his health. With the

probe a portion of carious bone was detected, and I recommended that he should allow me to make the necessary incisions for its removal. Accordingly, being provided with the requisite instruments, a crucial incision was made in the skin, and the surface of the tibia was laid bare over the affected part; here a small orifice was found not larger than the point of a probe, which led down to bare bone. I enlarged the orifice with the gouge and forceps and discovered a portion of the cancellated structure as large as a walnut, dead, emitting a most offensive odour, and loosely enveloped in a membrane similar to that which lines the interior of an abscess in the soft parts. By an additional enlargement of the outer shell of the bone (which was accomplished with some trouble, owing to its thickened and hardened condition, resulting from new ossific deposit) I was enabled to extract the dead bone. The large gap gradually filled and the surrounding swelling at the same time diminished: the surface cicatrized, and some time afterwards I saw this patient with the limb as sound as the other, and only a small dimple remained to point out where the disease had been. I could mention similar instances that have occurred in my own experience in patients at different periods of life; but this one may suffice as an example of a practice which, in my opinion, will be of much service in averting more serious consequences and abbreviating the tedious character of such diseases.

Very large portions of the tibia may be removed by means similar to those above recommended, whether the disease be caries or necrosis; but in either case, if the shaft of the bone is extensively sacrificed, it may be a question whether, under the circumstances, there is much utility in saving the remaining portion. I have seen one instance in a patient under puberty, where the anterior half of nearly the whole length of the tibia separated by necrosis, without any previous reproduction of bone; the large openings in the skin cicatrized, but as the person began to move about, and lean some weight on the member, the limb became gradually bent, and was at last so unseemly, and, moreover, so cumbersome and of so little use, as to induce her to submit to amputation.

Portions of the fibula may occasionally be removed with advantage, but cases where practice similar to that above recommended can be put into execution, are of rare occurrence in diseases of this bone. However, a good anatomist, with a correct knowledge of surgical pathology, may sometimes obviate the necessity of sacrificing the limb by amputation, by resorting to some such measures as those referred to, although here it is scarcely possible to state how or under what circumstances these operations should be performed.

Excision of the knee, notwithstanding the frequency of disease in this articulation, and also the great success of the operation as first done by Mr. Park, is rarely practised in the present day. I have myself seen only one instance where the operation was performed, but the condition of the limb, several years after, was very different from that

of the sailor on whom the above-named surgeon operated; for here, instead of being able to move freely about without the aid of a stick, the patient was obliged to support himself by a crutch, whilst the limb hung useless, being shorter than the other by several inches, and so flexible at the cicatrix, that it was totally unfit either for support or progression. In many respects there is great similarity between the diseases of the elbow and the knee; but considering the vast size of the wound required for the removal of the ends of the bones in the latter joint, one cannot be surprised that this operation should have been done so rarely compared with the frequency of that on the elbow. Besides the indifferent success of the dozen or more operations which have been recorded, I confess that in selecting amputation in my own practice, I have been influenced chiefly by the consideration whether the object to be gained by the patient would be worth the risk to be incurred, and have invariably come to the conclusion, that, by removing the limb above the seat of disease, I have done what was best for present safety and future comfort. Perhaps if we had sufficient evidence to reason upon, it might appear that the success attending excision of the knee-joint would bear a similar proportion to that of the elbow, as amputation in the thigh bears to that in arm, and that, therefore, excision in the lower extremity would not be so successful as in the upper; taking it for granted, too, (as, indeed, may be proved,) that excision of the elbow is equal to amputation in the arm, in saving life, a similar operation on the knee might be deemed proportionably successful. I imagine, however, that there must be greater relative danger in the knee; but in the absence of sufficient proof on this point, I shall not argue further upon it. The surgeon will at all times feel reluctance in resorting to amputation; and, for my own part, that feeling has ever been greatest where the operation has been required in the upper extremity; for I deem the loss of a hand a more severe deprivation than that of a foot, and would therefore encourage a patient to submit to excision of the elbow, when I might not do so in the knee. Some may, however, entertain different views of the value of the members, but at all events it seems evident that further experience is wanted to decide the relative merits (if any) of excision of the knee over amputation in the thigh.

In the dead subject, or on the living body, the operation may be performed thus:—An incision between three and four inches long should be made on each side of the joint, opposite the lateral ligaments, and a third should be carried across the fore part, so as to unite the whole, like the letter H. The ends of the lateral incisions should be nearly at equal distances above and below the articulation, and that in front should extend over the patella. This bone should now be detached by dividing the textures around it, close to its margins, and the soft parts should then be dissected upwards and downwards, to a sufficient extent to permit of a thorough examination of the diseased bones. And to facilitate this, as well as the future stages of the operation, the lateral and crucial ligaments should be

divided; the saw, forceps, and gouge, must then be used according to circumstances. It will in most instances be requisite to apply the saw, and the forceps will not be so useful here as at the elbow. The diseased portion of the femur may be first removed, and then the head of the tibia, as also that of the fibula, should it be involved in the affection. In using the knife in the posterior part of the joint, more care is required than in cutting deep in the elbow, for in dividing the crucial ligaments there is nothing between the instrument and the popliteal vessels but the posterior ligament and some cellular texture; in applying the saw, too, more care is required; yet in either proceeding I cannot recommend the introduction of a spatula of wood to protect these and other parts, as greater isolation of the bones is thereby produced than the circumstances warrant, for it appears to me that the supposed danger can, by due caution, be avoided.

In the dead subject the patella may be removed, and portions of the femur and tibia cut away with the saw, through an opening made in front of the joint by a single transverse incision; but on the living body the freer incisions above recommended will permit of the whole proceedings being completed in a more satisfactory manner. The patella must in general require to be removed, as it is seldom free from disease in such cases as may be deemed fit for excision; the operator may, however, look at its articular surface before he detaches it, and should he find it sound, he may use his discretion in leaving it; but in whatever condition the knee may afterwards be left, it may be doubted if this bone will be of much service. There will be no bleeding of consequence; perhaps not a single articular artery may require to be tied. The wound should be carefully dressed, the margins brought together with stitches, the ends of the bones allowed to be in contact, and the limb should be steadily supported in the extended position by any convenient apparatus; a M'Intyre's splint made straight, would answer well. The dressing and the after-treatment must be conducted on the ordinary principles of surgery; and if cicatrization is complete in the course of three or four weeks, or even as many months, and the knee stiff, the surgeon may flatter himself that he has done all which his art permits of.

Operations with cutting instruments are rarely required on the shaft of the femur; indeed, unless on the trochanter major, I am not aware of any operation for caries having been done on this bone, with the exception of the few that have been performed at its articular extremities. I have known one instance where the trochanter major was cut down upon and removed with a saw, in consequence of caries, and have seen several where such practice might have been of service. Abscesses occasionally form in the large bursa between this prominence of bone and the tendon of the gluteus maximus, and in some of these cases ulceration and caries come on. To effect the removal of disease in this process, a free crucial incision should be made through the skin and tendon of the gluteus maximus; and when the surface is sufficiently exposed, the gouge should be used to scoop

the affected parts away. I should myself place most reliance on this instrument; but, if the disease proved extensive, should be inclined to divide the attachments of the glutei to the upper and fore part of the process, and then effect the removal of the entire trochanter by the united aid of a saw and forceps. A small Hey's saw would be more manageable here than any other.

In some instances of necrosis of the femur, the surgeon may be of much service by judicious interference, although, unfortunately, considering the frequency of the disease in the shaft of this bone, the cases are but few in number where any attempt should be made to remove the dead part. I have seen a large portion of the shaft taken away through an opening in the front of the thigh; but in that instance, the plan of treatment was very clearly indicated: two inches of the necrosed portion of bone projected through an ulcer in the soft textures, and, nature having already nearly effected the complete separation, the surgeon had only to take hold of the sequestrum with his fingers, and apply a little force to pull it out, at the same time touching with the edge of the knife such of the soft parts as seemed to offer any resistance. But it seldom happens that the dead portion is thus thrown out of the axis of the limb, and in general before it is loose it has become so enveloped with new bone that the surgeon dare not interfere. Of the many cases of this kind which have come under my notice, there has seldom been any choice beyond amputation, or lingering illness; and among the instances where I have succeeded in removing any portion of bone, the following is the most remarkable. A boy, aged sixteen, had suffered for two years from necrosis of the lower third of the femur: when he first came under my notice the whole shaft was thickened, and the new bone seemed most developed at the lower end, just above the condyles, where, through several openings of the skin, a large dead portion could be felt with the probe. Perceiving that this sequestrum was surrounded by a thick case of new structure, I entertained little hope of saving the limb; yet, to ascertain the possibility of extraction, I laid open one of the sinuses situated on the outer margin of the tendon of the biceps, and exposed one of the openings in the new bone; next the edges of this opening were pared with the gouge and forceps, and having with these means taken as much liberty with the new bone as was deemed justifiable, I then attempted to pull away the sequestrum with a pair of strong forceps, but finding that I could not succeed, gave up the attempt in despair. A month after, the boy's health having in the interval improved considerably, I again resolved to try extraction, and on this occasion used the cutting instruments still more freely, when after much labour (for such a term is most applicable to some of these operations), I succeeded in extracting a portion of dead bone about four inches in length, and comprising the whole thickness of the original shaft: there were several smaller portions which had been previously cut off with the forceps, to permit of the more ready removal of the main part: indeed, it was my intention on this occasion to have cut the

sequestrum into pieces, had I not succeeded in removing it entire, and thus I might have been enabled to extract it bit by bit. The discharge from the large cavity soon assumed a healthy appearance, the callus in the course of three weeks had already diminished in circumference, all pain in the limb had ceased, the gap was gradually filling up, and the patient returned to his quarters in the country with every prospect of a complete cure.

Excision of the head of the femur has now been performed on several occasions; but experience as to the results of this operation is as yet so limited, that I can scarcely say more on the subject than express a belief that, in some instances of gun-shot injury of the neck or head of the bone, such a proceeding might be of service. If the operation were undertaken for disease of the hip-joint, it would probably be necessary in most instances to scoop away portions of the cotyloid cavity at the same time; but as in such cases the extent of disease in the os innominatum could not well be ascertained before making incisions, and possibly not even then, I fear that the results of the operation would often cause disappointment. Although I have for more than ten years meditated the performance of this operation in morbus coxarius, I have never, amongst the numerous cases of this kind which have come under my notice, met with a single instance where the practice could have been deemed justifiable. The incurable nature of this disease after caries has been established is but too well known; yet the case is not always without hope, and practitioners of much experience must occasionally have witnessed remarkable recoveries contrary to every reasonable expectation: such instances I have myself seen, and in others, when death has occurred, I have generally observed that the disease has covered a surface so extensive, and that the surrounding textures have at the same time been so involved, that an operation would have been utterly fruitless. In gun-shot injury the operation has been proposed to save the patient from almost certain death, or the fearful and precarious alternative of amputation at the joint, and in future wars the recommendations of such high authorities as Mr. Guthrie, Sir George Ballingall, and others of almost equal note, may possibly be put to the test of experience.

On the dead subject the head of the bone may be turned out of the acetabulum in the following manner:—The body being placed a little to one side so as to elevate the hip, an incision with a strong bistoury should be carried in a semilunar course about two or three inches above the trochanter, its ends being so limited as not to interfere with the crural nerve in front, or the gluteal artery behind: from the centre of the concavity thus formed, a straight line of incision should be carried downwards over the trochanter, the two being each of a length proportioned to the bulk and depth of the parts. The knife should be carried deep, and one flap should be turned forwards and another backwards, so as to expose the upper part of the trochanter, neck of the bone, and capsular ligament;—the three glutei, more especially the medius and minimus, being freely cut for the purpose. The capsule should

next be opened on its upper aspect, when by twisting the thigh across its fellow, and rotating it outwards at the same time, the head of the bone will start from its socket: if the round ligament remains entire, which it probably will unless considerable force is used, it can be touched with the knife, and the articular surface of the femur will now be thoroughly exposed. The saw may next be applied to the neck of the bone, and the head being separated, the chief steps of the operation will be completed. In gun-shot fracture, the lever force of the shaft of the bone will be wanting; but Sir George Ballingall seems to think this of little consequence; and in disease of the joint there may be circumstances demanding modification,—as, for example, the head of the bone may already be dislocated, and in great part absorbed; but formidable though the operation may be,—and I should consider it extremely so,—the difficulty of performing it would not, in my opinion, be equal to that attending the selection of cases in which its application would be reasonable. Hemorrhage from branches of the gluteal artery would, doubtless, be considerable, and it is evident that if the incisions were carried too far in front or behind, irreparable injury might be inflicted on nerves as well as vessels.

False joints in the lower extremity require no especial notice in this part of the work. Incisions and excisions are scarcely to be thought of in such cases, and a judicious practitioner would be most inclined to trust to one or other of the measures referred to in the chapter on these subjects.

The surgeon has usually every reason to be well satisfied when he succeeds in arresting the fatal progress of hip-disease, by a kind of compromise, as it were, with nature, for a stiff joint. Some, however, have not rested content with such a condition, and have actually proposed to remedy the anchylosis by cutting through the soft parts, dividing the neck of the femur, and establishing a false joint in this situation. In the absence of any personal experience in such proceedings, I shall only say that I am at a loss to conceive any improvement which such a proceeding could bring about,—such, at all events, as would be equivalent to the pain and hazard of the operation, and were I ever consulted on such a question, I should strongly recommend the patient to rest satisfied, and be thankful that he had escaped in any way from such an intractable disease.

Mr. Barton of Philadelphia has succeeded in one instance in improving the condition of the lower limb by such a proceeding. In this case there was great deformity and loss of power resulting from a fracture in the upper end of the femur, which (occurring in a sailor at sea) had not come under surgical care till the lapse of seven months.

CHAPTER VIII.

AMPUTATIONS.

AMPUTATIONS on the lower extremity may now occupy attention, and if the operations above referred to have already been performed, an untouched limb should be selected, although some of them may even yet be conveniently done on the mutilated member.

The small toes occasionally require to be removed, in consequence of accident, disease, or distortion. If the surgeon can save a portion of one of these toes it may be well to do so; but, in general, the part is separated at its articulation with the metatarsal bone. For the removal of a phalanx, a proceeding similar to one or other of those described for the fingers (p. 213) will serve the purpose, and these directions need not here be repeated.

For the removal of the whole toe a narrow bistoury should be passed up on one side of the proximal phalanx as high as the articulation; it should then be carried across the joint and down the opposite side, so as to make a wound similar in size to the first, when the toe will be separated. The knife when entered should lie flat against the phalanx; then, when it has been carried sufficiently deep, its edge should be directed against the lateral ligament, which should be put on the stretch by the surgeon judiciously twisting the toe whilst it is held in his left hand, and by the same means, too, he can make sufficient room to carry the knife across the joint without obstruction from points of bone: as soon as the latter object is effected the blade should again be laid flat against the phalanx, and held so until it is carried out of the fissure opposite to that into which it has been first inserted. In performing such an operation the surgeon's hand may be held either above or below the foot, at his pleasure. Perhaps the point on which he is most likely to err is in not carrying the blade sufficiently deep; for, as has been remarked in describing the mode of dissecting and examining these parts, the joint actually lies much deeper than a person not acquainted with anatomy might imagine.

Should the metatarsal bone be also affected, it may be removed after the separation of the toe, by extending the incision on the upper part of the foot, isolating the bone, and detaching it at its articulation with the tarsus; or if its proximal end is sound the cutting forceps may be used as in the corresponding bones of the hand. I have strongly recommended the removal of a portion of a metacarpal bone when it is necessary to sacrifice a finger, and have, I trust, both said and shown enough to prove the advantage of such a proceeding; but, from all I have seen, I should be equally anxious to preserve the whole of a metatarsal bone, as the breadth of the foot should never, in my opinion, be diminished unless there is absolute necessity.

The great toe may be removed in the manner above described; that is, by lateral flaps. If the distal end of the metatarsal bone can possibly be preserved, the foot will doubtless be much stronger afterwards than if it were removed, but it will often happen that the necessity for an operation depends on disease of the joint involving the end of this bone, and its amputation is therefore absolutely necessary. I have already stated, at p. 333, that excision of the metatarsal bone is not to be thought of here, (nor, indeed, should it be in any of these bones,) and in the event of amputation being required, as in an instance similar to the drawing at the page referred to, or the figure immediately below, the operation may be performed thus:—An incision should be made along the upper and inner side of the metatarsal bone, beginning a little behind the supposed seat of disease, therefore, in some instances, over the internal cuneiform bone, and running round the joint as here represented (fig. 179): the skin and soft parts should next be dissected off, so as to insulate the end of the metatarsal bone, when the forceps can be applied behind the disease; or, if the whole bone must be removed, the distal extremity can be held in the left hand, so as to convert the bone into a lever, as by such a manœuvre its disarticulation from the cuneiform bone can be more readily effected. In the adult I have sometimes seen the bone so hard that it was requisite to use the saw, but in general the forceps will suffice, and I recommend that they should be placed obliquely upon the bone, so as not to leave a sharp point on the inner margin of the foot, as there would be if thus applied at right angles. This latter direction may appear of no great moment, indeed, I do not consider it is so, yet if attended to, the operation will appear much more perfect.

Fig. 179.

In disarticulating, unless the knife is used very cautiously, there is every chance of wounding the anterior tibial artery, as it dips between the metatarsal bones; but in such an event the vessel can be readily secured after the separation; and, under any circumstances, it rarely happens that more than one, two, or three ligatures are required. In some instances, indeed I may say in many, occurring both in my own practice and that of others, I have seen much annoyance from continued bleeding in the deepest part of the wound, between the internal cuneiform and second metatarsal bones,

—perhaps, from the anterior tibial, or the extremity of the plantar arch, and after having in my own cases fruitlessly endeavoured to get a noose cast round the bleeding point, I have been obliged to resort to pressure, which on these occasions has never been found to fail. In such instances a little pellet of lint has been placed on the bleeding point, then a larger, until the wound has been partially filled, when I have compressed the whole with a bandage applied moderately tight round the foot.

Occasionally in scrofulous subjects the foot has the appearance represented in this drawing (fig. 180). In this instance the swelling was

Fig. 180.

so great on the inner margin that it was doubtful if any partial amputation, unless it were Chopart's, would be of any avail; I determined, however, to be guided by what appeared during an attempt to save the outer side of the foot by a longitudinal operation. Being convinced that the internal cuneiform, and probably the scaphoid bone also, was diseased, as well as that which supported the great toe, the external incision was made further back than for the operation last described: after separating the latter bone and the internal cuneiform, it was found necessary to scoop away a small part of the middle cuneiform, and also a portion of the second metatarsal bone, but thus the rest of the foot was preserved. I have lately had the satisfaction of learning that this patient has now, after the lapse of two years, an excellent use of the foot, which presents the appearance exhibited in figure 181. The concave shape of the inner margin of the foot will be noticed, and the manner in which the second toe (now the first) is curved inwards is remarkable. Had this kind of distortion proceeded further, the foot might have resembled the condition referred to at page 333, in which it became so much twisted inwards, with the sole upwards, as to resemble a club-foot when the person walks on its outer margin.

Fig. 181.

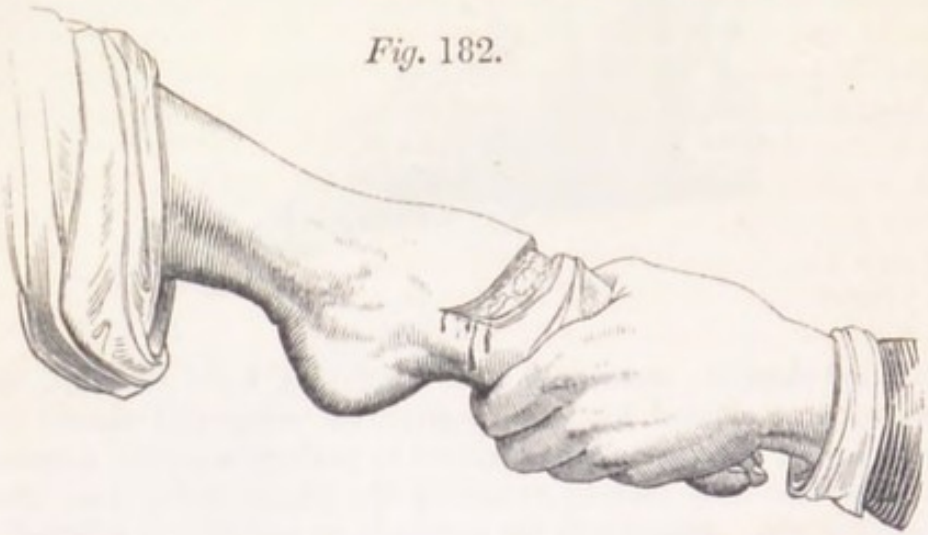
If more than one metatarsal bone is affected, I am doubtful, for the reasons above alluded to, if a longitudinal separation should be resorted to, and should be more inclined to perform a partial amputation in a transverse line, thereby removing the whole of the toes whether diseased or not. Sometimes the tarsus is so extensively affected, that there need be no doubt about its entire removal; and in such cases, according to the current doctrines of the day, the surgeon has the election of dividing the foot at the junction of the metatarsus with the tarsus, in the manner recommended by Mr. Hey, or still further back, between certain bones of the tarsus, in accordance with the proposal of Chopart.

In partial amputation for disease of the metatarsal bones Mr. Hey at first removed the skin so extensively that no adequate covering was left for the remaining portion of the foot, and many months elapsed before the large surface cicatrized. He afterwards preserved a sufficiency of soft parts from the upper and lower aspects of the foot to make a good stump, and, as he has himself remarked, "though the metatarsal bones, which had been removed, are usually about three inches in length, yet the mutilated foot was but one inch shorter than the sound foot, measuring from the heel to the root of the little toe." I cannot say that in the instances which have come under my notice, the length of the foot has been so nearly perfect; but I can speak in unqualified praise of the advantages of the operation over the more extensive mutilation of amputation above the ankle.

As in most other operations, there are various ways of performing this one. The method I recommend is as follows: the lower part of the leg should rest on the margin of a strong table, and the ankle should be firmly grasped by the hands of an assistant: the surgeon should then endeavour to make out the projection of the proximal end of the metatarsal bone,—especially that of the little toe, and, if possible, the internal cuneiform, and with a strong bistoury should begin an incision a little behind one or other of these points, carry it forwards on the margin

of the foot for three-fourths of an inch or more, and then across in a semilunar course, ending it on one margin as it has been begun on the other, a little behind one of the points above referred to: this incision should pass boldly down to the bones at once; but if any tendons or other textures have been left undivided they should next be cut, and an assistant should draw the flap upwards; the operator should then

Fig. 182.



forcibly depress the extremity of the foot, which he should hold in his left hand, and in this manner, by throwing the ligaments of the upper surface on the stretch, he can readily pass the point of the knife into the line of articulations, and whilst there is less danger of breaking it, he, by this manœuvre with the left hand, greatly facilitates

Fig. 183.

the remaining steps of the proceedings: the fibrous textures being all divided the incisions should be so conducted in the sole as to form a flap between the tarsus and roots of the toes, the knife being kept

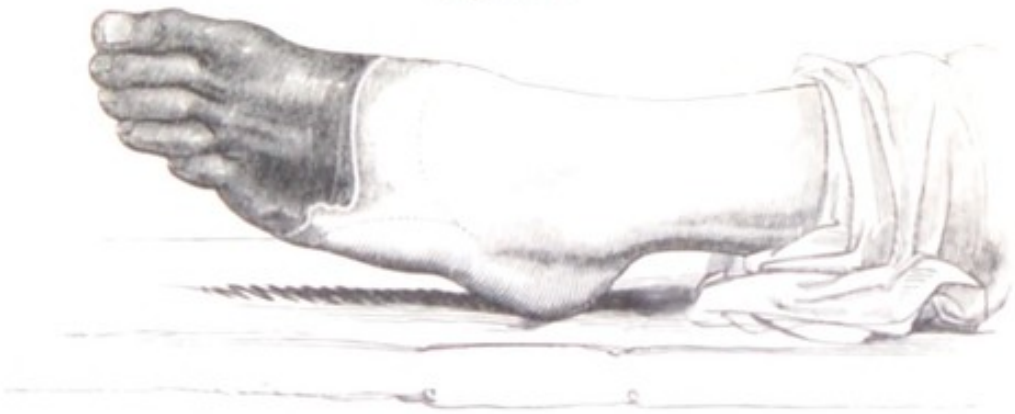
close to the under surface of the metatarsal bones as it is carried towards the surgeon. This long flap, with the short one above, will form an excellent covering to the ends of the bones.

Drawing 182 illustrates part of the operation just described, and the stump when healed will present the appearance exhibited in figure 183.

If the internal cuneiform bone seems to project too much, its extremity may be cut off with the saw or forceps, as was done by Mr. Hey; but, I believe, this will not be required on all occasions.

The proceeding of Chopart consists in the division being made in the line of articulations between the calcaneum and cuboid, astragalus and scaphoid bones. From the joints being larger and the bones less firmly knit together than in the seat of Hey's operation, amputation through the tarsus is much more easily performed; but it should not be preferred on this account, and it ought to be extreme necessity only, from the nature and extent of disease or injury, which should induce the surgeon to sacrifice so large a portion of the foot. In such an example as this, the separation of the dead parts might have been

Fig. 184.



left to nature, but the process would have been tedious, and I therefore deemed it better to use the knife. I have seen an exellent stump in a similar case, where all that was considered requisite was division of the bones with the saw. It is not always, however, that the work is so perfect, and if the surgeon interferes it will be better to preserve flaps, sufficiently large to cover the ends of the remaining bones. The dotted lines on the drawing (184) show the course of the incisions, which it will be perceived are very similar to those recommended for Hey's operation, excepting that they are placed nearer the ankle. The whole proceedings should be similar to those described; a small semilunar flap being preserved from the upper surface, and a large one from the sole. In disarticulating, if the left hand is used in the manner above adverted to, the bones will separate very readily as soon as the point of the knife is applied to the ligaments thus put upon the stretch. The projection of the scaphoid bone is the only prominent point which can be referred to as a guide, but on the living

body it may be impossible to feel it, in consequence of the swelling of the soft parts; but these joints are so very easily opened, by any one acquainted with the anatomy of the foot, that there can be little difficulty in accomplishing the operation. The future utility of that part which is left has been questioned by some; but from what I have seen of these partial transverse amputations in the foot, I should in general prefer them to more extensive mutilation above the ankle. It has been asserted that the heel is drawn so much backwards and upwards, particularly in the case of Chopart's operation, that the weight of the body will be thrown on the cicatrix and the anterior ends of the bones; but if the stump be kept in good position during the dressing, I do not think there is much cause for anxiety on this score. This stump (fig. 185), taken from one of my own cases, exhibits the extent to which the calcaneum and astragalus were acted on by the muscles of the calf.

Fig. 185.

The bleeding during these proceedings on the toes or foot can be conveniently and efficiently arrested by an assistant compressing the tibial arteries at the ankle, or, if greater security is desired, a tourniquet may be put on at the knee as represented at p. 23.

In performing these latter operations some transfix the sole of the foot with a small catlin, and cut the flap from this part at the first: others instead of transfixing proceed from the surface inwards; some open the joints below, others at the side, but I give the preference to the plan described above. I would not, however, on all occasions limit myself to the articulations. If, for example, the proximal ends of the metatarsal bones could be saved, I would assuredly do so, and in such a case would make a semilunar flap on the upper part of the foot, as already directed, only a little nearer the toes; then another below by cutting from the surface of the sole obliquely backwards and upwards towards the bones; next I would clear around each bone a proper space for the saw or forceps, and then with one or other of these would divide the bones. I have seen a most excellent and useful stump saved in this manner. If, further back in the foot, the cuboid and scaphoid bones could be preserved, I should do so; or, for the sake of saving as much of the organ as possible, I should be inclined in some instances to divide these bones in their middle with the saw. In the dissecting-room one seldom hears of any amputations in the foot excepting at the joints, Hey's and Chopart's being the favourite exercises; but occasionally it may

be well to keep these hints in view. The recommendation seems like a recurrence to the old and rude method of chopping off a part with the aid of the chisel, mallet, and block, or of severing the disease with a single grasp of strong forceps, as used to be the summary work of ancient surgeons; but it must be kept in mind that in reality the preservation of flaps forms the most important feature in the modern operations; indeed, I am inclined to suppose that Mr. Hey, if we may judge from his own remarks, seemed to consider this as the chief feature of his own method, for in the first instance in which he preserved flaps he did not limit his incisions between the tarsus and metatarsus, but actually removed a considerable portion of the former.

Although on the dead subject the foot may be readily separated at the ankle, and the proceeding has on one occasion at least been accomplished on the living subject, it is an operation liable to so many objections, and presenting so few advantages, if indeed any can be claimed for it, that its consideration may with all propriety be omitted in such a work as this.

When it is necessary to sacrifice the ankle, amputation in the leg may be effected in any part of its extent, according to the nature and seat of disease or injury. At one time it has been the fashion (this word being more applicable to the practice of surgery than some imagine) to amputate close above the malleoli, at another time close to the upper end of the tibia, and, again, the incisions have been made at all the intermediate distances: all these having been done by the same surgeon at different periods in his practice, whilst others have adhered, when circumstances would permit, to one particular part. Mr. Hey, finding that the stumps which he made immediately above the ankle did not on all occasions heal kindly, resorted at last to the middle of the leg, where he could procure more ample covering to the ends of the bones; and some I have known so dissatisfied with the amputations which they have performed close to the knee, that they have come downwards; thus, as it were, causing the two extremes to meet.

In by far the greatest number of amputations in the leg which I have witnessed, the incisions have been made in its upper third, and I have myself pursued a similar plan. Most of the patients have been in hospitals, and the common doctrine that persons in this rank of life can more readily procure a wooden leg on which the body may be supported with the knee bent, than any other substitute having the resemblance of a natural leg and foot, has probably been the chief reason for operating so high. If the knee is afterwards to be kept bent, a long stump projecting behind will be inconvenient, unseemly, and exposed to injury. But the knee may be kept straight, and an artificial limb applied, much lighter in appearance than the clumsy apparatus in common use, equally efficient, and also as moderate in price. This method, though still practised on the continent, and of old date among our own surgeons, has been almost entirely neglected till of late, when it has been revived by some practitioners. I have myself for several years been in the habit of preserving nearly a

half of the leg, more or less, with the object of continuing the movements of the knee, and having such a substitute applied as that referred to. Here (fig. 186) is an example of a stump from one of my

Fig. 186.

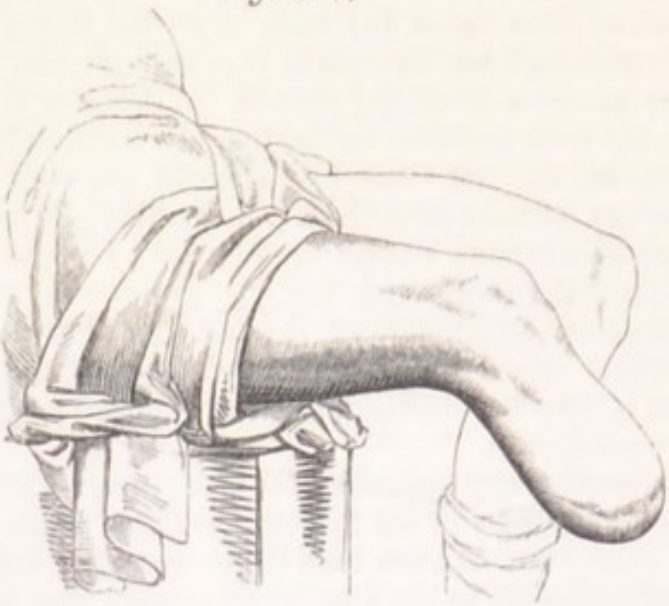
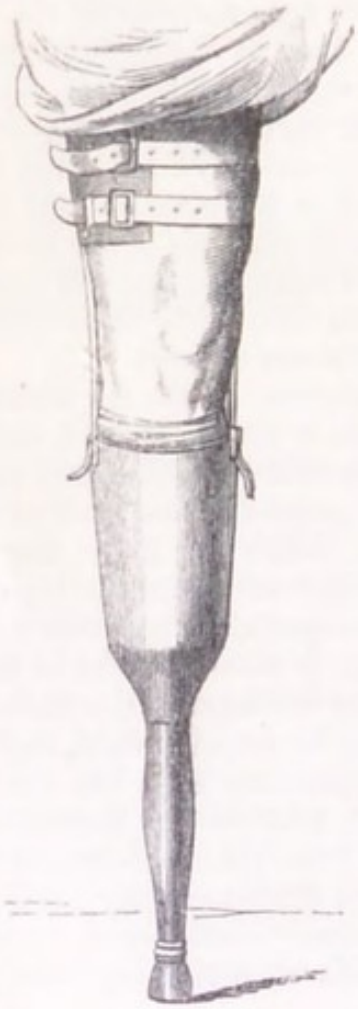


Fig. 187



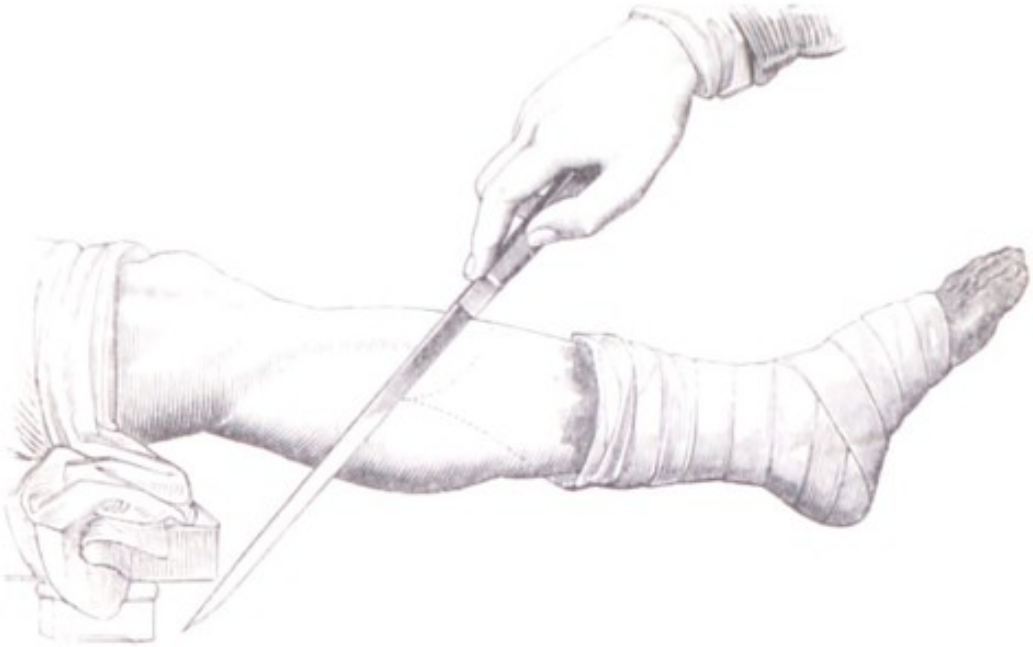
patients in King's College Hospital, and the other drawing (fig. 187) represents the substitute in question. The socket at the top of the pin (made of strong leather or of willow-wood), being well padded within, is fixed on the stump, and the straps serve to attach it above the knee. I have seen a person thus provided move about as freely as if no loss had been sustained, and from all I have witnessed of the practice, am strongly inclined towards it in most cases. Dr. Laurie of Glasgow, who is one of the modern advocates for this plan, mentioned to me that one of his patients was frequently in the habit of walking twelve or fourteen miles a day with the utmost ease on such a limb.

I have sometimes observed that it was more easy for the patient to rest the body on the bent knee than on the end of the stump, however well the latter may have been formed; but in the generality of instances the plan will be found to answer admirably well: and if the

stump be made of such a length only as to fix into the socket, should it be found that the weight of the body cannot be sustained in this way, the projection when the knee is bent will appear so trifling that little objection can be taken to it.

When the surgeon has a choice of parts, then, he should prefer operating about the middle of the leg. A stump of sufficient length for fixing any apparatus will thus be left, whilst at the same time the soft parts bear such proportion to the bones, that an excellent covering to their ends can be provided; whereas, if the incisions are made nearer the ankle this is not so certain. The operation may be conducted in the following manner:—A tourniquet being applied at the knee (p. 23), or the vessel commanded here or in the groin (p. 20) with the fingers, the patient being placed on a firm table, and properly supported and held by assistants, one of whom should have charge of the part about to be removed, the surgeon should pass an amputating knife, about seven inches long, from one side of the limb to the other, close behind the bones, and cut a flap from the back of the leg, about three or four inches long, in proportion to the bulk of the member; next he should draw the knife across the fore part of the leg with a semilunar sweep between the points where the knife has transfixed: the large flap behind and the small one in front being drawn up by an assistant, he should then carry the knife round and between the bones, a little higher than the line of transfixion, and having cleared a space for the saw, that instrument should be applied, and the separation of the part effected.

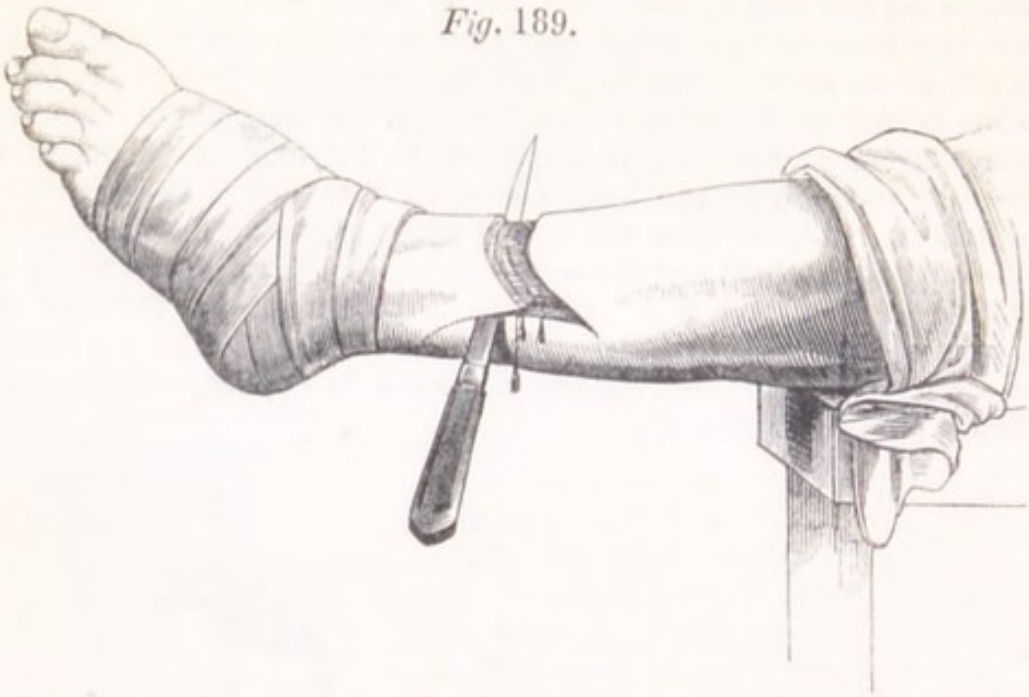
Fig. 188.



To the beginner this proceeding will be the simplest; but to any one who has confidence in the use of the knife, I recommend the following method: The heel of the instrument should be laid on the side of the leg furthest from the surgeon, and the blade should then be drawn across the front, cutting the semilunar flap of skin, until its point comes opposite to where the edge was first laid on; without raising the instrument transfixion should next be made behind the bones, and the rest of the proceedings conducted as in the other instance. The operation when done in this manner will look somewhat more elegant, (if the term be applicable to any such proceeding,) but can scarcely be said to possess any other advantage.

The drawings (figs. 188 and 189) will further elucidate these de-

Fig. 189.



scriptions: the one (188) exhibiting the first position of the knife, and the outlines for the two flaps; the other the attitude after transfixion, and as the blade is being carried downwards: both operations were done on the subject according to the method last referred to; and, in the lower part of the leg (fig. 189), as soon as the knife was thrust across behind the bones, the artist cried "stop," and pencilled the design as it is represented. I may here call attention to the acute angle at the junction between the two flaps: the incision is seemingly further back than there is any occasion for, and this will be most likely to strike those who may have witnessed only the method by transfixion first, and the transverse incision afterwards. By the latter proceeding the anterior and posterior do not correspond very accurately in their respective lengths, and so when the stitches are inserted there is always a puckered irregularity at each angle,—the wound in the skin of the posterior flap being doubled on itself, as it were, whereas by carrying the incision backwards on each side of the

limb in the first sweep, as above recommended, the point of the knife can not only be more readily inserted for transfixion, but also the surfaces will come more accurately together, and be better proportioned to each other than by the other method.

The surgeon has not always the opportunity of selecting such a place as he might prefer for his operation, and is therefore occasionally forced to amputate very high. When this is the case, perhaps the nearer to the tuberosity of the tibia that the operation is performed so much the better. The popliteal artery can then be secured, when one ligature will suffice, instead of three, (two tibials and a fibular,) as will be required if the incisions are made a little lower. The proceedings may be conducted in the manner already described; but in several respects they will not prove so satisfactory to the operator. First, if the limb is muscular, a fleshy mass, formed chiefly of the gastrocnemius and soleus, will be left, which will with difficulty be covered by the skin: the latter seems to retract more readily here than the muscular fibres, and the most expert operator can scarcely avoid the annoyance. I have seen a large granulating surface, on the end of the muscles projecting between the edges of the wound, remain open for months, and from all I have witnessed in such cases, I believe that the surgeon would do well to cut away some of the muscular fibres, after the flaps have been formed, so as to bring them down to a level with the skin. Such a proceeding will convey an impression to those who are inclined to be hypercritical, of a want of skill on the part of the operator; but he may console himself with the consideration that such practice is inculcated by an authority so high as Mr. Hey, who distinctly recommends it as advantageous. In the limb emaciated by long-continued disease, no such trouble is experienced, and an excellent posterior flap can always be made at once. Next, in the upper third of the leg it is often extremely difficult to seize the vessels and have the ligatures applied; so much so, indeed, that I have seen a most expert surgeon, in despair, transfix the soft parts around the bleeding point with a tenaculum, and then surround them with a strong thread, leaving the instrument to separate with the ligature, being afraid to withdraw it lest the noose should drop off. In this part of the leg venous hemorrhage is troublesome occasionally, when the tourniquet is slackened, and it is often so when pressure by the fingers in the groin is resorted to; it will generally cease as soon as the surfaces are approximated, but until then, while the arteries are being secured, a little pressure with the point of the finger will stem the flow.

In whatever part of the limb the incisions are made, I invariably preserve a semilunar flap in front, varying in length, in different cases, from half an inch to one inch, or more. I prefer this to the straight incision across the front, recommended by Mr. Hey, believing that the opposite surfaces will thus fit more accurately to each other. The crest of the tibia often seems so sharp and prominent that it is well to

remove it with the saw or forceps. I have seen it sometimes cause an ulcer in the skin, and exfoliate through the opening.

The limb should always be held nearly in a straight position, and I am partial to the same attitude in the after treatment. If the posterior flap be somewhat deficient in length, the surfaces can be most readily approximated when the knee is bent, but the skin in front, being thus put on the stretch, is more apt to be injured by the spine of the tibia.

Much has been said about the necessity of the surgeon's standing on a certain side of the limb in these operations. Some of the highest authorities have contended for the one side, others, equally good, have asserted that the opposite is better. It has been said, that as the fibula, in some part of its course, is a little behind the line of the tibia, there is danger of the point of the knife passing between the bones, if the instrument is thrust from the inner side; but it seems to me that, if the operator is not on his guard, it may happen when passed from either side. I have seen the occurrence twice on the living subject, and recommend, that, on whichever side the surgeon places himself, he should always keep in view the possibility of such a piece of awkwardness happening, and by a very moderate share of attention there will be no danger of committing such an error. I find one author, who insists on the advantages of invariably passing the knife from the outer side, equally strenuous in advising the surgeon to stand on the inside when he applies the saw, so that the fibula may be divided first; and to follow up these directions it must of course be necessary to change sides between the use of the knife and the saw! another, who recommends transfixion from the outer side, also advises that the fibula should be first cut; but he says nothing about the change of position, and it will be found exceedingly awkward to accomplish the section in this way; indeed he must stoop, or perhaps get upon his knee, in order to bring the handle of the saw below the bone. Some have advised that the operator should always stand on the patient's left side, so that, with his own left hand, he may keep the part about to be removed in a proper position for the application of the saw; for it may happen that the assistant who has charge of the lower part of the limb, will keep it so high as to cause the instrument to become locked in the groove, or else may depress it so much as to snap and splinter the bone. But it is erroneous to suppose, that in either of these events the fault always lies with the youth who holds the condemned part, for the same things happen if the limb above is not properly held, and as it also may be depressed or elevated, it follows that the surgeon's left hand must be equally useful above the wound as below it, and consequently that if he is to trust to himself to steady the parts properly, he may just as well have his left hand above as below, and therefore be either on the patient's right side or on his left, as may otherwise be most convenient.

For my own part, I think it a matter of indifference on which side the surgeon stands: the knife may be pushed between the bones from

either aspect, and on whichever side the person who guides it is placed, the work of the saw may or may not be properly accomplished. If a well set instrument is used, there seems no good reason for insisting on the division of the fibula first. This bone cannot be kept so steady after the tibia is cut, and it is therefore more difficult to use the saw well upon it. To effect this last object, here, as in other parts of the body, the hand should always, if possible, be above the level of the blade. If the surgeon always stood on the inside of the leg, then the cutting edge could be placed obliquely, so as to give the best opportunity of using it in the most favourable position for the division of the fibula first, and also afford the most easy and efficient attitude for his own arm and body. If, however, he invariably stands on the outside, it is evident that, unless the limb be much turned inwards the fibula cannot be cut first, without the wrist being most disadvantageously depressed; but the limb and saw may be so held that the division of both bones can be accomplished about the same time, whilst the heel of the instrument is but a very little under the horizontal line. It seems to me, however, that the necessity for the division of the small bone before the large, has been made a matter of too much importance.

If the operator resolves on dividing one bone before the other, he should see that the saw is of sufficient breadth: indeed, it is of more consequence to look to this in the leg than elsewhere, for if the amputation is very high, the great thickness of the tibia in this situation should not be overlooked.

By sawing the bones individually, I have in certain instances observed that the fibula has been left somewhat longer than the tibia. This is a mistake which should be carefully avoided, for the prominence will not afterwards admit of any pressure on the part. Some have recommended that the fibula should actually be cut shorter than the other bone; but in my opinion it is best to leave them on the same level.

When the amputation is very high, it has been proposed that the head of the fibula should always be removed for the sake of forming a better stump. This practice was at one time extensively put into execution in the Edinburgh hospital, by Messrs. Liston and Lizars; but in consequence of the frequent occurrence of inflammation and suppuration within the knee, it was at length wholly abandoned. It has been averred that the synovial capsule at the head of the fibula very frequently communicates with that of the knee, and that, therefore, when the small bone is removed on these occasions, there is every probability of the large joint being opened. I have not myself observed the communication to be a frequent occurrence; but the partition is on all occasions so very thin, that there will always be a likelihood of opening the knee in such a proceeding. Sometimes these gentlemen dissected out the end of the bone after the saw had been used; at other times, when the amputation was very high, the tibia was alone cut with this instrument, and a knife was carried round the head of the small bone, from within outwards, whilst the

limb was forcibly abducted, and the fibula used as a lever. Unless, however, the bone be extensively shattered, or in a state of disease, it never should be entirely removed.

The amputation in the leg which I have recommended, may be deemed that with the single flap, as originally proposed by Verduin; it will be observed, however, that such a portion of skin in front is preserved, that it may actually be called a double flap-operation. I have seen even a larger portion left in front, so as to give the proceeding still more the character of the double-flap operation; but one half of the stump appeared to me so like a bag of skin, containing pus within, that I was not impressed with any advantage which the method presented, unless it was that it allowed the surgeon to depend less on the bulk of the posterior flap, and thus enabled him to avoid the inconvenience of a large mass of flesh, such as has already been adverted to.

I have also seen lateral flaps made after the manner practised by Roux, by transfixing from before backwards; but although the operation was done by an adept in the use of the catlin, the stump was the worst I ever saw, and I should no more think of preserving lateral flaps here, than in the lower third of the fore-arm. In the latter case, although it might be easy to preserve a covering to the ends of the bones, from the radial and ulnar aspects of the member, it is quite evident that this can be most efficiently done from the posterior and anterior surfaces; and although the character of flatness is not so conspicuous in the leg as in the fore-arm, I am, nevertheless, of opinion that there is some resemblance, and that it is best to look to the corresponding surfaces in the lower limb. A single flap might be preserved from the tibial or fibular side, should it be deemed necessary; but such proceedings need no separate description here, as they can scarcely be deemed among the regular operations of surgery, and any one possessing a moderate share of anatomical knowledge, and of dexterity with the amputating instruments, can have little difficulty in preserving a covering, of skin at least, from any side of the limb.

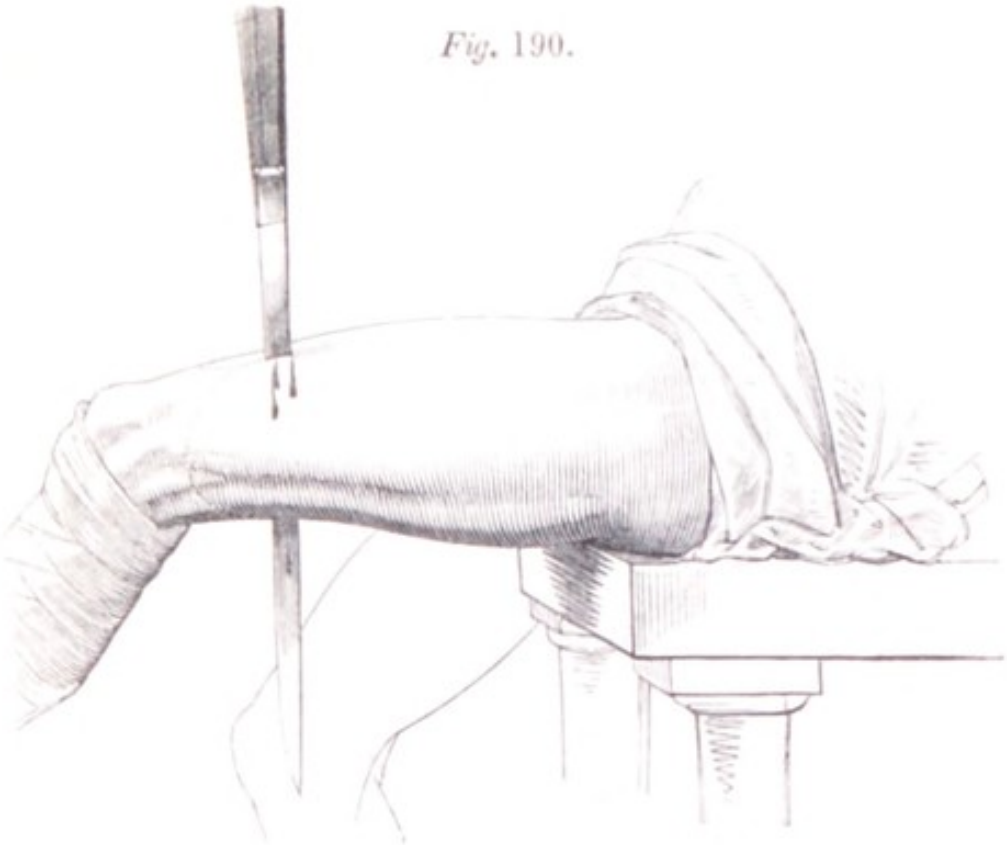
Whichever proceeding is followed, and in whatever part of the leg the incisions are effected, the general rule of preserving an inch too much rather than the least portion too little, should always be kept in view. The young surgeon will find three or six months after amputation, that he will have more reason to be well satisfied with a stump which looked somewhat clumsy at first, than with another which possessed all that finical neatness which may have captivated the spectator at the time, but will make an indifferent appearance when compared with the other at some future date. I have only once known a flap made too long in this situation. The operator apparently had a dread that his flap would be too short, and had made sure that it should not have this fault, by reserving nearly the whole textures on the back of the limb.

Amputation at the knee-joint has never, to my knowledge, been performed in this country; and, notwithstanding the testimony of Velpeau in its favour, there seems little inclination on the part of the

practical surgeon to prefer it to the ordinary method below or above the articulation. Since the operation was done by Hoin in 1764, it has been occasionally performed, and the results coming under Velpeau's observation seem to have been favourable enough. Being in no position to speak from personal experience on such a proceeding, I shall not dwell on the subject further than to state, that by making a semilunar incision in front, extending from one side of the knee to the other, then passing through the joint, by dividing the mucous, lateral, and crucial ligaments, and reserving another semilunar flap behind, there can be little difficulty in forming a covering to the end of the femur, notwithstanding the great extent of articular surface. The patella may be left, or removed, according to circumstances. It need scarcely be added, that the operation can be thought of only when the end of the femur is unaffected by disease or accident.

Amputation in the thigh may be performed in a variety of ways: perhaps the following, which is in most respects similar to that originally done by Vermale, may be found as efficient in every respect as any other, more especially in the lower third of the member. The femoral artery being commanded, as described and represented at pp. 20 and 23, the surgeon, standing on the outside of the limb, should grasp the outer side of the thigh between his fingers and thumb, and having drawn them as it were from the side of the bone, should pass the knife from before backwards, or rather from above downwards, as it is here represented (fig. 190), and then cut down-

Fig. 190.



wards and outwards so as to form a flap, the extremity of which is pointed out by the dotted line on the outer side; next, the knife should again be introduced in front, and carried backwards in a line with its original course, but on the opposite side of the bone, when by cutting again downwards and towards the surface, as partly indicated by the other dotted line, the inner flap is formed: both of them should then be drawn upwards with considerable force by the hands of an assistant and an incision made round the bone, fully an inch higher than the place of transfixion: the saw should then be applied in the course of this last cut, and the separation completed by division of the bone. In transfixing, the point of the knife should be thrust directly down to the femur, with which it should then be kept in close contact as it is carried round to the opposite surface, and this process will be greatly facilitated by grasping the limb as directed.

The assistant who has charge of the flaps should not forcibly elevate the one first made, as the knife is thereby prevented from passing readily across the limb the second time: he can scarcely, however, be too energetic after the other is cut in drawing both upwards, so as to give plenty of room for working the saw without rubbing against the soft parts. The femoral artery is not divided until the second flap is formed; indeed, Vermale had this in view when he made his external wound first; but I do not think it of much consequence whether this vessel is cut across first or last, provided the surgeon takes sufficient care to have the vessel properly commanded above, or has sufficient self-confidence, in the event of an accidental mistake, to grasp the limb, and thus whilst he may arrest the bleeding with one hand he can seize the vessels with the forceps held in the other. I deem the proposal of saving the artery to the last as of little consequence, and am generally in the habit of making the inner flap first instead of the outer, as I can thereby see the progress of the knife much more clearly during the second thrust.

The next drawing (fig. 191) exhibits the appearance of the stump with lateral flaps. It will be found during the dressing, that care is required to keep the soft parts in their proper and natural position: they have a tendency to fall backwards, and thus the end of the femur comes nearer the anterior angle of the wound than it should be: moreover, it will be found in the course of a few weeks, that the parts behind are all more drawn upwards than those in front, and at last the bone seems to have a very scanty covering. To provide against the latter occurrence it may be well to leave the flaps a little longer behind than in front, and for the former, the bandage, properly applied after the first ten or twelve days, will do all that is required, if the dresser is careful in keeping the soft textures well forward during its adjustment.

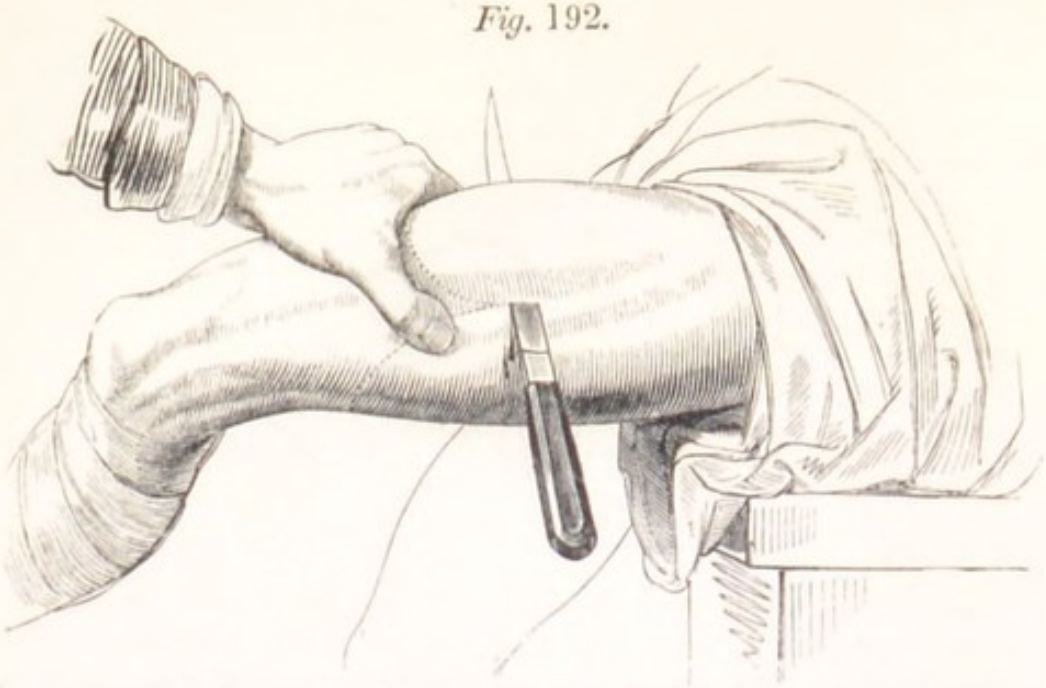
In figure 190, the point of the knife is nearer the table than it should be on the living subject, for by passing it somewhat obliquely to the long axis of the femur the soft parts can be kept longer below (or behind) than they might be if transfixion were made

Fig. 191.

at right angles. The young surgeon should remember, however, that if he slopes the knife in this way, and if the knee is much bent, as it often is in cases of white-swelling, there is a risk of thrusting its point into the calf of the leg below, as I have actually witnessed on the living body.

The projection of the bone through the anterior part of the wound, when the amputation is above the middle of the thigh, has been found so difficult to counteract, in consequence partly of the action of the psoas and iliacus internus muscles, and the weight and contraction of the muscles behind, as to induce most surgeons who practise the flap operation to select the covering from the anterior and posterior surfaces; in fact, it is now generally the custom with some operators to make anterior and posterior flaps in all parts of the thigh, and I have myself latterly often resorted to this method, partly with a view to obviate the ill effects above referred to, but chiefly because I find it to possess an advantage over the other, which does not seem to have attracted so much attention as, in my opinion, it deserves. The operation I perform is as follows:—grasping the soft parts, so as to bring them well forward, I push the knife across from the outside and form a flap in front; this being slightly elevated I again carry the knife in the direction which it first took, but behind the bone, and form the second flap from the posterior surface, taking care to leave it at least an inch longer than the anterior: the rest of the proceedings are conducted as in the other operation. The dotted lines in the next cut (fig. 192) exhibit the comparative length of the flaps, and the seeming arch of the thigh has been accurately represented from nature. When the knife is thus placed, if the parts are as fully drawn forwards as they should be, they give this appearance of distortion, but the sketch was purposely taken in this stage of the operation with the object of illustrating this feature, and the manner in which the operator may

Fig. 192.



employ his left hand when he stands on the left side of the limb about to be removed. If an operation of this kind is done towards the lower part of the thigh, it is impossible to make the anterior flap sufficiently large unless the skin and other textures are well elevated before the knife is applied.

A moment's reflection on the anatomy of the thigh will be sufficient to convince any one of the greater tendency to shortening of the muscles on its posterior surface than on the anterior: here, with the exception perhaps of the sartorius, which, however, will not be in the anterior flap if the amputation is low down, the only muscle likely to retract much is the rectus, but it lies so close to the bone, and, moreover, its fibres are so peculiarly arranged, that its sphere of contraction is but limited, when compared with that of those on the opposite side, where the semi-tendinosus, semi-membranosus, and biceps, with part of the adductor magnus, have so much scope, and are so far separated from the femur, that it would not, judging from physiological considerations only, be unreasonable to anticipate very considerable retraction. On the living body this actually occurs, and whatever operation is performed, unless some provision is made on this account, so that at first the parts behind shall be longer than those in front, the stump after a time will never look well. I have now frequently performed amputation in the thigh after this method, and can speak highly in its favour. The following figure (193), taken from a stump made in this way by my colleague Mr. Partridge, shows an ample cushion on all sides, without that prominence in front, formed by the end of the bone, such as is not unfrequently seen in stumps in this part of the limb.

The femur is covered with such a mass of soft texures on its whole

Fig. 193.

circumference, that, as I have already remarked with reference to amputations in the arm, the flaps may be taken from any opposite aspects, and I have frequently made them partly from the sides and partly from before and behind. Sometimes, as has actually occurred, it may be deemed requisite to have only one flap, and that may be taken from any side which is free from disease or injury. Dr. Little, of the Sligo County Hospital, has informed me of an instance in which he preserved a large single flap from behind,—the wound and cicatrix being thus, in some respects, like those after the single flap below the knee. Here possibly, as Dr. Little imagined, there may be an advantage in the cicatrix being in front of the bone, and thus less exposed to pressure whilst in the socket of a wooden leg. With such a flap I should cut away a considerable portion of the great sciatic nerve, so that it might not by any chance be brought to lie against the divided surface of the femur.

I need scarcely add, that circular operations may be performed on any part of the lower limb; I shall not, however, describe any of them in particular, but will refer the reader to the introductory chapter on Amputation, especially to that part where this mode of procedure is described. Although it is my opinion that casualties must follow circular operations more frequently in this extremity than those by flap, I feel bound to say, that I have seen stumps of an admirable kind after the circular mode, both in the leg and thigh. Perhaps the proper period to judge of the excellency of a stump is after the lapse of months or years, and the last case of the kind which has come under my notice is one below the knee (made, I believe, by my friend Mr. Rutherford Alcock in his Spanish campaign), which will bear a comparison with the most finished performance by the flap.

I have recommended the outside of the limb as being the best to stand upon in amputation of the thigh, and if the operation is to be done with anterior and posterior flaps in the upper third of the limb, it will be found that if the knife is passed from within outwards, the

other thigh will make it difficult to depress the hand sufficiently to enable the operator to elevate the point over the front of the bone; in short, he will discover that all the movements of his right hand will be very much cramped if he places himself between the patient's legs, or if, for example, in amputating in the upper part of the right thigh, he places himself on the patient's left side, he will find that what between the difficulty already referred to, and having to stretch across the patient's body, the whole proceedings are both troublesome and awkward.

In any of these operations the superficial femoral artery will first demand attention as soon as the part is removed. The vessel is never difficult to discover, but sometimes, particularly when the transfixion is from the outside, it will be found split for an inch or more. In such a case, as well as when the artery is cut almost directly across, it must be cautiously separated from the vein with the points of the forceps, and slightly drawn out of its sheath, ere the ligature is applied. The anastomotica magna may require ligature in the lower third of the thigh, but in general the main vessel is either cut across or tied above this branch. Higher up the branches of the deep femoral may require three or four additional ligatures: but it is difficult to say how many may be necessary, for I have seen an instance where even the main vessel did not bleed, (the case was one of gangrene,) so that it was more choice than necessity that induced the operator to put a thread around it, and most practitioners of experience must have seen occasional examples where one ligature was sufficient, whilst in others eight, ten, or a dozen, may have proved not more than enough. In the upper part of the thigh venous hemorrhage will often cause annoyance, but it usually ceases as soon as the pressure in the groin is taken off, and invariably does so when the flaps are laid together. The point of the finger will here also (as in the leg) be of service for a time.

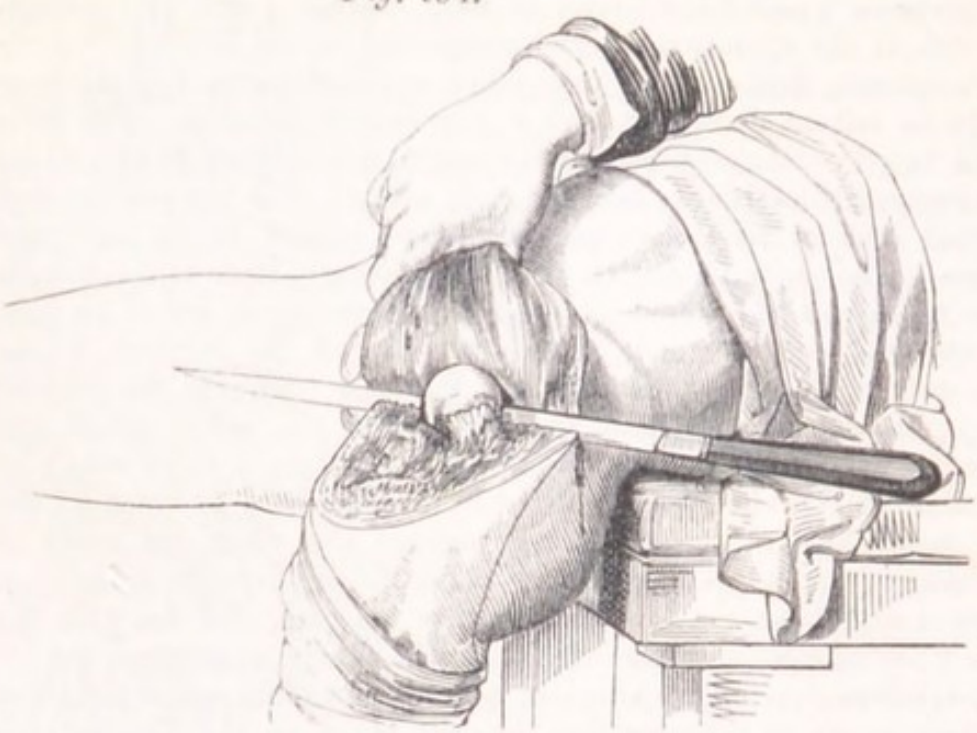
Amputation at the hip-joint has now been so frequently performed, that the surgeon needs no other justification for resorting to it than the urgency of the case; and although no reasonable practitioner would ever attempt it except as a last resource, it is somewhat satisfactory to know, that with all the disadvantages under which it has been performed, particularly in military practice, and notwithstanding the fearful shock which must of necessity attend such an extensive mutilation, the success of the operation has probably been such, that one patient out of every three on whom it has been performed has been saved. It is difficult, however, to collect the proper data for the statistics of this operation, but I believe I am within the mark in the above statement. During my residence in Edinburgh the operation was done four times, twice by Mr. Liston and as often by Mr. Syme: all the patients died, although one of the latter gentleman's cases may actually be deemed to have succeeded, for the wound was entirely healed, when, unfortunately, effusion into the peritoneal cavity caused death within eight weeks after the operation.

Fewer methods of operating on this joint have been proposed than on the shoulder, yet there is no lack of choice here either, for fifteen at least have been described. The remarks which have been made with reference to amputation at the shoulder-joint, p. 229, are equally applicable here: any one familiar with anatomy, and possessing a moderate share of dexterity with the knife, may without much difficulty disarticulate the head of the bone, either by a circular or flap incision, and whether, in following the latter method, transfixion is resorted to or the textures are cut from without towards the joint: neither does it seem of much consequence from which surface the stump is formed,—whether a flap is left longer on one side than on the other, nor whether, indeed, there is one flap only, or that the stump is formed of two.

Most surgeons have preferred the flap operation in this situation, and as it is the method which I have seen admirably put into execution on the living body by Mr. Liston, I should feel on all occasions inclined to prefer it, although circumstances might necessitate certain modifications, which I shall refer to after describing the proceedings. Previous to the operation, every arrangement should be made regarding assistants, instruments, and other appurtenances, and nothing should be left to chance on such a momentous occasion. The table should be very stout, of a convenient height, not so broad as to prevent the surgeon and assistants being in close contact with the patient, and a folded blanket with a couple of pillows should be on its upper surface. The patient's breech should be brought close to the margin of the table, and the sound limb should be fastened to one of its legs. An assistant should stand immediately behind the surgeon, whose chief duty will be to raise the first flap and compress the femoral artery; another should stand opposite to hold the pelvis steady and assist in keeping the patient's body from slipping; a third may also be useful at the shoulders to assist in this, as, from so much of the body being beyond the table, and perhaps also from the mode of operating, there is a chance of the pelvis falling over the margin: a fourth should have the limb entrusted to his care, and he, with the other who has charge of the artery, should clearly understand the intended movements of the surgeon, as the immediate and satisfactory accomplishment of the operation depends much on the simultaneous movements of the whole three. If the circumstances are favourable, and the arrangements well preconcerted, the whole proceedings, in so far as the removal of the limb is concerned, may be gone over in so brief a period, that the term "simultaneous" may be used with propriety. On the dead subject the operation may be done in twelve or twenty seconds, and it may, as I have seen, be accomplished with equal celerity on the living. The surgeon, standing on the outside of the limb, should insert the point of a long catlin about midway between the anterior superior spinous process of the ilium and trochanter major, keeping it rather nearer the former than the latter; he should then run it across the fore part of the neck of the bone, and push it

through the skin on the opposite side, about two or three inches from the anus; next, he should carry it downwards and forwards, so as to cut a flap from the anterior aspect of the thigh, about four inches in length. When the blade is entered, the limb should be held up, and even slightly bent at the joint; the instrument will then pass along more readily than if all the textures were thrown on the stretch, and, moreover, there is greater certainty of passing it behind the main vessels, and even dividing some of the fibres, if not the whole, of the iliacus internus and psoas muscles. As the knife is carried downwards, the assistant, who stands behind the operator, should slip his fingers into the wound and carry them sufficiently far across to enable him to grasp the femoral artery between them and the thumb: this he may do from the inside or outside at will, and with the right or left hand as may be most convenient, the same grasp enabling him to raise the flap as soon as it is completed. The right hand is represented in the drawing (fig. 194), which exhibits part of the operation on the left

Fig. 194.



hip, but some might prefer the other hand, although I should myself put more reliance in the grasp of the right. The flap being raised, as here exhibited, the point of the knife should then be struck against the head of the bone, so as to divide the anterior part of the capsular ligament and any textures in this situation which may not have been included in the flap. To facilitate this part of the operation, the knee should be forcibly depressed by the assistant who holds it; the head of the bone will thus be caused to start from its socket, and if the round ligament is not ruptured by the force, a slight touch with the edge of the knife will cause it to give way. At this period, depression

being no longer required, the assistant should bring the head of the femur a little forwards to allow the knife to be slipped over it, and when it is in the position represented in the design, it should then be carried downwards and backwards in the course of the line, so as to form a flap somewhat longer than that in front, the last cut completing the separation of the limb.

By means of the fingers of assistants (and here one or two more than those referred to may be of service) and the application of sponges, the bleeding may in some degree be restrained until ligatures are applied. If the vessels seem large on the posterior flap, it will be best to secure them first, and then the femoral and such other branches as may require ligature in the front flap should be attended to. If, however, there is any fear of the main vessel eluding the grasp of the assistant, there will be greater safety in tying it first. If, in making the anterior flap, the knife is kept close to the femur for some way down, the superficial femoral will not be divided until the incision is nearly completed, and this branch with those of the profunda may all be sufficiently compressed whilst the hand is used in the manner above described.

Delpech and others have recommended ligature of the femoral artery as a preliminary step, but it seems unnecessary, and the proceeding has not been frequently resorted to. Pressure with the thumbs on the brim of the pelvis has also been recommended; but as there can be no bleeding of any consequence until the main vessel is cut across, and as it is quite possible for the assistant to have his fingers behind it, as the surgeon cuts towards the surface, this preliminary pressure is not required: should the assistant, however, be unable to squeeze the flap sufficiently tight, he should at once apply pressure on the common femoral at Poupart's ligament, with the thumb of the hand which is free, or he may commit the flap to the charge of another, and apply both. When thus placed, however, they may prevent the flap being raised with the same facility as when they are absent, and it is of some consequence that the operator should see where to apply the knife when he is about to cut the capsular ligament.

I have not inculcated the necessity of introducing the point of the blade a certain number of lines distant from the spine of the ilium, nor have I been very precise as to the exact distance from the anus at which it should protrude, for I believe that the operator, instead of limiting himself to lines here, may actually take the freedom of inches: his object should be to make as broad a flap in front as the method by transfixion will admit of; but whether he pushes in the knife, or brings it out, an inch above or the same length below certain given distances, seems to me of very little consequence: if he begins low down, he has to cut so much deeper, as it were, ere he reaches the capsule, and if this is a disadvantage, it is, perhaps, compensated by the wound on and near the surface being a little further from the trunk: if he introduces the point much behind the tensor vaginæ femoris, he cannot with safety carry it so near the anus as if it

were pushed in front of that muscle, and so what he strives for on one side is lost on the other.

Next to having command of the vessels, the management of the thigh may be deemed the most important part of the assistants' duties. If he to whom this task is allotted does not depress forcibly, and then raise the head of the bone, as has been directed, the disarticulation can never be easily or rapidly accomplished: besides, to do his work well, he should be careful when the surgeon is forming the posterior flap, not to abduct the thigh or allow it to be turned forward on its own axis, as the knife is thus apt to get between the head of the bone and the trochanter, so that its progress is completely arrested by this process. I have frequently seen this occur on the subject, and the artist has been careful in showing the limb in a proper position to obviate this difficulty. It is evident, however, that these manœuvres with the femur cannot be practised on all occasions, as for example in gun-shot fracture of the neck of the bone, and the operator must therefore do the best he can, under the circumstances, in disarticulating. In such a case the knife, after the formation of the first flap, might perhaps be insinuated between the fragments, although probably this plan would not succeed, as I have, in fractures in other parts requiring amputation, known its progress arrested or impeded by a small fragment or splinter: if then, the circumstances did not seem favourable for such a proceeding, the head of the bone might be dissected out, and the blade then placed behind it; but I should feel most inclined under the circumstances to make the posterior flap immediately after the first is formed, by transfixing a second time, as in the amputation of the thigh with anterior and posterior flaps, and then apply the saw above the seat of fracture, if that were possible; if this could not be done I would use it at any other convenient part, and the limb being removed, and the vessels secured, would then with a scalpel or bistoury remove the remainder of the bone. It is possible that in such a case (indeed I have seen it on the living body) the femur might separate at the seat of fracture after division of the soft parts, and in such an event the end of the upper fragment would require to be smoothed, or perhaps its entire removal might be necessary.

In certain cases of disease or injury in the upper portion of the bone the surgeon may find it impossible to determine the condition of its neck and head, and perhaps in such examples it would be best to amputate through the trochanters; and then, should it be necessary, remove the head of the bone. I have often amputated at the hip-joint on the dead subject in this manner, and have found it a simple proceeding to cut out the head: as soon as the limb is separated, the end of the upper portion should be seized with the left hand, and turned in the requisite directions to expedite the application of the knife to the capsular ligament, and when a sufficient opening is made in this part, in front, or towards the inside, a slight twist will cause the disarticulation.

PART IV.

OF THE HEAD AND NECK.

CHAPTER I.

DISSECTIONS OF THE NECK.

THE dissection of the head and neck may be conducted on the same subject as that on which the superior extremity was examined. If, however, another and a better can be procured, it may be well to take the advantage.

The posterior part of the neck presents so little that is interesting to the surgical anatomist, that only a brief space of time need be devoted to the dissection. The body should be placed in the position described at p. 146, when, if the skin has not yet been taken off the trapezius, an incision should be made from the spinous process of the first dorsal vertebra to the acromion process of the scapula, another should next be carried from the point first named upwards to the occipital tuberosity, and from this a third should be made to the mastoid process of the temporal bone. The skin and cellular membrane may then be dissected towards the side of the neck, so as to expose the whole of the upper end of the trapezius, a portion of the sterno-mastoid and part of the splenius.

In this stage of the dissection there is nothing of much surgical consequence. It may be noticed that there is less fat immediately under the skin than in some other regions; that the cellular texture is in considerable quantity, but dense and fibrous. The occipital artery may be observed midway between the occipital protuberance and mastoid process, emerging from below the splenius capitis, in its course towards the scalp.

I need not describe the mode of dissecting the muscles on the back of the neck for surgical purposes. As the student takes off each layer attached to the cranium, he may observe that beneath the line leading from the occipital protuberance to the mastoid process the occipital bone is so covered with muscular attachments, that it would be almost impossible from any external examination to detect fractures in this

situation, and also that in the event of applying a trephine in this place, it will be necessary to divide the attachments of several muscles. Such a proceeding is, however, very rarely required.

As it is presumed that the back of the neck may have already been dissected for the purposes of ordinary anatomical investigation, it need scarcely be again examined merely for surgical purposes, and therefore the subject may at once be placed on its back, with a block between the shoulders, of sufficient height to permit the head to hang with the parts in front on the stretch.

The side of the neck may be first examined ; and whichever is selected, the head should be so turned as to stretch the skin completely. The dissecting-hooks had better be fixed to the chin and table, to keep all steady. An incision should then be made along the course of the clavicle from one end of that bone to the other; the knife should next be carried along the base of the lower jaw, from the chin, under the lobe of the ear, as far as the mastoid process, and the two incisions should then be connected by a third one, passing from the middle of the one to that of the other. The skin should now be dissected off the platysma myoides, as far as the anterior and posterior margins of this muscle ; the anterior flap should be carried forward to the mesial line, the posterior backwards to the mastoid process, and a line leading downwards to the acromion. Skin, fat, and cellular texture should be raised at once, so as to display the platysma-myoides, which muscle may now be seen throughout its length and breadth, with the exception, perhaps, of some of the fibres at the upper and lower ends which extend beyond the transverse incisions. It will be observed that this muscle does not cover any of the mesial line, nor does it lie over any part of the parotid gland ; condensed cellular membrane will as yet be seen in these situations. Perhaps a blue discoloration will be observed in the middle of the muscle, parallel with its fibres, indicating the situation and course of the external jugular vein ; if not, there may probably be such a mark along the anterior border of the sterno-mastoid, in the course of the anterior jugular, when such an irregularity exists.

The platysma-myoides should be raised by dividing its fibres obliquely in the course of the sterno-mastoid, and dissecting the two portions of the muscle, one upwards, the other downwards, when, if nothing but the muscle has been interfered with, the whole side of the neck will seem covered with a dense layer of cellular membrane, which is usually denominated the superficial fascia.

The course of the external jugular may now be more clearly seen passing from about an inch in front of the angle of the jaw, almost in a straight line downwards, until it disappears in the cellular substance at the root of the neck, above the middle of the clavicle. As the vessel lies embedded in the fascia, it will be requisite to raise the cellular membrane from its outer surface, to permit its course being traced at this stage of the dissection.

An incision should now be made along the course of the sterno-

mastoid, from one end to the other, and the fascia may be dissected upwards and downwards, so as to expose the outer surface of that muscle, and also its anterior and posterior margins. The external jugular vein should still be left, and the superficialis colli nerve, which seems nearly parallel with the vein, and not far from it in this situation, may also be allowed to remain. If the handle of the scalpel is slipped under either margin of the muscle, it will now be seen that the fascia is so connected with a deep layer, that a kind of sheath is formed for the sterno-mastoid, throughout the greater part of its extent.

The textures immediately above the clavicle may first be examined; and for this purpose the flap of superficial fascia should be turned downwards, or removed in any convenient manner, care being given to preserve the external jugular vein, and notice taken of some twigs of nerves which run downwards in this situation, towards the skin, in front of the chest. When the cellular membrane is detached, the clavicle will be more fully exposed than hitherto; the posterior margin of the sterno-mastoid will be more distinct, and the anterior border of the trapezius should also be cleanly dissected for an inch or more above its attachment to the clavicle. A space will now be distinctly observed between the two last-named muscles, which will vary in breadth according to the extent of attachment of each of them to the bone; in some subjects it will be about two and a half inches, in others much more, so that very little of the trapezius may be seen in the position in which the subject is supposed to lie in the present dissection. The exact limits above to this space need not attract much notice; if the two muscles which form its lateral boundaries have each a broad attachment to the cranium, they may approach so closely as to give it a triangular shape, but the upper part merits no especial attention from the mere surgical anatomist. Below, however, there is much of importance. As yet only fat and cellular texture will be noticed immediately above the clavicle; but if a little of this be removed, the lower end of the external jugular vein will be more distinctly made out than hitherto; in addition, the posterior belly of the omo-hyoid may now be seen passing obliquely upwards and inwards, and leaving a small triangular space between it, the clavicle, and the sterno-mastoid. This space varies considerably in size; sometimes the omo-hyoid is so low,—so close to the clavicle, that it (the space) is scarcely appreciable; generally, however, it is of such dimensions, that there can be no difficulty in perceiving it. In some rare instances the muscle takes a few fibres from the clavicle, or occasionally is attached to this bone instead of the scapula (of both of which irregularities I have seen examples), and in such cases the muscular fibres occupy the usual place of the triangle. The omo-hyoid should now be drawn slightly upwards (if attached to the clavicle it should be divided), and by carefully detaching the fat and cellular substance lying between it and the first rib, the subclavian artery may be exposed in this situation, as also the important parts in its

immediate vicinity. Perhaps in making the dissection the posterior-scapular (transversalis colli) and supra-scapular (transversalis humeri) arteries, with their accompanying veins, may have already been observed ; the former is somewhat irregular in regard to size and situation, but the latter is seldom so, and will generally be met with immediately behind, and parallel with the clavicle. These vessels, if traced towards the mesial line, will be perceived to lie close in front of the anterior scalenus muscle, whose fibres may be seen directly behind the outer margin of the sterno-mastoid. If, however, the clavicular portion of the latter muscle is broad, the former may be completely covered, and the dissector will not have a good view of it unless he divides a few fibres of the sterno-mastoid. The anterior scalenus deserves particular notice, and both eye and finger should be made familiar with it. The tuberosity on the first rib into which it is inserted should be felt, if possible, with the point of the finger ; but it is seldom so distinct as some have described it. Immediately on the outer part of this tuberosity or outer margin of the lower extremity of the anterior scalenus, the subclavian artery will be observed, lying in a slight groove on the upper surface of the first rib. From half an inch to an inch of the vessel will now be exposed, but this will depend a good deal on the shape of the neck — particularly on the position of the rib—for generally when this bone slopes much downwards, as it often does in long-necked persons, the subclavian artery and contiguous parts above the clavicle are most extensively exposed in the present stage of the dissection. But in any subject the extent of parts seen above will depend a good deal on the position of the latter bone ; for if the shoulder be much raised, the collar-bone is so thrown up against the side of the neck, that no portion of the artery can be seen in this situation ; on the contrary, if the shoulder be drawn downwards, the triangular space in which the vessel is placed is always considerably increased in size.

The subclavian on the first rib, may be observed to have the vein in front and a little lower, the inferior cervical nerves with the first dorsal being above and somewhat behind the artery. The vein is but loosely connected with the artery in this situation, the scalenus anticus being between them; but the inferior nerves are so close upon it, that there need be little wonder that on the living subject the one should, for a time, be mistaken for the other.

Before the space in which these parts are situated can be clearly examined, and more especially before the nerves can be displayed, the omo-hyoid muscle must be drawn upwards and backwards ; and it will here be observed, that it is better to draw it upwards on such occasions rather than downwards, as, by the latter movement, the muscle is thrown on the stretch, whilst the triangular space is increased by the other proceeding. The difference may be worthy of notice on the living subject.

After the parts have been carefully examined in their present con-

dition, the clavicular portion of the sterno-mastoid may be divided close to the bone, and then by turning the separated portion a little aside, the anterior scalenus may be more clearly exposed. The transversalis colli and supra-scapular arteries will now be more completely seen, particularly if a little cellular texture be removed; and, in addition, the ascending cervical may also be perceived running upwards along the inner margin of the muscle. The phrenic nerve may likewise be observed on the inner margin of the scalenus. The muscle should now be cut across, from its outer margin, and by this proceeding it will be seen that a considerable additional portion of the artery will be brought into view: it may also be observed that the division of the fibres will, with ordinary caution, be accomplished without risk of injuring either phrenic nerve or the arteries which cross the muscle. Perhaps, now, the deep cervical branch of the subclavian may be brought into view, as this vessel often arises from the main artery between the scaleni muscles: possibly, however, it may have been seen at an earlier period of the dissection, in front of the cervical nerves, or dipping between them in its course backwards.

During all these dissections the external jugular vein may have been left untouched, but it will generally be of advantage to divide it, a couple of inches above the clavicle, at an early period of the proceedings. Several veins will also have been noticed passing obliquely downwards and forwards through the triangular space, which may, with the jugular, have been left or removed at will.

The internal margin of the sterno-mastoid should now be examined. The semi-tendinous attachment to the sternum should be cleared, and the margin of the muscle for several inches upwards should be accurately made out. The cellular membrane covering the sterno-hyoid and the sterno-thyroid muscles should then be removed, and notice should be taken of the considerable hollow now left on the inner margin of the sterno-mastoid. In making the last part of the dissection, various veins may have been met with in their course downwards through the loose fat and cellular substance which occupy the hollow alluded to. About midway between the sternum and the hyoid bone, the upper belly of the omo-hyoid will be observed, passing obliquely upwards to the body of that bone. This muscle should be cleaned up to its attachment, and the anterior belly of the digastric should also be cleaned, between the hyoid bone and its attachment to the lower jaw. The cellular membrane between the line formed by these two muscles in front, and the sterno-mastoid behind (being part of the superficial fascia), should now be raised, and thus the anterior margin of the last named muscle, with a large portion of both the parotid and sub-maxillary glands, will be brought into view. In making this part of the dissection, it may be remarked that the fascia is here of considerable density and firmness.

It may now be observed that between the base of the lower jaw and

the point of approximation of the sterno-mastoid and omo-hyoid, there is a kind of triangle bounded on each side by these two muscles,—the inner side being completed by the anterior belly of the digastric.

If the cellular membrane is now cautiously divided, a little above the omo-hyoid muscle, and close to the sterno-mastoid, the common carotid artery will be exposed, and by continuing the dissection upwards, the vessel may be traced to its bifurcation. In doing so the descendens noni nerve may be seen, either outside of the membrane which covered the artery, or actually in its substance; and in raising the superficial fascia, as also in making the latter part of the dissection, several veins may have been observed, some passing to join, or to assist in forming, the external, others proceeding deeper to join the internal jugular. Perhaps an anterior jugular may be present, in which case it will be found passing downwards, on the inner margin of the sterno-mastoid, to join the large veins at the root of the neck.

The external carotid artery may next be traced, and to do so, the lower part of the submaxillary gland should be raised, and held upwards with a hook: the lower portion of the parotid should be treated in the same way,—veins, twigs of nerves, or small arteries being freely divided for the purpose. The posterior belly of the digastric with the stylo-hyoid muscle will now be in part exposed, and the external carotid with several of its most important anterior branches, as also the ninth nerve, will be readily displayed by a very slight dissection. The superior thyroid artery, the lingual, the facial, and perhaps the occipital, will all be uncovered at their origins from the main vessel, and each may be traced as far from it as the present stage of the dissection will, with propriety, permit. It will in the meantime be better to allow them to remain as they are, until the examination of the course of the common carotid is completed,—the dissection being now so far advanced that this may be advantageously accomplished.

The sterno-mastoid muscle should be divided about its middle, and the under end turned towards the sternum. The sterno-hyoid and sterno-thyroid may be treated in the same way, and the omo-hyoid may be left entire or not, at the will of the dissector. As yet the common carotid will be covered by condensed cellular tissue, which will be seen to be a continuation of that which has already been divided to show the artery in the upper point of its course. It is the deep layer of the cervical fascia formerly alluded to,—it forms, in fact, what is usually called the sheath of the vessels here, and must be divided as low as the sternum, and turned to each side, ere the carotid can be properly traced downwards. In dividing the sterno-hyoid and sterno-thyroid muscles, and the sheath of the vessel, the branches of the descendens noni, that twig itself, as also the communicans noni, will be exposed, and may if necessary be cut across. As the cellular sheath is turned outwards, the internal jugular vein will be brought into view, lying on the outer side of the artery. In the middle of the neck the vein will be in pretty close contact with the artery, but lower

down the connexion is somewhat more loose, and they can scarcely be said to touch each other. The latter feature is, perhaps, most conspicuous on the right side, and on the left the vein at the lowermost part of its course lies somewhat in front of the artery.

If the sterno-thyroid, sterno-hyoid, and sterno-mastoid muscles be now replaced, and if the fat, cellular membrane and skin, be taken into account, the great depth of the lower part of the carotid artery may be appreciated, and it will be seen how it is covered by the lower ends of the two first-named muscles, and by the sternal portion of the sterno-mastoid.

The surgical anatomy being different on the two sides of the neck, some separate consideration must be given to each.

If the dissection above described has been on the left side, the carotid artery may next be traced as deep into the chest as the neighbouring bones and soft parts will permit. For this purpose the internal jugular vein should first be traced downwards, and then be held aside. The vein will be seen to join the subclavian almost in front of the artery, and the two combined, forming the left vena innominata, may be traced towards the right side of the neck; but the latter part of the course of this vessel need not be attended to at present. The remaining structures in this situation had better be examined. The subclavian artery, which has already been traced to the inner margin of the anterior scalenus, should be followed into the chest also. If any of the fibres of the last-named muscle be still entire they should be cut across, and in doing so, care should be taken to preserve the phrenic nerve, which here lies close upon the inner margin of the muscle. If the vessel be now cleared a little nearer the heart, the origin of most of the branches of the subclavian may be observed: the thyroid artery, by itself, or giving off the ascending cervical, transversalis colli, supra-scapular, internal mammary, and perhaps the vertebral, may all be displayed: the origin of the latter, however, may not be distinctly observable, nor will it be possible to see the superior intercostal branch. Notice should be taken of the proximity of all these to that part of the main artery which lies between the scaleni muscles, and it may now be perceived, too, how short that portion of the vessel is which can be seen between the origin of these branches, and where it dips behind the pleura. At this latter part of its course the par vagum may be noticed in front, and from the inner margin of the first rib as far as the artery may have been traced, the vessel may be observed to be in pretty close contact with the pleura, which membrane projects a little above the level of the rib in most subjects.

In making the dissections last described, the internal jugular vein should be drawn towards the trachea, and the subclavian, if much in the way, should be held downwards. Several branches may perhaps have been noticed joining the latter, and the thoracic duct may probably have been seen joining it also, at the angle of union between this vein and the internal jugular. Unless, however, the dissector be an experienced anatomist, or that the duct has been distended with air

or with injection, it is apt to be overlooked, its tunics being so remarkably thin.

The right side shows a considerable and important difference in the condition of the blood-vessels. Supposing the dissection to have been conducted on this side in the same way as has already been described, until the sterno-mastoid muscle, the sterno-hyoid, and sterno-thyroid, have been divided and turned downwards, the carotid artery, instead of disappearing in the chest as on the left side, may here be traced to the arteria innominata, which vessel may be seen projecting above the sternum the length of three-fourths of an inch, more or less, according to the position of the head, the length of the vessel, or the height of the arch of the aorta. In clearing the innominata, the sterno-hyoid and sterno-thyroid muscles will be observed to lie completely in front of it: a considerable quantity of cellular texture will also be noticed, and the division into carotid and subclavian may be seen immediately behind, and, perhaps, a little above the sterno-clavicular articulation. Several veins will probably be noticed passing downwards, some above the small muscles here, others closer to the trachea, and the vena innominata of the right side may probably not be perceived,—it usually lies so deep here.

Behind the above-named muscles, on the right side, the cellular tissue presents a dense membranous aspect, and between the carotid and inner margin of the scalenus anticus, nothing of consequence can be seen distinctly. Perhaps, however, the outline of some of the branches of the subclavian may be noticed, as also that of the internal jugular vein, particularly if it be distended with blood. If the cellular membrane be now cautiously dissected away, the branches of the subclavian artery may be displayed as on the left side, the internal jugular vein may also be seen as on the other side—excepting that it lies further from the carotid: the par vagum will probably be more distinctly seen than on the left, and little anatomical discrimination is required to discover various branches of the sympathetic, which pass towards the chest in front of this artery.

The difference between the two subclavians at the root of the neck may now be clearly observed: between the origin of that under notice, and the branches which are given off before it passes the scaleni muscles, the vessel is throughout its course above the level of the first rib; whereas, on the left side the greater part of this artery, before it reaches the rib, is much below the level of that bone, and is in fact so deep that it is difficult to expose it in such a dissection as has been described.

The right subclavian vein occupies much the same relation to the artery as does the left, being in front and somewhat below the level of the latter vessel: it unites with the internal jugular as on the left, and forms the right vena innominata.

The mesial line of the neck may now be examined. Whether the dissections already described have been performed on one or both

sides, the muscles which have been raised and turned down on the sternum should be replaced, and thus again the depth between the sterno-mastoid muscles immediately above the sternum will be apparent. At the bottom of this space some of the rings of the trachea may be noticed between the sterno-hyoid muscles; but possibly the tube has not as yet been sufficiently cleared to permit its being seen: a small part of it should, however, be laid bare by dividing the cellular tissue in contact with it between the two muscles last named, about an inch or a little more above the sternum, and thus some idea may be formed of the difficulty which has occasionally been experienced in tracheotomy in this situation, more especially in short-necked muscular subjects, straining every muscle in the neck during inspiration, and having the veins distended, and perhaps, too, the cellular tissue under the skin infiltrated with serum from the previous use of sinapisms and blisters. In this view of the parts also it may be observed that the sternal portion of the right sterno-mastoid muscle covers the arteria innominata.

The under ends of the muscles may now again be turned down, and the other extremities of the sterno-hyoid and sterno-thyroid should be dissected upwards. Thus the thyroid gland will be brought into view, and, by some additional dissection, so as to remove the cellular tissue from the trachea above and below the gland, the greater part of the tube will be exposed. The cellular substance should be completely removed from behind the upper margin of the sternum, as far down as the knife and forceps can conveniently reach, when the vena innominata of the left side will now be seen throughout its course in this situation, and that on the right side may also be more distinctly perceived than hitherto. It usually happens, however, that both of these vessels are so deeply placed that they may probably not be seen at all in this part of the dissection. The arteria innominata will, however, be completely cleared for surgical purposes. Perhaps, in dissecting in front of the trachea at the root of the neck, a small artery may have been noticed passing upwards to the thyroid gland, (the middle thyroid coming from the innominata or arch of the aorta,) but it is an irregularity not often met with, and probably of less consequence than some have imagined. Besides the anterior jugular which, as has already been stated, may be in this situation, smaller veins will be met with, passing downwards to join the large vessels at the root of the neck.

Between the sternum and chin the following parts may now be noticed. The arteria innominata,—its lowermost end, perhaps, nearly in front of the trachea, but the greater portion of it being to the right side of that tube: the rings of the trachea, uncovered for about two inches above the sternum; then, the isthmus of the thyroid gland, and above it two or three rings of the trachea: the cricoid and thyroid cartilages, with the membrane between them: the pomum Adami formed by the projection of the union of the two plates of the last-named cartilage: the hyoid bone, with the membrane between it and

the thyroid cartilage; and lastly the junction between the mylo-hyoid muscles, with the anterior belly of the digastric on each side of the mesial line.

To complete the dissection of the lower part of the neck, the clavicle should be removed at its articulation with the sternum, when a more perfect view than ever of the vena innominata on either side may thus be obtained, more especially on the right side, where, in addition, the great artery, and also the subclavian, may be more accurately examined. In this latter proceeding the close proximity of these large vessels to the pleura cannot escape notice, more particularly if this membrane projects much above the first rib. On either side of the neck the lower part of the carotid artery should be drawn outwards with a blunt hook, and by a slight dissection between the trachea and œsophagus, the recurrent branch of the par vagum may be discovered in its course towards the larynx. On the right, the connexion between this branch and the subclavian artery should be particularly noticed, and on either side, in making this examination, it will scarcely be possible to avoid the inferior thyroid artery, which may be seen passing up behind the sheath of the vessels towards the lateral lobes of that organ, which will, itself, be sufficiently conspicuous.

The upper part of the neck may now be referred to again. The sterno-mastoid should be dissected upwards, which will permit a more free examination of the deep-seated important structures on the side of the neck. In raising the muscle and turning it towards the mastoid process, the spinal accessory nerve will be seen piercing its upper end, on its way towards the trapezius muscle. The external carotid and its branches should now be more completely laid bare, as far as the present removal of integuments will permit, and for this purpose the submaxillary and parotid glands may be either held upwards, as already described (p. 372), or freely divided. The lingual nerve (ninth) will thus be exposed where it crosses this artery and its branches, and the digastric and stylo-hyoid may either be left entire or divided—the former perhaps being best, as some further reference to relative position may still be desired.

The superior thyroid artery should now be traced down to the gland, and perhaps in doing so one branch or more may be noticed coming off in the direction of the sterno-mastoid, which will probably have been cut across, in first exposing the common carotid artery. These branches are by no means regular, yet I have known the division of one of them on the living subject cause considerable annoyance in the operation for ligature of the carotid. Perhaps, too, in tracing the artery a branch may be seen running under the thyro-hyoid muscle to join a similar branch from the opposite side, on the crico-thyroid membrane; but it is seldom of such magnitude as to attract much attention. The lingual artery should next be traced, to the lower surface of the tongue: the length of that part between its origin and the posterior margin of the hyo-glossus muscle should be carefully noticed, and its relation to the ninth nerve, as also to the extre-

mity of the great horn of the hyoid bone, should not be overlooked. The length alluded to, will probably be about an inch, including any curve that may be present; the nerve will be found nearest the dissector,—it may be a little above or below the level of the artery; and the latter will disappear under the hyo-glossus about a quarter of an inch above the rounded end of the horn of the hyoid bone. The last-named muscle may be divided for half an inch or more to expose the vessel still further; and here it may be observed, that whilst the latter is covered in this situation by the muscle, the nerve lies upon its outer or lower surface.

The facial artery may next be traced as far as the margin of the lower jaw. It will be observed to pass behind the stylo-hyoid and digastric muscles, and along the upper and back part of the submaxillary gland, to which organ it is connected by numerous short branches. The vessel runs through the substance of the gland at its upper part, and here it will be found considerably above and behind the margin of the bone, before it reaches the groove a little in front of the attachment of the masseter muscle. In dissecting this vessel, as well as the other branches of the external carotid, various veins may be noticed passing to join the internal jugular, but they are very irregular in different subjects both in size and position. The vein corresponding to the facial artery does not accompany this vessel behind the submaxillary gland, and will, in all probability, have been removed with the superficial fascia in the early stage of the dissection.

The upper part of the external carotid may now be traced a little above the angle of the jaw, where it will be found imbedded in the deep part of the parotid gland. A vein will perhaps be seen in close contact with it in this situation, which may probably run to the internal jugular; if not, it will have gone to assist in forming the external. The artery here almost invariably lies under the digastric and stylo-hyoid,—occasionally it passes between them, and in one instance I have seen it run superficial to these muscles. In tracing it through the parotid, many branches of the portio dura will be observed; these may be kept entire, and if one is traced backwards the trunk may be exposed as far as the stylo-mastoid foramen, although it will be difficult to do so even in the present state of the dissection.

The occipital artery may next be traced, but as neither this vessel nor any other posterior branch of the external carotid possesses any peculiar surgical interest, I will not dwell upon their dissection.

At the origin of the external carotid, the internal cannot escape notice, as it is usually as prominent in this situation as the external itself. It soon, however, passes deeper, and need not attract further notice at present.

The internal jugular vein will be found immediately behind the last-named vessel, and should now be traced downwards. Throughout its entire course it lies on the outer side of the common carotid artery, being attached to it and enveloped by the same sheath of cellular membrane. The sheath will have already been freely opened and re-

moved in front; but hitherto the two vessels will not have been separated from each other: this should now be done, when the par vagum will be found immediately behind and almost between them; and if all these parts be held aside, the sympathetic nerve may be noticed in front of the spine, behind the sheath, but not intimately connected with it. If both internal jugulars can be examined at the same time, in all likelihood one will be found much larger than the other. These vessels are often irregular in their size; and I have in several instances observed that one was deficient. It is, therefore, not difficult to understand why one surgeon in tying the common carotid should have had great difficulty in keeping free of the vein, whilst another has not even seen it during the operation. At the root of the neck, the same reason, coupled with the fact that all the veins here are more or less irregular in different individuals, and in the same person at different times, will sufficiently explain the discrepancies regarding the veins which may or may not have given trouble during operations in this situation.

The larynx may be examined either at present or after the face has been dissected. If it is an object to economize, it will be best not to interfere until the proceedings described in a future chapter have been accomplished; but for the purpose of enabling me to refer in the next chapter to the operations on the neck, I shall here complete the description of the mode of dissecting this part. The mylo-hyoid muscle should be cut across at its junction with that of the other side, and turned upwards, or it may be separated from the lower jaw and dissected down towards its fellow: in either way the genio-hyoid and genio-hyo-glossus muscles may be examined, and at the same time the sublingual gland, with its duct, and also that of the submaxillary may be traced, although they can be much better seen when a part of the jaw has been removed in the manner afterwards described.

The larynx must now be removed; but before doing so, a glance should be taken at the position of the œsophagus, which will be seen to project a little more to the left side than to the right, as it lies behind the trachea. If the lobes of the thyroid gland be at all enlarged, they will generally be observed to project backwards in such a way as to lie against the sides of the œsophagus. In this stage of the dissection it may also be well to pass the finger through the mouth into the pharynx, then to pass a probang or a stomach-tube down the œsophagus; and some of the instruments used in operations here, (such as those referred to in future pages,) may be passed into the throat, pharynx, and larynx, so that their course and position will be better understood on the living body. The attachments of the tongue in front and at the sides may now be divided: the pillars of the fauces, and the constrictor muscles of the pharynx, should next be cut, and the tongue, hyoid bone, larynx, trachea, with the thyroid gland, and the œsophagus, should all be turned down, and the two tubes should then be cut across at the root of the neck.

The parts thus separated, should now be more carefully examined.

The œsophagus should be laid open, and its commencement behind the cricoid cartilage having been noticed, it should be dissected from the trachea. The position of the epiglottis should next attract attention, and the relations which it bears to the upper opening of the larynx, during different movements of the tongue, should be observed. Then, by looking into the upper part of the larynx, the opening formed by the fold of mucous membrane passing on each side between the arytenoid cartilages will be noticed, and a little lower down, the proper vocal chords, forming the rima glottidis, with the pouch on each side between these and the folds first seen, may also be observed. The membranous part of the trachea behind, cricoid cartilage, and the soft textures between the arytenoid cartilages, should now be slit open with the scissors, when the folds of mucous membrane already alluded to, with the pouch, or ventricle, on each side, may be more accurately examined. The space between the cricoid cartilage and the thyroid should again be looked at: it will be observed to be of greater extent transversely than vertically; and if the scalpel is thrust through the membrane from without inwards, the point may be seen below the anterior attachments of the vocal chords. The space between the thyroid cartilage and hyoid bone may next be noticed: the point of the instrument, if passed from without inwards here will be found between the larynx and the epiglottis, and if it be pushed in above the hyoid bone, it will usually be noticed between the latter part and the tongue. The thyroid gland may next be dissected from the trachea, when its isthmus will, in general, be found to have covered two, or perhaps three, of the rings of the trachea: as, however, the size of this organ, both here and in its lobes, varies exceedingly, the whole gland may be more prominent than the beginner may suppose it to be in accordance with a normal condition.

As it is not my object to give a minute description of these parts, I must refer those who wish to inspect them in this way to a work on Anatomy, and shall now proceed with the practical illustration and application of the mode of dissection here described,—leaving the dissection of the Head and Face for a future chapter.

CHAPTER II.

OPERATIONS ON NECK. LIGATURE OF ARTERIES.

On the back of the neck there are few operations of great consequence ever required. The application of the cupping apparatus, or the introduction of a seton, are, perhaps, the chief of them, and no particular notice of either is here necessary. The skin in this situation is so thick, that the lancets may be allowed to penetrate to any reasonable depth, more especially as there will be no danger of coming in contact with important organs: it is not, however, considered advantageous to make very deep wounds in the operation of cupping. The seton is used more frequently in this region than in any other part of the body. The cord is generally introduced about three inches below the occipital protuberance, being carried in a transverse direction about an inch in length under the skin. The most convenient mode of passing it is such as has already been described at p. 47. Occasionally it is necessary to remove tumours from this part; and as these are usually superficial, there is little care or skill required in such operations. Some time since I removed a fibrous growth, about the size of the fist, which had been present for many years, and prevented the development of the upper ends of the large muscles in this situation: the mass was in contact with the occipital bone, touched the upper cervical vertebræ, and some pains and caution were required for its separation. The occipital artery, and some of its branches, bled freely. The patient had so long carried his head in a stooping position, that little benefit in this respect was derived from the operation; otherwise, however, he had got rid of a considerable deformity, and had more facility in moving his head.

On the side of the neck venesection is occasionally performed in the external jugular. That part of the vessel over the sterno-mastoid muscle is the seat of operation, and here, as the vein lies under the platysma myoides, it may be well to keep in mind the recommendation to carry the lancet across the fibres of this muscle, as there will thus be less chance of a thrombus forming under it. In other words, the incision may be made parallel with the sterno-mastoid. Perhaps the best reason for this proceeding is, that the vein will be cut obliquely; for, though I do not mean to deny that the fibres of the platysma, if not divided, may obstruct the flow of blood, I believe that more importance has been attached to this circumstance than it really deserves, having often seen the blood flow freely with the wound made in either direction. Probably the different size of the vein in different individuals will sufficiently account for the stream flowing more rapidly in one than in another. Nevertheless, as it will be as easy to make the incision in one direction as in another, it will be best

to divide the platysma over the vein, and thus obviate any obstruction which these fibres, if left uncut, might offer to the flow of blood. The lancet must be held and used in the manner already described in other pages, and care must be taken that the orifice in the skin is fairly over that in the vein, and that it is kept steadily in this position until the desired quantity of blood is drawn. To retard the circulation in the lower part of the vessel a pad may be placed at the root of the neck, over the vein, and retained by a bandage carried under the arm-pit of the opposite side; but this will seldom be necessary, as a little pressure with the thumb or forefinger of the left hand will keep the vein sufficiently distended during all the desired period. When the pressure is taken off the stream will cease, and the wound, being covered with a piece of lint or a slip of plaster, will heal like that in venesection at the elbow.

Ligature of the main arteries may next claim attention. The subclavian, as has already been stated in a chapter on the upper extremity, is now usually secured above the clavicle, when it is necessary to interfere with the vessel, at a distance from injury or disease. Under ordinary circumstances the seat of deligation is immediately on the outer (acromial) margin of the scalenus anticus muscle, and here the operation may be done on the subject in the following manner:—The body being placed on its back, with the chest raised on a block, and the head also elevated, and slightly turned to the opposite side, the shoulder, on that side on which the proceedings are to be accomplished, is to be drawn downwards and forwards, when (the operator standing on whichever side is most convenient) an incision should be made between three and four inches long, and about half an inch above and parallel with the clavicle, one end being over the clavicular portion of the sterno-mastoid, the other over the anterior margin of the trapezius. This incision (letter *b*, fig. 195) will be slightly lunated, and should expose the fibres of the platysma myoides, and probably two or three cutaneous nerves running in the same course. The knife should again be applied to divide this muscle, and any texture over it which may not have already been cut, when the margins of the sterno-mastoid and the trapezius will in all probability be exposed; possibily, however, the trapezius may not be seen, and, indeed, unless it is apparent that this muscle has a more than usually extensive attachment to the clavicle, there is no particular occasion for carrying the first incision so far outwards. The external jugular vein will now perhaps be seen, when it should be slightly loosened, and held by a blunt hook towards the trachea or acromion, according to its proximity to these parts: generally, it will be most convenient to draw it inwards; but should it appear in the way, a couple of ligatures may be applied and the vessel divided between them. Now the dissection should be cautiously continued through the fat and cellular substance, when the posterior belly of the omo-hyoid muscle will be brought into view: a blunt hook should be used to draw it gently upwards, and then the space between it and the clavicle will be increased. Here

Fig. 195.

the knife should be applied very cautiously, and not before the parts have been examined with the eye and point of the finger ; the handle of the instrument, or a silver blade, may be called into requisition ; for, besides the danger of coming in contact with the artery or vein, there is the risk of wounding some of their branches.

If, after a careful division of the textures supposed to lie over the artery, the vessel is not yet exposed, the anterior scalenus muscle should be looked for, and to facilitate this step a few of the fibres of the sterno-mastoid may, if required, be divided,—indeed, whenever this muscle takes a broad attachment to the clavicle, there should be no hesitation about this proceeding, and thus the scalenus will be readily exposed by separating with the handle of the knife the cellular tissue immediately over it. The fore-finger should now be run down to the attachment of this muscle to the first rib, and immediately outside and a little behind this point the artery may be felt pulsating: a slight and cautious dissection will now expose a small portion of the vessel; and, when its identity has been ascertained, the point of the aneurism needle should be carried under it, from before backwards, and thus the ligature may be conveyed around it. On the living body when the needle is under the artery, or before the noose is drawn, the vessel may be slightly elevated and compressed with the point of the finger, and by watching the effects of this manœuvre on the pulse at the wrist and on the aneurismal tumour, if one be present, all further doubts (if any still remain) about the vessel, will be set at rest. The ligature may now be tightened; one or both ends should be allowed to hang out of the wound, the edges of which, on

the living body, may be kept in apposition with a couple of stitches, and treated according to rules laid down in other parts of this volume.

On the dead subject the operation, as just described, may be readily accomplished;—few of the difficulties which have occasionally been encountered on the living can now be met with. Sometimes, when the neck is short and muscular, the clavicle high, and the veins are turgid, there may be trouble, but not such as can be compared with that which may occur in practice. As has already been seen in the dissection, and as may now be observed, when the shoulder is elevated, the artery is nearly covered by the clavicle, and as a large aneurismal tumour in the axilla will have a similar effect, the difficulty in reaching the vessel under such circumstances may be thus in some measure appreciated, for when there is a tumour present the shoulder cannot be held down as when the parts are in a more natural condition. In an operation of this kind occuring in my own practice, the ligature within the wound was two inches and a quarter long, and yet the tumour in the axilla was not by any means so large as others which have been seen in this situation.

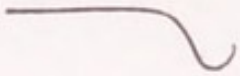
On the living body, the hemorrhage, especially if there is disease in the axilla, may be very troublesome, more particularly from small veins, which may not attract much notice in the healthy state of the parts. In such cases, if pressure cannot be applied with effect, I should not hesitate to apply ligatures to all the bleeding points; and here, as also with the external jugular, if this vessel should be tied as above recommended, I should be inclined to allow the ligatures to remain; for in all the operations on the large arteries at the root of the neck, which I have witnessed, where temporary ligatures have been used, I have invariably noticed that, after the patient has been put to bed, bleeding has occurred generally from the upper end of the vessels. Sometimes a vein may be so deep that a noose cannot be cast around it, or if, unfortunately, the subclavian itself should be wounded, then pressure after the operation can alone be depended upon. The main vein, however, is generally so far in front of and below the artery that, with ordinary precaution, there will be little difficulty in avoiding it. The supra-scapular and transversalis colli arteries are both in danger, and it is not easy to say which may be most so: the former is usually protected in some degree by the clavicle, and the latter is perhaps most in the way,—but is irregular in size and position, and as both may be so, it will be well to have a sharp eye on the textures about to be cut. Were either of these vessels divided, or any other artery of considerable size, a ligature would be necessary.

Both touch and sight may be of the utmost service here, but they are not always so available as the dissector may imagine. Sometimes the pulsation of the main artery cannot be felt with the point of the forefinger, as once happened to myself, when the tunics were thickened; and on other occasions they may be so feeble as to cause some doubt, as happened to Professor Todd of Dublin. The depth of

the wound may prevent a fair view of the parts, and for these reasons, then, when the needle is passed under the artery, it will be advisable to try the effects of compression as above referred to, more especially when it is remembered that on the living body a nerve has been mistaken for the vessel, and actually surrounded by the thread. In this instance the error was discovered immediately, and rectified at once. The large nerves are generally so placed behind and above the artery that they are certainly not much in the way, yet it is well to bear the above fact in mind. In recommending the artery to be "slightly elevated" with the needle or the thread, as has been done in a preceding page, I hope it will be understood that this gives no sanction to unnecessary rudeness, for the less the surgeon moves the vessel in this way, the more will he comply with the rules of good surgery.

It has been stated that the point of the needle should be introduced from before backwards, but some good authorities have recommended the opposite course. The former has been thought best for avoiding the vein, the latter has been found convenient in instances where the elevation of the clavicle has prevented the requisite depression of the handle of the needle. For my own part I should follow whichever course I found least troublesome, taking care, however, to keep the point as close upon the artery as possible.

When Mr. Ramsden first performed the operation, this was found to be the most difficult part of the whole proceeding. After using various forms of needles, the thread was at last carried under the artery by means of a common silver probe, bent at one end. Many ingenious contrivances have since been recommended (such as Weiss's, Mott's, Gibson's, L'Estrange's, &c.), but I doubt if any one of them be superior to a needle such as is represented at p. 29. In all it is absolutely necessary that the point should be carried under the vessel, so that it may be drawn or pushed up on the side opposite to that where the shank is placed, as this latter part, with the handle, cannot be depressed, as in operations on most other arteries, so as to cause the point to rise above the level of the vessel. I imagine, however, that if the point can be seen under and at one side of the vessel, there can be no further difficulty; for if the eye is close to the extremity (as it should be), as soon as it appears the thread may be seized with a hook or forceps, and drawn up, without the necessity for any depression of the handle whatever, which, as soon as the thread is secure in the surgeon's hand, can be withdrawn in the course through which it has already been passed.

It is certain that in many (I should say in most) instances the common needle has been found to answer perfectly, but it is equally so that most expert operators have had great trouble in this part of the proceedings, and although I myself should first make use of such an instrument, I would assuredly be provided with various sorts in case of any difficulty. In 1831, I successfully applied a ligature to this vessel, with a needle of this shape  , the concavity

near the handle being for the purpose of allowing the instrument to revolve, in a manner, over the clavicle. In that instance, however, I believe that a needle of the ordinary shape would have answered equally well. The case was published in the 109th number of "The Edinburgh Medical and Surgical Journal," and some further particulars were given in the September number (1841) of "The London and Edinburgh Monthly Journal of Med. Science," including an account of the *post mortem* appearances about four years after the operation.

In a deep wound there may be difficulty in drawing the noose and knot sufficiently tight with the fingers alone; for here, as in other parts, their points should, if possible, be kept close to the artery, so as not to raise it from its natural position, as would happen if this manœuvre were not attended to. In deep and narrow wounds, then, some substitute for the fingers may perhaps be of service:—such as an instrument somewhat similar to the polypus forceps, afterwards represented, having a small eye at the point of each blade, through which the ends of the ligature can be passed after the first noose has been cast. If these be closed, slid on the thread down to the artery, and then opened, whilst each end of the ligature is held firmly, the noose can thus be tightened, and then the second may be drawn in a similar manner. Two rods of iron, about the diameter of a quill, each having a small aperture at one end, have been used in a like manner,—they are long, narrow substitutes, as it were, for the fingers; but the latter should always be preferred, where they can be applied, and I believe that, if dexterously used, they will seldom be found incapable of fulfilling the wishes of the surgeon. In whatever way the knot is drawn tight, it is advisable after the first twist is effected, to apply a little pressure with the point of the finger until the second is completed. An assistant generally does this; and when the finger cannot be conveniently used, the common forceps (p. 7) may be applied with advantage.

An additional turn of the thread is a wise precaution, as it is just possible that those already made may actually become loose, and in this situation I prefer allowing both ends of the ligature to hang from the wound;—but on this subject I must refer to the third chapter of the introduction to this work.

In looking over the history of axillary aneurisms, for which ligature of the subclavian has been performed, one cannot but be struck with the frequency of suppuration occurring in the tumour afterwards. My attention was first directed to the circumstance by a case under my own care, when I perceived that it had happened in Mr. Bullen's practice, and also with many others. Although this process appears to have been more frequent in this situation than in similar diseases elsewhere, it does not in general seem to have been attended with ultimately bad results. In Mr. Bullen's case the abscess burst into the bronchial tubes, and also opened externally, (air passing freely between the two,) yet the patient did well. The course of practice to

be pursued may be difficult to decide, for a feeling must always be uppermost that in opening the abscess the aneurismal sac must be wounded at the same time, and that possibly uncontrollable hemorrhage may ensue,—indeed I have known this happen in popliteal aneurism after ligature of the superficial iliac; but in general, if inflammation, fluctuation, and other symptoms be distinct, there should be no hesitation in making an opening at the prominence formed by the matter. This, however, should not be so very free as if the abscess were one of an ordinary kind, although the after-treatment should in most respects be the same. The cause of inflammation and suppuration in these cases has never yet been satisfactorily accounted for.

It has been the custom with some to speak of applying a ligature to the artery when it lies between the scaleni muscles, as a distinct operation, and the high authority of Dupuytren has been quoted on the subject. I confess, however, with all due deference to that distinguished name, that I have never been able to look upon it as such. If from the size of an aneurism, or any other reason, the surgeon perceived that it would be improper to carry the external end of his incision so near to the trapezius as has been above recommended, he would (still supposing he could expose the vessel as it lies on the first rib) keep the external wound somewhat nearer the trachea, and if on getting upon the anterior scalenus, or the artery, he found the latter diseased, he should assuredly divide the muscle to ascertain the condition of the vessel behind it, and, in the event of its being healthy, apply a ligature, as he might do at the outer margin of the muscle in any other case. In 1819, Dupuytren operated on the left side, having the intention from the first of dividing this muscle, which he accordingly did, and the proceeding was successful. The case was an axillary aneurism, resulting from a stab. In 1820 Mr. Liston tied the vessel (with success) above the clavicle for a spontaneous aneurism, and in the progress of the operation found it necessary to divide a portion of the outer margin of the muscle. His original object was to secure the vessel after it had passed that point, but finding the tunics diseased, he, without making any alteration in the external wound, proceeded to treat the muscle in the manner alluded to.

Should it be deemed necessary to interfere with the scalenus, it must be remembered that the knife comes nearer and nearer to important parts. First, the posterior and supra-scapular arteries lie closer here to each other than further on, then the phrenic nerve may be endangered, and even the internal jugular vein. The proceeding should be effected with a probe-pointed bistoury, and, as an additional security, a director should be pushed under the muscle. If any of the vessels above named were visible, they should be held aside with hooks, or with a curved spatula, and the movements of the knife should be made with the utmost caution, more especially if it should be found necessary to divide the whole of the muscle, so that the phrenic nerve may not be injured. This nerve generally lies close upon the inner

margin of the scalenus; but it may be a little towards the middle of its anterior surface, although it is perhaps more frequently slightly separated from the margin by some loose cellular tissue.

In the dissecting-room it is an easy matter so to contrive the incisions as to permit a saw to be applied to the middle of the clavicle for the purpose of dividing it, and thus exposing the artery more completely. On the living subject, however, I can scarcely imagine such a case as to require or warrant this proceeding. If the aneurism is high, large, and encroaches on the clavicle, in all probability the bone will actually form a portion of the sac: here, then, such a step is inadmissible, and if the tumour is not in the condition described, I cannot suppose that the proceeding is at all necessary.

Perhaps in such a case as that just referred to, or in an instance of a small aneurism connected with the vessel between or immediately outside of the scaleni, the surgeon might endeavour to deligate the subclavian at a point still nearer the heart. Such an operation, however, can only be resorted to on the right side, for on the left the vessel lies so very deep that, in so far as I am aware, no such proceeding has ever been accomplished on the living body.

The patient should be on his back, with the shoulders slightly raised, a pillow being placed under the neck, so as to allow his head to hang a little; care, however, being taken not to depress it so much as to cause him any uneasiness. The surgeon should stand on the patient's right side, or at his head, being guided by circumstances or taste in selecting his place. For my own part, I should prefer standing at the end of the table, so as to look, as it were, over the patient's face.

Fig. 196.

Letter *c* on figure 196 points out the line of incision for the external wound. It should commence nearly over the inner margin of the left sterno-mastoid muscle, and extend outwards in a slightly lunated direction, about three-fourths of an inch above the clavicle, for three inches or more. The skin, platysma myoides, and fascia, should be divided as in the operation last described: then the sternal portion of the right mastoid should be cut after having passed a director or the point of the finger under it: next the sterno-hyoid and sterno-thyroid should be divided in the same cautious manner, and then the vessel should be looked for in the loose cellular tissue in this situation. The point of the knife should be used as little as possible, and its handle will probably be found sufficient for the greater part of this stage of the business. It may happen, as I have twice seen on the living subject, that the carotid artery comes first into view, and care must therefore be taken that no mistake occurs. This is not by any means probable; but as soon as the one vessel is recognized the operator will know that the other is not far distant. The carotid (supposing it to be thus first exposed) may be followed down to the innominata, and then the subclavian may be traced from this last-named vessel. In thus pursuing the course of the carotid, the cellular tissue should be separated only to such an extent as to permit the recognisance of the vessel. It will be better, however, if this vessel can be left alone; and, therefore, whether it is seen or not the surgeon should keep close to that part of the wound immediately behind and above the inner end of the clavicle: by careful separation of the cellular membrane, he must come upon the artery, at a distance from the innominata of three-fourths of an inch perhaps, when the needle and thread should be passed from below upwards, with the same care and precaution as has already been recommended for the operation on the acromial side of the scaleni.

If the circumstances are favourable, and the operator is an expert anatomist, the ligature may be applied without any important part, excepting the vessel, having been observed. Possibly, however, besides the glimpse of the carotid already alluded to, he may perceive the par vagum, some branches of the sympathetic, the internal jugular, perhaps the vena innominata, and even the upper surface of the pleura. Some of the twigs of the sympathetic must of necessity, I imagine, be cut, and the par vagum can scarcely be avoided:—indeed, if that nerve is perceived, it will be a good guide to the artery, for by tracing it down the latter is certain to be reached. If this course is followed, however, the nerve should be fingered and touched with instruments as little as possible, for there is good reason to suppose that (physically or functionally) it may be seriously affected by such injuries. On all occasions it will be necessary to avoid including this nerve or the recurrent in the ligature, and only by great caution can such a serious evil be prevented. The internal jugular is certainly less in the way than the par vagum,—it will be on the outer side of the ligature, but yet so near, that too much caution cannot be

taken to protect it. The vena innominata is still less in the way than the other, as it lies rather under the level of the artery; but there may be smaller veins which will cause considerable annoyance if divided. These should be held aside with blunt hooks; if this be inconvenient, they may be tied and treated in the manner already recommended in the description of the operation on the outer side of the scaleni. The proximity of the pleura should not be overlooked: usually the connexion between it and the artery is very loose, and I do not suppose that the operator will be able to recognize it on all occasions: much care, however, must be taken in passing the needle, and perhaps the safest plan is to keep its point in close contact with the vessel. There is every reason to suppose that Mr. Colles (who was the first who tied the artery on the living subject in this situation) punctured the upper part of the membrane, and though it is certain that this had but little, if any, influence in the result of the operation, the surgeon should do all in his power to avoid it.

The ligature, when placed as directed, will be very close upon the vertebral artery, but this cannot be avoided. As this vessel is somewhat irregular in its origin, it may be on the distal or proximal side of the thread, although it will most probably be on the former. I cannot, however, recommend that the ligature should be placed near the heart, nor is it advisable to place it further from it. In the one instance the current of blood through the innominata and carotid might impede, prevent, or destroy, the adhesion of the vessel at the seat of ligature, and in the other the recurrent circulation through the branches of the subclavian beyond the ligature might have a similar influence. The same remarks, it will be perceived, may be applied to the vertebral; but here the disadvantage cannot be avoided.

Were I asked to state which I thought the most difficult operation in surgery, I should at once name the one last described. A good knowledge of anatomy, great tact in discriminating textures, steadiness, coolness, and a ready use of the fingers and instruments, are all required in such a proceeding: the slightest carelessness with the knife,—a trifling deviation on one side or other, may produce the most serious consequences, and no one should attempt it unless he feels assured that he possesses most or all of the above qualities.

I have recommended that the sternal end of the sterno-mastoid should be cut, for I believe that the operation will be most readily accomplished by doing so. On the living body I should not hesitate to separate even the clavicular attachment also, and certainly should prefer doing so to that of only dividing the latter portion, as has been recommended by some. If this part only of the muscle were divided, the surgeon would be certain to come right down upon the internal jugular vein;—the branches of the artery would be in his way, and possibly, too, the phrenic nerve would be in danger. On the dead subject the vessel can be readily secured by only interfering with the outer head of this muscle, and in such a case

the sterno-hyoid and thyroid muscles need not be meddled with; but in every respect I should deem the operation more hazardous, and being attended with no advantage, that I am aware of, I should certainly prefer cutting for the artery in the manner first described.

In some subjects the two portions of the sterno-mastoid have a considerable space or slit between them, and in the dissecting-room the ligature of the vessel has been exhibited, by cutting between the two, holding them aside, and leaving the fibres untouched. Such a process and on such an occasion is usually simple enough; but I should be amazed at any one seriously attempting it on the living body. The idea that it is meritorious to save the fibres of this muscle uninjured, in an operation undertaken for an otherwise hopeless disease,—a proceeding, too, involving, it may be said, the immediate safety of the patient,—seems, in my view of the case, a refinement and nicety of operative surgery, which I cannot at all appreciate. The division of one half or even the whole of this muscle will not, in my opinion, make the smallest appreciable difference as to the ultimate success of the attempt thus made to save the patient's life, whilst it will greatly expedite the proceedings; and large though the gap may be, there will be more safety for the patient at the time, and less pain too, I imagine, than if the surgeon were to limit himself to so narrow a wound as there must be by following such a course as that which has induced me to make these remarks.

A single incision parallel with the clavicle has been recommended; but I would not limit myself if I found the wound deep and narrow, and the operation difficult. Such an additional cut as that marked *d* in figure 196, might be made with great advantage, or the knife might becarried straight upwards, so as to make the wound like an inverted , or like a crucial incision ;

but there need be no restriction as to the shape or size of the external wound, provided it is sufficiently free, and allows the parts beneath to be reached with facility.

As already stated, this operation was first done by Mr. Colles, of Dublin, in 1811, and since then it has been repeated several times. Hitherto, however, it has invariably been unsuccessful. In the spring of 1841, I assisted my colleague, Mr. Partridge, in its performance on a patient in King's College Hospital. It is not possible to imagine such a proceeding being better done, or with less injury to the surrounding parts. Every thing seemed favourable; the tumour small, and between the scaleni; the patient, a middle-aged, healthy, strong man, possessing great firmness and courage;—yet he died on the fourth day. The particulars of the case are given shortly in The Lancet for 1841.

Taking into consideration the want of success attending this opera-

tion it may well be deemed a serious question whether it should again be attempted. For my own part, I should do it with great reluctance. Brasdor's operation has been talked of here, and a surgeon could not be blamed for performing it; but we have little to hope for from such a proceeding either; and under the circumstances I believe that a surgeon might be fully justified in amputating at the shoulder-joint, treating the stump in the ordinary manner, and keeping up steady and properly regulated pressure on the disease. This seems a shocking alternative,—nay, it is so; but it must be remembered that death is almost the certain result in any other way; and if there was a chance of life being preserved by such a sacrifice, it would be the duty of the surgeon to urge it. It is known that amputation at the shoulder-joint is generally a very successful operation: as far as this wound is concerned, then, there might be little to apprehend, but the effect on the tumour is not so easily foretold. Ligature of the axillary artery on the face of the stump might here be reckoned like Brasdor's operation,—yet there is a vast difference, for in the latter case the same amount of blood which previously passed towards the upper extremity would still find its way down, and probably part of it would run through the sac; whereas, were the member removed, as the same quantity would no longer be required in this direction, the tumour might possibly be much more under the control of pressure. The value of such a suggestion remains yet to be tested, however, and it would be futile to reason upon it at present. It might be a judicious venture first to tie the axillary or subclavian under the clavicle, and then if it were found that the aneurism still increased, amputation might be performed, either immediately before or after the separation of the ligature.

I have now seen two instances of aneurism of the subclavian, in both of which ligatures were placed nearer the heart (in one case on the innominata, in the other on the affected vessel); and were a case similar to either to occur in my own practice, I should be inclined to follow the method above referred to, for assuredly the event could not be more disheartening than in these two examples.

The arteria innominata may be tied in the following manner:—The patient and surgeon should occupy such positions as are recommended for the preceding operations, when an incision should be made between three and four inches in length, commencing over the middle of the upper part of the sternum, one inch or more below its margin, and passing upwards parallel with the inner border of the right sterno-mastoid. The skin, such of the fibres of the platysma myoides as are in the line, and the superficial fascia, should all be cut, and when the inner margin of the muscle is exposed the finger or a director should be passed under it, about half an inch from the sternum, and its fibres should be divided: next the cellular tissue should be separated, being slightly touched with the knife, when the fibres of the sterno-hyoid will be exposed: this muscle, and part or the whole of the sterno-thyroid should then be cut across, opposite the division

already made in the mastoid; and now the vessel should be cautiously looked for in the cellular membrane opposite the upper margin of the sternum. Perhaps the lower part of the carotid may be first laid bare; but if it is, the main vessel cannot be far off:—by tracing the former a little downwards, the innominata will be reached, and the needle and thread should be passed around it, (from below upward, or as may be most convenient,) about half an inch below the origin of the carotid. If the operator keeps low in the neck, the latter vessel, more especially when the innominata is of considerable length, may not be observed, and unless it be from small veins, or possibly some small arterial branch, there can scarcely be any annoyance in the whole proceeding. A good deal on this score may, however, depend on the steadiness of the patient, the length of the vessel, and particularly the length and thinness of the neck. Although the operation must be deemed the most formidable which can be undertaken on the large arteries, (unless, indeed, ligature of the abdominal aorta can be considered more so,) it is by no means the most difficult, for under favourable and ordinary circumstances, and with moderate precaution, the surgeon can scarcely go wrong. There is nothing of consequence, excepting the veins already alluded to, lying over the vessel, and the venæ innominatæ are usually sufficiently low to be out of harm's way. The pleura, too, is so far under the artery, and the cellular tissue between them is so loose, that there need be little fear of this membrane suffering from the needle.

The incision above recommended is such as I have seen made on the living body; but, as with the operations previously described, I would not have the surgeon limit himself to one or other set course. Mr. Liston recommends that the incision should be made parallel with the left sterno-mastoid; but for my own part, I should, as has been stated elsewhere in this volume, (p. 36,) have more confidence in being able to appreciate the subcutaneous textures. A single perpendicular incision on either side, a transverse one, or a crucial will be nearly alike useful to a competent anatomist: such as that indicated by letter *d* in figure 196 I should prefer; and, if I found the space limited, I should make a transverse wound in the course of letter *c* on the same drawing.

It was in an instance of aneurism of the subclavian above the clavicle that Dr. Mott first carried the bold idea into execution of performing this operation. In a case where he intended applying the thread to the latter vessel, he found after exposing it on the inner side of the scaleni that the tunics were apparently so diseased as to induce him to give up the idea, and (still anxious to afford his patient a chance of life) he determined to place the ligature on the innominata itself,—an alternative which he had at the commencement resolved to adopt, should circumstances require it. Accordingly the artery was tied, and the operation was all but successful: the patient, however, died on the 26th day, and such has been the result of all succeeding operations,—some, as Graefe's case, living a longer period, others a shorter. Mott's opera-

tion was done in 1818, Graefe's in 1822: the next was accomplished by Mr. Norman of Bath, in 1824, and, singularly enough, there are few British practitioners aware of the fact, although that gentleman has long been distinguished as an ornament to the surgery of this country. Dupuytren alludes to an instance which occurred at Paris some years back. In 1837 I assisted my friend Mr. Lizars in such a proceeding (the case was published in The Lancet of the same year), and another example by M. Hutin is related in the same Journal for 14th May 1842. In the latter instance the operation was performed for hermorrhage from the axilla, which was not effectually restrained by deligation of the subclavian outside of the scaleni: all the others were done for aneurism in the vessel last named.

The results of all these operations have been so unfortunate and discouraging as to induce any reasonable surgeon to hesitate about repeating such a proceeding. Yet it is difficult to decide on such a question without having a specific case in view. It may fairly be doubted if ligature of the innominata will ever succeed; nevertheless, it may be said that the most successful instance of the kind was one where the vessel was not tied at all. Mr. Porter (of Dublin) will, I hope, excuse the liberty which a Scotchman thus takes in referring to his most interesting case. The artery was cut down upon by that gentleman, but was found in such a condition that he did not deem it advisable to place a ligature upon it. The wound was therefore closed, when, strange to say, ere long all pulsation in the aneurism ceased, as also in the innominata, and ultimately the cure was complete.

It was supposed by Dupuytren, and the opinion has since been extensively entertained, that in these operations, as well as in others at the root of the neck implicating one or more of the minor veins, the ingress of air into their canals has occasionally been the cause of sudden death. Dr. Rose Cormack, who has ably inquired into this interesting subject, has, however, expressed his opinion that the alarm on this score is greater than the occasion justifies. No surgeon would willingly keep the orifice in a wounded vein open, and as Dr. Cormack has shown, a few globules which may accidentally be admitted cannot do that harm which some have imagined.

Attention may now be given to ligature of the common carotid. The operation may be required for many different reasons, such as hermorrhage from wounds or ulcers, vascular tumours about the head, face, or neck, examples of which will be referred to afterwards, and especially for aneurism in the main trunk or some of its large branches. It has been performed in cases of epilepsy and for headache, and some enthusiastic dissecting-room operators have even proposed that it (or the internal carotid) should be tied in apoplexy! Both carotids have been obstructed by ligature on the same individual. Mott tied both simultaneously, but the patient died within twenty-four hours. The result has, however, been more fortunate where a lapse of time has

been allowed between the operations, as has been evinced in the practice of Kuhl, Mussey, and others. Mr. Crosse was on one occasion called in to place a ligature on one of these vessels, the other having been secured a short time previously; but on trying pressure on the vessel, the symptoms became so alarming that he did not interfere. I am inclined to think, with all due deference to such an authority, that pressure with the fingers produces effects very different from a ligature, and that therefore such a mode of testing the immediate danger of deligation is not altogether to be relied on. A case illustrative of this occurred to me in the summer of 1841. Being about to place a ligature on the common carotid, some doubts were entertained as to the immediate results of the proceeding, in consequence of the singular symptoms caused by pressure in the course of the vessel. When the ligature was tightened, however, no similar complaints were made, and I conclude, therefore, that the peculiar effects of the previous compression in this instance were not dependent on the mere obstruction of the carotid.

When the surgeon has the option of selecting a part of the vessel on which to place a ligature, the upper third of its course is decidedly the most eligible, and here the operation may be done in the following manner:—The patient should be laid on his back with the shoulders a little elevated, and the head slightly turned to the side opposite to that on which the incisions are to be made. The surgeon, standing at the head of the table as recommended for some of the preceding operations, should commence the incision about an inch and a half below the pomum Adami, over the inner margin of the sterno-mastoid, and carry it upwards for three inches or more, in a line parallel with the fibres of that muscle. Such a line is indicated by letter *e* in figure 195, p. 382. The skin, platysma myoides, and superficial fascia should all be divided to about the same extent, and when the above-named fibres are exposed they should be drawn slightly outwards, and then the cellular tissue forming the sheath of the vessels should be cautiously opened with the knife, opposite the middle of the thyroid cartilage: by sight and touch the artery will be recognized, and by a most careful application of the blade near its outer side, there will be room made for the introduction of the needle, which should be carried round, its point being close upon the vessel, from without inwards, and thus the operation may be completed as in other examples.

An expert anatomist may accomplish this proceeding without seeing any of those important parts which lie in close proximity. It may be different, however, for on many occasions the internal jugular has overlapped the artery so much (from its great size) that much care has been necessary to avoid it. I have already, in my remarks on the surgical anatomy in this situation (p. 378), explained how this is likely to occur in consequence of the difference in size of this vein on opposite sides or in different individuals, and it is very certain, as I have myself experienced, that the jugular may not be seen at all during the whole proceeding.

When the operator entertains any doubt about his locality, he should immediately refer to some well-known object in the vicinity: thus, the sterno-mastoid, whose fibres will always be more or less distinct, may be looked at, and if those of the upper belly of the omo-hyoid be exposed at the same time, the vessel, which lies immediately behind the angle where these muscles cross each other, can scarcely be missed, particularly after some of the cellular tissue has been divided.

The par vagum should not be seen; but the close position of this important part to the outer and posterior side of the artery should not be forgotten. The best method of avoiding it will be that already pointed out, viz. keeping the point of the needle close to the artery: by following this proceeding, too, and also carrying it from without inwards, the convexity of the instrument will be opposed to the vein, which, as the operator should know, lies close on the outer side of the carotid.

The sympathetic is invariably so far behind and so loosely connected with the posterior surface of the sheath, that it is scarcely possible to imagine an instance where it could be included in the ligature.

Perhaps the greatest trouble in the operation will be from some small artery or vein. Often one or more branches of the superior thyroid, which pass to the sterno-mastoid, are so large as to bleed freely at first: if these give the least annoyance and cannot be commanded by the fingers of assistants, or by broad copper spatulæ (either of which may be used to keep the wound open), ligatures should be at once applied, and I should say the same practice might be adopted in case of hemorrhage from small veins, which sometimes run across the course of the incisions. Such practice will seldom be required for the latter, however, and certainly should not be adopted without real necessity. If there is an anterior jugular it must be held aside with a blunt hook.

If the ligature is applied at the point above directed, it will probably be about half or three quarter of an inch from the bifurcation; a line or two higher or lower cannot make any material difference. But it often happens that the operation must be done much lower in the neck, and here it becomes somewhat more difficult. The external incision must be of a similar length, only lower down, yet still on the inner margin of the sterno-mastoid. The same tissues must be divided, and in addition the sterno-hyoid, and possibly also the sterno-thyroid muscles, must be partially or wholly cut across. In fact, the instructions which have already been given for finding the commencement of the subclavian, or for exposing the innominata, will answer equally well for this proceeding on the carotid. In the operations referred to it is recommended to divide the inner head of the sterno-mastoid; and were I operating on the lowermost part of this vessel, I should not hesitate about doing so, for doubtless this would greatly facilitate the remaining steps. In such an instance I should make the external incision exactly in the line recommended

for deligation of the innominata; and if the operation were required on the left carotid, I should make a similar wound, parallel, however, with the sterno-mastoid of the corresponding side. Towards the root of the neck the jugular vein and the par vagum are but slightly attached to the artery, but the surgeon will do well to remember that both are close at hand. Here, as in the other operations above described, some minor veins may be troublesome; indeed, in all incisions at the root of the neck such as those under consideration, as well as for other purposes, veins, which from their magnitude would give no trouble in other regions, may give great annoyance here, in consequence of the distended condition into which they may be thrown during the irregularity of breathing and straining incidental to such proceedings.

In an instance where an aneurismal tumour is low down in the neck, it will be perceived that such an operation will be exceedingly difficult, as the deep incisions must necessarily be limited between the tumour and the upper margin of the sternum. By great care, however, the vessel may be reached without serious injury to the neighbouring parts. Mr. Porter has successfully tied the carotid within the eighth part of an inch of the innominata, and Dr. Robertson, of Edinburgh, has, with equal success, cured a large aneurism, occupying nearly the entire side of the neck, when it was with the utmost difficulty that he could find space between the disease and the sternum to expose the root of the carotid.

It has often appeared to me an exceedingly singular circumstance how it happens so frequently, that ligature at the root of the carotid should be, upon the whole, so successful, while deligation of the origin of the subclavian has been so unfortunate. Until within a very recent date it has usually been considered that secondary hemorrhage (which is so fruitful a cause of death after these operations on the great arteries) has always occurred from the proximal end of the vessels; but the idea is now gaining ground that this occurrence happens as frequently, if not more so, from the distal side of the seat of ligature; and certainly the *post mortem* examinations of some of these operations on the large arteries at the root of the neck go to favour this view. Cases in the practice of Mr. Lizars, Mr. Liston, and others, might be brought forward in support of this doctrine, and the circumstance has been very pointedly alluded to by Mr. Porter, in his published lectures on aneurism. The greater facility for retrograde circulation in the subclavian than in the carotid, will not, however, account for the unsuccessful issue of all the cases in which the former vessel has been tied on the inner side of the scaleni muscles, as death has usually occurred before the period at which secondary bleeding may be expected.

Professor Miller, of Edinburgh, has, in a most able paper in the January number (1842) of the London and Edinburgh Monthly Journal of Medical Science, endeavoured to prove that death has resulted, in most of these operations on the great arteries of the neck, from inflammation of the lungs, and it cannot be doubted that such a

condition has often been present on these occasions. It appears, also, from certain experiments on the lower animals by M. Robert (de Lamballe), that the lungs become seriously affected after ligature of their carotids; and from what I have myself seen, I should strongly recommend the free use of the lancet in all such operations as those which have lately been under consideration.

In instances of aneurism at the root of the neck, whether in the innominata, the origin of the carotid, or of the subclavian, the operation of Brasdor may be put into practice, or the modification of it recommended by Mr. Wardrop. If, for example, the disease were supposed to be in the innominata, Mr. Wardrop would place a ligature on the carotid or on the subclavian, one being obstructed, the other left to nature, and he would be guided by circumstances, whether at any future period he would perform a similar operation on the other vessel. Brasdor's operation could be put into practice only on the carotid, for here in an aneurism at its root the circulation might be completely arrested. On the other branch of the innominata, however, if the aneurism were supposed to be at its root, a ligature placed outside of the scaleni could only have the effect of partially obstructing or altering the course of the circulation; and this, therefore, would be Wardrop's operation, the difference between the two modes being that, in the one (Wardrop's) the entire column of blood is not intended to be checked, whilst this in a manner constitutes the chief feature of the other (Brasdor's). My limits will not permit me to say more on such operations, and I shall therefore only state that I should feel inclined, in some of those cases where the patient's prospects were otherwise desperate, to offer a chance of cure by ligature on the distal side of the disease. The first instance in which Mr. Wardrop himself operated, that treated by Mr. Evans, of Belper, and various cases occurring in the practice of Dr. Mott, my friend Mr. Fearn, of Derby, and other practitioners of note, all hold out some gleam of hope in such unfortunate cases. In the summer of 1841 I placed a ligature on the carotid, for aneurism of the innominata, but the patient did not survive sufficiently long to enable me to form a decided opinion as to the probable result of the proceeding. The case was published in the November number (1841) of the Edinburgh Monthly Medical Journal, and I may refer the reader to Mr. Wardrop's treatise on aneurism, published in 1828, in which the principles of this operation are detailed, and, in addition, to the article Aneurism, by the same author, in The Cyclopædia of Practical Surgery.

I have not as yet alluded to any important irregularities in these great arteries. The subclavian has occasionally been seen in front of the anterior scalenus muscle. I have myself met with only one example of the kind in the dissecting-rooms. Mr. Lizars, in operating outside of that muscle, discovered the vessel lying in front; the case was published in the Lancet of 9th August, 1834. Mr. Liston, in placing a ligature on the subclavian at its origin, had considerable difficulty in exposing the vessel, and at the time fancied, from its depth, that it might arise from the left side of the

arch of the aorta, and pass to the right, between the trachea and œsophagus, or even behind the latter tube; he afterwards found that it sprung from the innominata, only a little further back than usual; but, in truth, the vessel often does curve back in this situation. Irregularities in the origin and course of the right subclavian, such as those alluded to, have frequently been met with by anatomists, and Mr. Harrison refers to a case where the right subclavian, passing between the trachea and œsophagus, was opened by ulceration, occasioned by a fish-bone sticking in the gullet, when fatal hemorrhage ensued. The right carotid, too, has its irregularities. It has been seen originating from the arch of the aorta; and in such a case it will be perceived that it cannot be a guide either to the innominata or subclavian. The innominata, as I have already stated, may be long or short; and it was probably from the latter circumstance that a Leipzig surgeon, instead of tying the main vessel, as he intended, placed the ligature on the carotid and subclavian at the same time; it may give off the left carotid, as well as the two large vessels on the right side; and in such a case, besides the danger of wounding the branch going to the left, as it lies in front of the trachea, its origin might be exactly in the situation where the surgeon might wish to place the ligature. He might hesitate to apply it immediately above the left carotid, for fear of the circulation preventing or breaking adhesions in the seat of deligation; on the other hand, were he to place it below, he might dread the effect of arresting the flow of blood through both carotids and right subclavian at the same time. Considering how seldom this irregularity has been seen, it must be admitted that such an emergency as that now referred to will be rare indeed. Were such a case to occur to me, however, I imagine (thinking quietly of it at the present moment), that I should prefer obstructing all three. We know that in the lower animals both carotids may be obstructed by ligatures at the same time, and there is reason to suppose that such a step might be hazarded on the human subject (p. 393). We also know, however, that obstruction of both carotids and vertebrals at the same time produces death, if continued for a very brief period only, (the exhibition of the experiment was a favourite subject with Sir Astley Cooper in his latter years,) and in such a case, then it would assuredly be well to try the effect of compression on the innominata before tightening the ligature. If it appeared that the patient could not suffer the obstruction, then the surgeon might console himself as Sir Charles Bell did when he came on the double femoral artery, by the reflection that he could not be held responsible for all nature's irregularities; and even in such a plight he might, for the time, at all events, keep in mind the remarkable case to which I have already referred, where Mr. Porter, after exposing the innominata and finding it diseased, gave up the idea of securing it with a ligature, in which, nevertheless, the artery afterwards became permanently obstructed, and cure of the aneurism in the subclavian was the result.

The external carotid, or some of its branches, occasionally require

to be tied. When this artery itself is the seat of operation, the thread is usually applied immediately above or below the digastric muscle, and consequently after three of its chief branches have been given off. The operation may be performed as follows :—The patient being placed as for the preceding operations, and the surgeon occupying a similar position, a lunated incision should be made extending between the mastoid process and the body of the hyoid bone, in the line indicated by the letter *f* in figure 196; the skin, platysma myoides, and superficial fascia, should all be divided to about the same extent, when the lower part of the parotid gland will be brought into view near the posterior end of the incision: the margin of this gland should then be turned or drawn slightly upwards, and then the anterior border of the sterno-mastoid will be distinctly brought into view: the digastric and stylo-hyoid will now be exposed, and, by dipping a little deeper on the upper or lower margin of these conjoined muscles, the external carotid may be exposed just before it passes into the substance of the parotid. There may be one or more small veins in contact with the vessel; but the needle may be passed in any way the operator finds most convenient. Several veins of considerable magnitude will cross the line of incisions, and these must either be divided or held aside. Even in such large arteries as the subclavian, the sense of touch, as I have experienced, does not always enable us to feel the pulsations of an artery; and in such an operation as that now under consideration the surgeon should trust more to his eye-sight than to the point of his finger: indeed, its accomplishment must be deemed more difficult than ligature of the common carotid, in consequence of the smaller size of the artery, and I may also say the greater depth. Fortunately, such a proceeding is rarely required. I have seen it done previous to removal of the upper jaw; but it may be considered a settled point that such a preliminary step is not requisite. In referring to the surgical anatomy of this artery (p. 377), I have noticed an instance in which it was found in an unusual position, external to the digastric and stylo-hyoid muscles.

The superior thyroid has occasionally been tied in cases of goitre. In such an instance the guide to the vessel would be its own pulsations near the skin, for unless it were ascertained by such proof, that the artery was enlarged, and therefore, probably, a considerable source of nourishment to the morbid growth, the operation would be worse than useless. On this subject more will be found in a future page, (411,) as also a drawing illustrative of the enlargement both of the gland and the arteries which belong to it.

The lingual and facial arteries may be exposed at their roots; but such operations are seldom necessary. Mirault tied the right lingual, but failed in finding the left. Many years ago I saw Mr. Liston in the Edinburgh Hospital apply ligatures to both lingual arteries, for enlargement of the tongue, but no benefit resulted. The anterior end of the incisions above described for the external carotid may suffice, but were I to attempt operations on either of these vessels, I should begin the incision a little further forward, and not carry it so far back,

—keeping it, however, much in the same line, and dividing the same textures, though not so extensively. The extremity of the great horn of the hyoid bone, and the posterior margin of the hyo-glossus muscle, I should take as the best guides for the lingual artery, and possibly the same parts, and the lingual nerve, might show the necessity of looking a little higher for the facial, where it lies below the under margin of the submaxillary gland. Were such operations demanded on the living body, they would, in my opinion, require a far greater nicety of manipulation, and a more complete knowledge of anatomy than might be necessary for exposing larger vessels.

CHAPTER III.

DIVISION OF CICATRICES AND OF STERNO-MASTOID. LARYNGOTOMY. TRACHEOTOMY. PHARYNGOTOMY. ŒSOPHAGOTOMY. TUMOURS IN THE NECK, ETC.

On the dead subject it is not likely that any idea can be formed as to the kind of operation which may be required in instances of deformity resulting from burns in this situation: indeed, no two cases on the living body will be altogether alike; and if anything is to be effected by the surgeon, he must be guided more by his own judgment and ingenuity, than by such rules as can be given here. I have seen several operations for such deformities, and have myself tried the efficacy of dividing bands of cicatrices, and sometimes removing them altogether, but cannot on the whole speak in high terms of such proceedings, although I have occasionally seen some little benefit derived. When a cicatrix has been removed, and the wound treated in the manner recommended by Mr. Earle, viz. by bringing the skin up from the sides, so as to unite the opposite edges by stitches or straps, I have generally noticed that after the first few days the surface has gaped as much as when first made, and that after union by granulation had been accomplished, the parts were in much the same condition as before,—in some, perhaps, a little the worse for the proceeding. In instances when a cicatrix has been merely cut across, and where the head has been held in a favourable position for weeks, I have almost invariably noticed that, at last, matters have arrived at nearly the same condition as when the knife was first used. I must admit, however, that all instances have not been alike unfortunate. I have no doubt that much might be done in the early treatment of burns in this situation as elsewhere, to obviate the contraction of the granulations. In the introduction (p. 74) I have referred to the necessity for keeping any granulating surface in a proper attitude in case of deformity occurring in the progress of cicatrization, and a case is

detailed illustrative of the continued tendency to that result even after the latter process is apparently complete.

Of late years, since subcutaneous incisions have become so common, the sterno-mastoid has been frequently cut across for the cure of wry-neck (torticollis) by such a wound. Formerly, in dividing this muscle, or any portion of it, the custom was to expose the fibres through an incision on the surface, and afterwards to complete the proceeding on a director; now, however, it can scarcely be doubted that a subcutaneous wound should be preferred, and the operation may be done as follows:—The muscle being put on the stretch, a narrow blade (p. 324) should be passed flatwise behind its inner margin to such an extent as may be deemed necessary, when the edge should be turned upon the fibres, and their division effected by cutting towards the skin. Perhaps the incision of the sternal portion of the muscle may suffice; but in most instances the clavicular portion must be divided also. If the operator is cautious in not pushing the knife too deep at first, there can be no danger in the proceeding just described; but every anatomist may foresee what might happen from carelessness here. The blade may be first passed below the skin only, and then thrust against the muscle; but if this method is chosen, care must be taken that the knife does not plunge deep when the division of fibres has been effected. After the operation, a pad should be placed over the little wound in the skin and the space between the retracted ends, and subsequently the case must be treated according to circumstances. If the distortion has previously been slight, possibly no particular apparatus may be requisite; but, in general, as in the instance of club-foot already referred to some mechanism, such as has been represented by Benjamin Bell and others, should be applied, for the purpose of keeping, or rather bringing, the head into a proper position.

Laryngotomy and Tracheotomy may be performed on the dead subject, and thus some idea may be formed of these operations on the living body.

If an incision be made about an inch long, in the mesial line, between the pomum Adami and the lower margin of the cricoid cartilage, the crico-thyroid membrane may be exposed almost immediately below the integument, the blade will pass between the two sterno-hyoid muscles, and, on the dead subject in particular, the depth of the wound will be trifling. When the membrane is exposed, the point of the knife should be thrust into it with a kind of jerk, and the requisite extent of incision made—sometimes in a vertical line, at other times in a horizontal, or, in some instances, in a cruciform direction, according to circumstances.

Tracheotomy may be performed thus:—The chin and sternum being well separated, an incision through the skin, about an inch and a half or two inches long, should be made, extending from near the upper margin of the sternum to the fore part of the cricoid cartilage; then the cellular tissue at the lower end of the wound should be cautiously divided, the operator keeping a sharp look-out for veins that may be in the

way, so that they may be held aside, when, by keeping in the mesial line, the trachea will be exposed a little below the isthmus of the thyroid gland. The point of the knife should now be passed into the tube at the lowest part of the exposed portion of the trachea, and carried from below upwards to any desired extent.

It may happen that these proceedings when required on the living body will be accomplished with as little trouble almost as on the dead; but it will often be otherwise; and many circumstances may be connected with these operations which will call forth much of the skill and coolness of the operator.

Laryngotomy is but rarely performed compared with the operation on the trachea, and the cases are few in number in which the proceeding seems to possess any advantage over the latter: indeed, it is scarcely possible to name an instance. The principal necessity for either operation is to allow the patient to breathe more freely, whilst occasionally an opening is required to give egress to a foreign body, which may have accidentally passed into the larynx, trachea, or one or other of the bronchi. Such a body may be the cause of the difficulty in respiration, or this condition may be the result of inflammation of the mucous membrane; but unless there is a special reason for dividing the crico-thyroid membrane (such as the ascertained lodgment of a foreign substance in the larynx, or the shortness of the neck, as in an infant), the operation of opening the trachea is most generally preferred.

In Laryngotomy, the only casualty which is at all probable, is the division of a branch of the superior thyroid artery (crico-thyroid), which runs across the membrane, and is occasionally of such a size as might cause trouble when cut. The late Professor Turner, of Edinburgh, used, in his lectures, to relate an instance where, in such an operation, a child bled to death from a wound of this vessel. Possibly the division of the membrane between the cricoid and thyroid cartilages may not leave an opening sufficiently large, and it will, therefore, be requisite to carry the knife upwards or downwards. If the thyroid cartilage be cut, there is a probability of one or other of the vocal cords being divided, unless the incision is exactly in the mesial line: if the wound is extended downwards no serious harm can result; but it should be remembered that the aperture in the cricoid cartilage will not gape like that in other parts, for the elasticity of the ring is such that the cut surfaces will continue in contact unless they are held asunder. In a young subject, the chief difficulty in the operation seems to be in the recognition of the parts, from the smallness in their size, after the wound on the surface has been effected, and this difficulty may be greatly increased if the skin and cellular tissue be inflamed and infiltrated with serum, in consequence of the previous application of leeches, sinapisms, and blisters.

In Tracheotomy the casualties and difficulties may be more numerous and greater. It may be the case that the parts over the trachea are much swollen, from the circumstances alluded to above; but besides this, the tube is always much deeper in the neck than the larynx, and

if the patient is fat, muscular, short-necked, and unsteady, there may be great trouble in the operation. The isthmus of the thyroid gland is generally more or less in the way, but unless it be enlarged there will seldom be much trouble from the bleeding, which may result from its division: if there were sufficient room below to keep clear of it I should certainly do so, but it should always be borne in mind, that in avoiding this evil and getting nearer the sternum, others of a more serious nature are encountered:—the subcutaneous veins increase in size towards the root of the neck, and if wounded low down the blood might regurgitate from them: possibly the left vena innominata might be in the way, although this is not likely, for it is generally below the level of the upper margin of the bone: the arteria innominata, or the right or left carotid may, as already referred to at p. 398, be so high in the neck as to be in danger. Hence then the propriety of passing the point of the finger to the bottom of the wound to protect the parts in this situation, and also the wise precaution of introducing the point of the kinfe with the back nearest the sternum and cutting upwards; for, by these proceedings, although the edge of the instrument may come in contact with the thyroid gland, it is the least of the evils that have been under consideration. The necessity for keeping in the mesial line cannot be too carefully attended to: in the upper part of the trachea, a slight deviation may endanger one of the lobes of the thyroid, from which the bleeding would assuredly be much more copious than from the isthmus. In an instance occurring in my own practice, where the patient, a short stout-necked female, was remarkably unruly, I got a little to one side and the bleeding was very copious. In the lower part of the neck the danger may even be greater, for the carotids lie closer to the tube than towards its upper end. A case has been mentioned by Desault in which the carotid was opened, and where of course death ensued.

I have seen Tracheotomy performed when probably half an ounce of blood did not escape; but in most of the instances which have come under my notice the hemorrhage has been remarkably free. Sometimes this has apparently arisen from the inflamed state of the textures over the tube, in other instances from the distension of the smaller veins, produced by the derangement in respiration, and occasionally from the vascular condition of the mucous membrane.

A variety of circumstances must guide the surgeon in giving preference to one or other of these operations, — in selecting a place at which to open the trachea, and in the manner of conducting the proceedings.

As already stated, there are few reasons in favour of Laryngotomy, and, excepting the suspicion that a foreign substance is impacted between the vocal chords, I know of no other inducement to select this proceeding in preference to Tracheotomy,—unless, indeed, it be that the crico-thyroid membrane is more superficial than the trachea. Cherry-stones, plum-stones, kernels of fruit, beans, kidney-beans,

small pebbles, buttons, coins, and such like objects, which children may inadvertently allow to pass the rima glottidis, may lodge in the ventricles of the larynx, and might be more readily displaced by having the opening near. A fish-bone has been known to stick across the larynx, and La Martinière has related a case where a large brass pin, which had been attached to the end of a boy's whip, was in cracking the toy forcibly driven across the larynx, from whence it was extracted by making an incision through the skin sufficient to permit of its head being seized, as the latter was sunk deep underneath.

Whether an opening be required for œdema of the rima glottidis, for ulceration connected with the upper orifice of the larynx, for croup, or for the removal of foreign substances from the bronchi or trachea, the incision is almost invariably made in the latter tube. In the first of these conditions above named, the opening is required to allow respiration to go on; in the next, partly with the latter object, but more particularly to allow the ulcers to remain at rest,—at least so some have argued, and for croup to admit of more free respiration, and also of the escape of mucus (perhaps of false membrane) from the trachea and bronchial tubes.

In asphyxia, from whatever cause it may arise, and when it is resolved to open the air passages in the neck, it is evident that there is no time to lose, and therefore the surgeon should complete the operation at once without heeding the hemorrhage, however copious it may be: the patient has no chance of life unless respiration is restored, whereas experience has shown that death from hemorrhage in such proceedings is exceedingly rare. It is generally recommended that in doing this operation the wound in the trachea should not be made until all bleeding has ceased; but although it is satisfactory to see that such is the case, it would in some instances be highly improper to do so. Mr. Porter states, "that it has happened that a patient has been lost whilst the surgeon delayed the opening into the trachea in order previously to controul an alarming hemorrhage." An erroneous impression obtains with some, that the interior of the trachea is as exquisitely sensitive as the upper orifice of the larynx, where a drop of water cannot touch without producing a paroxysm of coughing; but experience in these operations has shown, that the lining of the windpipe possesses as little of this peculiar delicacy as in most other mucous canals. A few drops then, or indeed any quantity, so that it does not impede breathing, may pass into the tube through the wound with impunity, as it will be expelled again as soon as its presence causes annoyance. Indeed, without wishing to detract from the danger of bleeding, I nevertheless doubt if any one ever died from the internal hemorrhage on these occasions: I have myself seen blood flow freely into the trachea from such wounds, but it has been speedily and as freely ejected again, and, for my own part, the bleeding which I should most dread would be from a copious flow externally. If half an ounce or an ounce of blood was to flow into the trachea, unless the patient were exceed-

ingly exhausted, he would be sure to expel it again by the wound, or by the upper part of the tube. Such a circumstance should induce the surgeon to examine the external wound, when if the bleeding vessel is of any considerable magnitude he will discover it at once, and if it is an artery a ligature can be applied, or if a vein pressure may suffice. But even in the case of severe hemorrhage the blood is much more likely to flow through the external wound than into the trachea, and in illustration of this, I may refer to a case related by Mr. Porter, who, after tracheotomy had been performed by another party, was called in hurriedly as the patient was stated to be bleeding to death. He found him sitting on a chair, blood profusely flowing from the wound, and a coagulum on the floor at his feet "as large as a liver," to use Mr. Porter's own words, yet even in this case there does not seem to have been any bleeding internally, and that on the surface was speedily arrested by pressure.

I have recommended a knife wherewith to make the opening, but some have preferred a trochar, and one of a particular shape has actually been made for the purpose. It requires a little dexterous management to introduce even the sharp point of a scalpel in some of these cases, and I should consider it much more troublesome to cause the clumsy point of the other instrument to pass with facility. The rings of the trachea, and also the fibrous intervening membrane, are so dense that in the young subject they will sink before the point, until the opposite sides almost meet, and even with the scalpel a kind of plunge, or jerk as I have previously called it, is necessary at this stage of the operation.

If the opening has been made to allow the patient to breathe more freely, it will be necessary to make some provision to keep it patent. Some portions of its margins may be cut away with this object, and such a proceeding has been frequently done; but in general it will be best to introduce a silver tube of the shape here represented (fig. 197), and to retain it by tapes attached to the rings made sufficiently long to join at the back of the neck. Such an instrument is useful for the purpose referred to, and may be serviceable too by its pressure in arresting bleeding,—indeed, in cases of venous hemorrhage it may be of great advantage, whether by itself or partly surrounded by lint. I have seen some trouble in passing this tube, both in Laryngotomy and Tracheotomy, owing to the elasticity of the cricoid cartilage or the rings of the trachea: the edges, therefore, require to be held asunder by hooks or forceps until the

Fig. 197.

point is fairly inserted. But before this can be attempted it is necessary, in many instances, to hold the wound open to permit the egress of mucus which may have accumulated in the trachea and bronchi. In croup, when such an operation is performed, the necessity for this is very evident, so that both mucus and lymph may be allowed to escape; but the same may exist in other instances. Occasionally it has happened that unless means had been resorted to to promote the escape of the contents of the trachea the patients would have perished. Mr. Porter relates an example of the kind where one of his assistants emptied the passage, by placing his lips over the wound and applying suction, and another where a syringe was used with an equally good effect.

In many instances, even after the tube has been introduced, the accumulation goes on so rapidly again that it is requisite from time to time to clean it with a feather or a piece of lint on the end of a stick or probe; and at all times it is necessary to be careful that the tube does not slip out, or that it is not removed at too early a period.

In one of my patients in the Edinburgh Hospital, difficulty of breathing (from disease in the larynx), came on so suddenly one evening that ere my house-surgeon, Dr. David Williamson, could be at the bedside, asphyxia had ensued. With great promptitude, however, that gentleman made an orifice in the trachea, applied his mouth and forced some air into the lungs, which he immediately forced out again by pressure on the abdomen and chest, when happily, after a repetition of one or two such manœuvres, the patient breathed for himself again, which he continued to do, partly through the orifice and partly through the larynx, for many weeks, until he at last died from disease of the chest also.

The tube must be worn as long as there is a necessity for it, and this period will vary in different cases according to a variety of circumstances. As soon as it can be dispensed with so much the better, and the wound will in general close of its own accord. Sometimes, however, it does so but slowly; occasionally it continues open ever after, and the patient when about to speak has to place the point of his finger on the orifice in order to throw the current of air between the vocal chords. Caustic, the cautery, or even paring the edges with a knife, may be resorted to with advantage. I once saw my former colleague, Mr. Watson, cut the edges of the orifice, bring them together with a twisted suture (taking care, however, not to separate the skin for fear of emphysema, and also not to pass the needle into the trachea), and succeed in closing the aperture permanently.

When Tracheotomy is performed for the purpose of removing a foreign substance, which has passed through the larynx downwards, it will in general be necessary to introduce instruments to assist in this object. Such cases have been most frequently seen in children, although accidents of the kind occasionally occur in adults. Stones of fruit, pebbles, small coins, and the like, as previously stated, may slip

between the vocal chords, and lodge immediately below, or in one of the bronchial tubes—generally that of the right lung—or may move upwards and downwards between the bifurcation and the rima glottidis. The history of such cases usually explains what is wrong: at first the patient may have been almost suffocated as the object has passed into the larynx, then he may have had severe fits of coughing, which may suddenly have ceased and as suddenly begun again: these symptoms, coupled with the knowledge that a foreign body has passed backwards from the mouth, will go far to show the cause of the paroxysms; but the stethoscope may aid greatly in the investigation.

It has happened in some of these cases that as soon as the opening has been made the substance has been forcibly expelled through the wound, and hence the propriety of keeping the margins of the aperture in the trachea asunder by means of hooks; but there has more frequently been a necessity for the introduction of instruments, and such a one as that represented a few pages further on, for the extraction of polypi from the nostrils, has been used on these occasions. The blades beyond the hinges should be somewhat longer than those referred to, and the whole instrument must be adapted, both in thickness and length, to the age and size of the patient about to be operated on. These must be passed upwards or downwards, as may be required: if upwards, probably the blades may be kept shut, and used as a kind of probe to push the substance through the upper part of the larynx; and if downwards, they must be opened with the purpose of grasping the object to be removed. Mr. Porter, whose admirable work on the Larynx and Trachea cannot be too highly extolled, has related many remarkable cases of the extraction of extraneous bodies from the air passages. Dr. Houston relates an instance where a large molar tooth with its fangs entered the trachea; Mr. Key opened the trachea for the purpose of extracting a coin from the right bronchus; I once saw Mr. Liston most adroitly and successfully extract a portion of bone from the right bronchus (the case is referred to in his excellent work on Practical Surgery), and a somewhat unusual case of the kind occurred some time ago to myself. A girl, seven years of age, in reaching her hand high above her head, inadvertently let a plum-stone which she had in her mouth slip backwards, when it entered the larynx and immediately produced most severe coughing and occasional obstruction to inspiration. My friend, Mr. Stuart of Kelso, saw the case, and proposed Tracheotomy, which was accordingly performed. Owing to the impossibility of keeping the patient quiet, the object could not be seized, and, from the injudicious interference of the friends, it was found necessary to give up any further attempt to do so. The wound closed, and the girl continued to suffer as before: at times she had some rest, but often, and suddenly, she would drop on the floor in a state of asphyxia, from which condition she would recover after a violent effort at inspiration. Three months afterwards she came under my charge,

but seemed so alarmed at the approach of medical men, that I almost despaired of being able to attempt anything for her relief. By kind management, however, she was induced to submit to another operation, when I succeeded in extracting the plum-stone. Before the proceeding it had been ascertained that the object moved between the bifurcation and upper end of the trachea: this was most distinctly noticed when the forefinger and thumb were placed one on each side of the larynx, for then, if she was desired to cough, the impulse of the stone was felt as it struck the narrow part above. My friends, Drs. Spittal and Henderson (both well known as accomplished stethoscopists), who examined the case with me, felt more satisfied in this way than by auscultation. After making the wound in the trachea, I introduced a slender pair of forceps, similar to those already recommended, and for a time was unsuccessful in my object: the stone seemed to move upwards and downwards alongside of the blades, and at last, under this impression, and at a time when I imagined that it was at the lower part of the tube, I opened the blades and held them so until the next expiration, when I closed them suddenly and thus caught the object, which was then extracted with a slight pull. Immediately all annoyance ceased; the wound closed almost entirely by the first intention, and every danger being apparently over, the patient, eleven days after was permitted to go into the country. Here, however, she seemingly had caught cold, and three weeks afterwards she died of difficulty of breathing, occasioned, from what I could subsequently learn of her history, by swelling of the mucous membrane of the larynx.

My limits will not permit me to dwell longer on these matters; but I cannot avoid again drawing attention to Mr. Porter's treatise, in which numerous cases illustrative of the affections of the larynx and trachea will be found, accompanied by practical remarks, which are additionally valuable coming as they do from such a source.

It is scarcely necessary for me to mention that, after such an operation, the wound should in general be closed at once. In Tracheotomy for difficult breathing, the opening is made with the object of allowing the patient to breathe through it: here, however, it has been made only for the convenience of removing the cause of annoyance.

Pharyngotomy and Œsophagotomy are operations which are very rarely required, and for which no exact rules can be given. It is customary to notice that the gullet lies a little to the left of the trachea, and in cutting into it on the dead subject this side is alway selected: the proceeding may be done in the dissecting-room as follows:—A portion of bone, bit of muscle, or other convenient substance, should be pushed into the lower part of the pharynx, until it is made to bulge in the neck, which it will probably do most conspicuously on the left side of the thyroid cartilage; then an incision through the skin, between two and three inches long, should be made over the swelling, when the platysma, cellular tissue, and gullet, should be divided

until the object is uncovered, which must then be extracted by means of hooks or forceps, as may be most convenient. Here it will be observed, that the wound will probably enter the lower end of the pharynx instead of the œsophagus; but similar instructions will enable the student to cut into any part of the latter tube above the root of the neck, although it must be evident that there are many objections to attempting such a proceeding on the living body. Opposite the larynx the incisions pass between that part and the common carotid: the latter vessel is so near that it must be considered in danger, and in all probability the superior thyroid artery would be cut, whilst the superior laryngeal nerve would possibly meet the same fate. Towards the root of the neck the carotid would be nearer to the course of the knife, the thyroid gland, the inferior thyroid artery, and perhaps, too, the inferior laryngeal nerve, would all be in danger: in short, simple though the operation may appear on the subject, I should consider it attended with great danger on the living body, and would proceed about it (should I ever be called upon to undertake such a proceeding) with the utmost caution: I should examine every texture before applying the knife, and after making a small opening in the tube, should probably use a probe-pointed bistoury to enlarge the aperture.

In my own experience I have only seen one instance in which it was proposed to perform Pharyngotomy or Œsophagotomy. A girl about twenty years of age came under the care of Mr. Lizars in the Edinburgh hospital, who was said to have swallowed a small padlock, which she asserted was lodged in her throat. The most careful examination by means of the finger, steel sound, and probang, gave no indication of its actual seat, and only on one occasion, during the different consultations which were held on the subject, was there any evidence that the object could be touched by the instruments introduced for the purpose: the sound seemed undoubtedly to indicate the presence of the metallic substance; but upon another trial it was observed to strike against the incisor teeth, and as the point could not again be brought in contact with the padlock, the idea of making an incision in the neck was abandoned for the time, more particularly as there were reasons for supposing that the person was an impostor. As she, however, still asserted the truth of her first story, she was kept in the house, and some time after, during the night, the house surgeon was suddenly called to her in consequence of a severe fit of vomiting: during an effort he introduced a large pair of forceps into the pharynx, and at once seized the padlock, which he removed without the least difficulty. Whether it had ever been in the stomach it was impossible for any one to say,—certainly there were no marks of the gastric juice having acted upon it, although three weeks had elapsed from the time when it was said to have been swallowed.

A case of an unusual character has lately been communicated to me by Dr. Little of Sligo, where a gentleman, during an epileptic fit, swallowed five false teeth with their gold setting, and from all the

symptoms, there is every probability that they have lodged in the lower part of the œsophagus for several years.

On the dead subject, in making the incision above recommended, it will be an advantage to introduce a steel bougie through the mouth into the pharynx, the point of which can be made to project into the wound on the neck: such a proceeding might also be of service on the living, more especially if the foreign substance did not project much.

Sometimes, instead of cutting on the projection, it might be deemed advisable to make the opening below or above, so that the offending substance should be pushed upwards or downwards, as circumstances might indicate: if upwards, perhaps the finger introduced through the wound, might answer; but if downwards an œsophagus bougie would be required. It seldom happens, however, that, when an object has once passed the upper end of the gullet, it does not readily find its way to the stomach.

The introduction of bougies, probangs, stomach-tubes, and other instruments, into the pharynx and œsophagus, will be readily understood by the student, after the anatomy of the throat has been examined. Meantime it may be stated generally, that, with few exceptions, it is always best to allow the patient to keep the tongue within his mouth when it is desired to introduce any object into the pharynx or gullet. Sometimes it may be necessary for the surgeon to depress the root of the organ with the point of his finger, and at other times it may be requisite (as in using the stomach-tube in those who have swallowed soporific or intoxicating poisons) to use a gag, as it is technically named,—that is, a piece of wood, placed between the teeth, having a hole in its centre, through which the tube is inserted,—which prevents the individual offering any obstruction to the point of the instrument, or closing his jaws upon it. When the larynx is to be reached, it will be advisable that the patient should project the tongue so as to bring the epiglottis forward.

Wounds of the neck must in general be treated according to the ordinary principles of surgery, and although it is often the custom to allude to such cases as requiring peculiar modes of practice, I cannot perceive any difference that may be necessary further than what a knowledge of anatomy and physiology might indicate. Those most commonly met with in civil practice are in individuals who attempt suicide with a razor or other sharp weapon. In such cases, supposing that the escape of blood has not caused immediate death, the first object which the surgeon has to attend to is to prevent further effusion, should such a proceeding be found necessary: he must, therefore, cleanse the wound with a sponge and warm water, and then secure the bleeding vessels as he would in other parts of the body: next he should bring the edges together, and retain them by stitches, taking care to keep the patient's head forwards, so as to cause the surfaces to approximate. Whether the trachea, larynx, or pharynx be opened, I can see no material difference in the practice, in so far as the above

directions go: perhaps the whole wound may unite by the first intention, or possibly air may escape through part of it, or fluids taken by the mouth may escape: in neither of these events can complete union occur at once; but in both cases the open points may heal by granulation. In the air passages it will be the duty of the practitioner to watch that inflammation, or that matters from the pharynx or gullet, do not interfere with respiration; in those leading to the stomach it will be necessary to see that sufficient nourishment is allowed to pass downwards, and possibly a small tube, leading from the mouth or from the wound to that part of the gullet below the injury, may be required for a time.

Tumours in the neck are of frequent occurrence, and operations for their removal usually require more caution and surgical skill than similar proceedings in other parts of the body. The most common of all swellings in this situation is that connected with the thyroid gland so well known under the term of Bronchocele, Goître, (fig. 198), Derbyshire Neck, &c. &c.; but such an affection is seldom, among surgeons of the present day, considered a fit case for interference with the knife. Although Gooch, Desault, Hedenus, and others, dissected out such tumours, and Klein of Stuttgard wrote so familiarly (flippantly I should say) about such operations, few leading surgeons now-a-days countenance such proceedings; nor, indeed, excepting in cases where the tumour attains a large size, does it appear to give any inconvenience saving that arising from its unseemly appearance. Anatomical examinations of such enlargements display the thyroid arteries, one, two, three, or all of them prodigiously increased in size, the carotids in close contact with the mass, which itself is so intimately connected with the root of the neck, trachea, and œsophagus, as to forbid any attempt upon the entire growth by means of incisions. On one occasion, in a case where the affection produced more than usual annoyance, I witnessed an attempt to remove a portion of this gland, but the operator was speedily obliged to desist in consequence of the profuse hemorrhage: a needle was thrust across the swelling, (which was chiefly in the middle or isthmus,) and a stout double thread was tied tightly round the most prominent part, by which the blood was restrained; a slough followed, and the patient was relieved of a troublesome, tickling cough, which had resisted all other means of cure. Roux, after expending more than an hour in

Fig. 198.

removing a portion of this gland about the size of an orange, and applying forty-seven ligatures, lost his patient fifty-six hours afterwards.

In some young subjects the frequent use of leeches and of iodine may check this disease, or actually cause its disappearance. I have seen several examples of the kind; but such cases are few in number compared with the numerous instances where these and other means fail. Ligature of the enlarged arteries has occasionally been performed; but the success does not seem to have been such as to induce frequent repetition of the practice: Sir William Blizard put it into execution, Walther, Coates, and others, have tried its efficacy, and Professor Chelius of Heidelberg has related two cases in which deligation of the superior thyroids was successful. Although the disease abounds in Scotland, I have seen no interference with it (excepting in the case above referred to) otherwise than by the ordinary means which are supposed to have a restraining effect on the growth of tumours, and in them, as may be gathered from my general remarks on such matters in the chapter devoted to the subject, I have but little confidence. The present, however, is an example where I should be inclined to persist in their use, as the disease is not such as should be at once removed with the knife, nor indeed, should any attempt of the kind ever be made excepting under peculiar and urgent symptoms.

The next most frequent kinds of tumours are, probably, connected with the lymphatic glands. These may form in any part of the neck, may be superficial or deep, not larger than a garden pea or equal in size to the patient's head; they may be of the simple sarcomatous character (perhaps the most common of all) or present the features of scirrhus, medullary sarcoma, or other species usually enumerated in classifications of such diseases. The glands in the neck are remarkably subject to strumous affections; cysts occasionally form in them, and fatty deposits in the subcutaneous cellular tissue are by no means uncommon. Although goître is frequently seen in those who possess the scrofulous diathesis, it but rarely shows its peculiar characters in the thyroid gland; and the parotid, submaxillary, and sublingual, I feel assured are rarely the seat of actual enlargement of any kind. Twenty years ago it was more the custom to speak of tumours of the parotid than it is in the present day, and for my own part I cannot say that I have seen a single unequivocal case of the kind. I have seen many swellings in the seat of the parotid, and have removed many with my own hands, but have invariably noticed that these were, to all appearance, developed in a lymphatic gland; when small, the parotid was slightly compressed, or perhaps turned aside; and when large, most of it had disappeared.

The diagnosis of tumours in the neck is often difficult, and the most skilful surgeon will occasionally be uncertain as to the propriety of attempting their removal with the knife. Aneurisms in the neck are seldom difficult to detect: Allan Burns and Sir Astley Cooper

long ago pointed out the possibility of this disease being supposed to be in the carotid or other large vessels at the root of the neck, when, in reality, in the arch of the aorta or innominata; but elsewhere their diagnosis is usually very clear. I once saw a large deep-seated abscess above the clavicle, in the course of the right subclavian artery, which in many respects, and on a slight examination, resembled an aneurism of this vessel. Upon the whole, however, a mistake can scarcely occur in such cases if anything like reasonable care be taken in these investigations.

The difficulties of deciding a question as to the removal of certain tumours by incision can scarcely be appreciated, unless by those who have such cases before them. The mobility of such growths I consider the most valuable criterion of all; and if it were evident that the part slid freely over the subjacent textures, I should not hesitate about using the knife, whatever might be the bulk of the disease, provided there was no other circumstance to contra-indicate such a proceeding; but if, on the other hand, the tumour seemed fixed to the neighbouring parts, if its limits were not clearly defined, if an attempt to move it caused pain, I should not readily be induced to use the knife, however small the mass might be. When the tumour is under the platysma, or superficial fascia, in or under the parotid, it is likely to present most of the latter objectionable characters; yet a careful examination with the finger may probably lead the surgeon to perceive that it is only bound down by the textures over it, but not inseparably connected with those in the vicinity. If two or more lymphatic glands are affected at the same time, it will be well to watch the progress of the case before deciding to attempt removal; for if these organs be predisposed to disease, many of them may speedily assume the same condition, and in such examples no operation is justifiable. Many years ago I attended a boy with a tumour about the size of a small orange, in the upper part of the neck, which it was proposed to remove; but as it seemed fixed, and the case seemed otherwise unfavourable for such practice, I did not interfere; within a few months small glandular swellings could be detected on the opposite side; these gradually increased, and the patient ultimately died from starvation and suffocation occasioned by an enormous swelling on each side of the throat, which impeded both deglutition and respiration. Dissection showed that most of the lymphatic glands in this situation were more or less involved, and that the pharynx was encompassed behind and at the sides with the diseased mass, which, in addition surrounded the main vessels in such a manner, that I had reason to congratulate myself on my non-interference. In museums there are generally plenty of specimens of similar cases, where probably the common carotid, internal jugular and par vagum, are seen passing through the centre of the enlargement. I know of one instance where a surgeon, in attempting to remove such a tumour, cut all these parts across, and secured them in one ligature; the result (death) will not be difficult to conjecture.

I have seen a surgeon attempt the removal of a fixed tumour not larger than a walnut, situated in front of the transverse processes of the vertebræ at the root of the neck ; but he durst not proceed, as, after detaching the integument over it, the disease remained as fixed as ever, and seemed so connected with the nerves and other textures, that the operator wisely saw the propriety of desisting. Mr. Luke, of the London Hospital, showed me a mass the size of the first, which he successfully removed from the situation of the parotid ; it had been deep, and firmly fixed, and a vessel was pointed out as the external carotid, a part of which had been taken away at the same time; yet the bleeding was not so great as might have been expected, and the case did well. Mr. Carmichael in dissecting out a large tumour from this locality, divided an artery which was supposed to have been the external carotid ; and here also the result was favourable, although the hemorrhage was most copious, and was commanded with difficulty. Mr. Crosse has related a case where in the removal of a small tumour from behind the angle of the jaw, a vessel was cut from which the hemorrhage was so profuse, that a ligature was placed on the common carotid ; even this did not restrain the flow of blood, and the patient perished.

In all operations like those under consideration, the general rule of planning the incisions in such a way as to leave the smallest possible amount of scar afterwards, should be carefully kept in view ; the operator should not, however, confine his movements to a narrow space, by limiting his external incisions, and should bear in mind that the patient's safety is of more consequence than avoiding a small additional extent of superficial wound ; therefore I recommend that in removing tumours, as well as in exposing large arteries, the external aperture should be sufficiently free to permit as favourable an examination of the parts about to be cut, as the circumstances otherwise will admit of.

CHAPTER IV.

DISSECTIONS OF HEAD, FACE, AND THROAT.

To dissect the posterior part of the scalp, the body should be placed as recommended at p. 146, when an incision should be made from the occipital protuberance to the mastoid process (such as has already been described at p. 367), and another, from the first of these points, should be carried in a line with the sagittal suture, as far forward as the position of the head will permit. The scalp should now be dissected towards the ear, when the occipital muscle and a portion of the aponeurosis, to which it is attached in front, may be displayed ; the pos-

terior and superior muscles of the ear may also be dissected, although none of these parts (excepting, perhaps, the aponeurosis,) present any remarkable features of interest to the surgeon.

The body should next be turned on its back, and a block being placed under the occiput to keep the vertex of the head upwards, the incision in the mesial line should then be extended down the forehead to the root of the nose, from which point the knife should be carried in a semicircular course outwards, above the eyebrow, to the upper margin of the malar bone, when by dissecting off the scalp to the side, the whole of the epicranial aponeurosis may be displayed, as also the anterior muscle of the ear, with the whole of the frontal. Considerable care is required in raising the scalp to preserve the aponeurosis beneath ; for as these are more intimately attached to each other than the latter is to the periosteum (pericranium), they are liable to be elevated at the same time. If the skin on the other side of the cranium be now removed, some idea may be had of the extent of the aponeurosis (occipito-frontalis tendon, as it is often called); and it may also be perceived that when matter collects under this texture, it may possibly burrow extensively, ere an opening forms for its escape.

By making an incision in the scalp, a little above and in front of the ear, and also one about midway between the latter part and the occipital protuberance, the trunk or a branch of the temporal and occipital arteries may be discovered, and their ramifications may be traced as far as the dissector thinks fit. The size and position of the occipital should not be overlooked, but most attention may be paid to the temporal, which will usually divide into two branches, the one passing forwards being that usually selected for Arteriotomy. The incisions for exposing these vessels, when the scalp has been removed in the manner above directed, may be made either on the inside or outside ; the occipital, owing to the density of the hairy scalp, will probably be most conveniently got at on the inner side, and the temporal by cutting through the skin.

The aponeurosis and the muscles attached to it may next be removed, and it may now be observed that the periosteum is thinner in this situation than on many other large bones. It will be a good lesson to trace the course of the sutures now exposed, with the eye and the point of the finger, as such a proceeding may enable the surgeon afterwards to detect the difference between them and fractures. The coronal, sagittal, and lambdoidal may be examined in the present stage of the dissection, but most of the squamous will still be covered by the temporal muscle.

The face may now attract attention. The block should be taken from under the occiput: the cheeks should be stuffed and expanded with horsehair, and the lips attached by a few sutures, or by that kind known among dissectors as the "glover's stitch," and then an incision through the skin should be carried around the mouth about half an inch from the margin of the lips: from the angle of the mouth,

or rather from this last incision, the knife should be carried obliquely down to the lower margin of the jaw, about midway between its angle and the chin: then a cut should extend, from opposite the upper end of the one last made, as far up as the outer extremity of the incision already over the eyebrow, to the upper margin of the malar bone: a semicircular incision should next be made along the lower eyelid, about an inch from its margin, from that over the malar up to the division in the forehead at the root of the nose. The orbicular muscles of the mouth and eyelid may now be displayed,—the depressor and levator anguli oris, the zygomatici, the depressor labii inferioris, the levator labii superioris, and the smaller muscles connected with the lips and nose may all be displayed by elevating the flaps marked out by the incisions recommended; but I must refer the student to a work on anatomy, if he wishes to examine them particularly. Wherever the knife passes in the face, it will divide some twig of the portio dura; but this can scarcely be avoided unless the dissection be solely for the purpose of exposing the branches of that nerve. In the hollow of the cheek, or rather where it is now pressed outwards, the facial artery will be observed passing obliquely upwards to the root of the nose, and the corresponding vein will be noticed a quarter of an inch or more behind and above it: here, too, a pellet of fat will be found between the anterior margin of the masseter and the buccinator, and, in removing it so as to expose the latter muscle, the anterior extremity of the parotid duct (Steno's) will be brought into view. The latter may now be traced back to the gland, and the masseter may be exposed at the same time: some of the branches of the portio dura may be readily preserved in this part of the dissection, and (particularly if an injection has been used) some branches of the external carotid (the transverse facial) may also be displayed: these may be traced through the substance of the parotid, — the arteries to the main trunk, and the nerves to the portio dura itself, where it has already been displayed in the dissection of the neck. The facial artery may now be traced throughout its whole course from the margin of the jaw (where it has been previously exposed, p. 377) as far as the inner commissure of the eyelids, and the branches most worthy of notice are those proceeding to the lips: if these are followed whilst the lips are closed, it will be necessary to remove the orbicular muscle; but it will be better to open the mouth and examine their position by dividing the mucous membrane, and it should be noticed that they lie close upon it.

The supra-orbital, infra-orbital, and mental foramina should now be exposed, with the branches of the fifth pair passing through them, and the further examination of the face may be delayed for the present.

The aponeurosis over the temporal muscle may next be cleared, and then it may be detached from its connexions above, when the course of the muscle can be traced as far as the zygomatic arch.

The calvarium should next be removed by carrying a saw through the bones a little above the occipital protuberance, ears, and supra-

orbital ridges. The instrument should not pass so deep as to injure the dura mater, and a chisel and hammer may be applied advantageously to break any portion of bone which cannot be reached with the saw without necessitating a division of the membrane within. The sharp claws of a hammer may be used for the above purpose, so as to obviate the necessity for a saw: with a good eye and a dexterous hand, a succession of blows may be applied, which will cause a fissure all round scarcely larger than that formed by the saw, and if the points are hooked into it in the forehead, the skull-cap may be elevated by pulling it upwards and backwards, and the whole process will occupy less time than that required with the ordinary means. The dura mater will not be torn, nor will the brain be at all injured. In private *post mortem* examinations, I should give a preference to the saw and chisel, more especially if any relations were present, as the mode with the hammer has an appearance of coarseness with it, which it would be desirable to avoid on such occasions. The whole process appears sufficiently rude to such a looker-on, in whatever way it may be done.

The branches of the middle meningeal artery will now be perceived, and the greater part of the course of the superior longitudinal sinus may be traced: it should be laid open with the scissors. With the latter instrument the dura mater should be cut from before backwards, a little outside of this sinus, when by dividing it and the falx cerebri the membrane may be so elevated and turned aside, as to expose the whole upper surface of the hemispheres of the brain. In raising the falx, the passage of the superficial veins of the latter organ may be observed passing obliquely from behind forwards into the superior longitudinal sinus.

The brain may now be examined in any way that may be thought proper; but as it is not my intention to describe any mode of investigating the anatomy of this organ, I shall here only recommend that it should be removed by elevating the anterior lobes, then dividing the optic nerves, the internal carotid arteries, and each nerve in succession, so as to allow the middle lobes also to be raised, when by cutting the tentorium on each side from before backwards, and carrying the knife across the medulla oblongata, or upper part of the spinal marrow, the separation of the whole organ (cerebrum and cerebellum) will be effected; and now, by continuing the incision already made in the superior longitudinal sinus, the transverse sinuses may be traced in the same manner: it will be better, however, to leave them in their natural grooves, and to cut into them from the inner side of the dura mater. After these have been traced as far as the jugular foramina, the torcular Herophili may next attract attention, and also the sinuses of a minor size, which, however, as they do not lie near the surface of the cranium, and present few features of interest to the practical surgeon, need not here be particularly noticed. Neither is it of great consequence in the present investigation to occupy much time in examining the passage of the nerves through the base of the cranium, for although each may

be said to have its surgical anatomy too, I shall not at present dwell on the subject.

The orbit may next be examined. A saw should be carried through the supra-orbital ridge, a little on the inner side of the notch through which the nerve of that name emerges, and then through the orbital plate, on a line with the optic foramen: next the bone should be divided between the latter part and the external angular process, when the roof of the orbit may be removed, and such a dissection made as may be desired. For present purposes, a general glance at all the different parts within will suffice; therefore, the first object which should attract attention will be the supra-orbital, or frontal branch of the fifth pair, which will be found between the periosteum and levator palpebræ muscle. The lachrymal and nasal branches may also be examined; and, in tracing the former, the attention will be drawn to the lachrymal gland, which may be observed to lie under and within the external angular process. The levator palpebræ superioris may then be displayed, and the superior oblique, the four recti, and the inferior oblique can next be examined: the origins and attachments of all these muscles should be carefully noticed, and the anterior part of the superior oblique (trochlearis) should not be overlooked. In tracing the tendinous connexions of these muscles, the eyelids and conjunctiva will be interfered with, and at this time, or even before the dissection is commenced, these parts may be examined. The margins of the eyelids, with the roots of the eyelashes, should be looked at; and towards the inner commissure the openings (puncta) of the lachrymal ducts will be readily detected, and a bristle may be passed into each so as to reach the lachrymal sac: the caruncula lachrymalis may next be observed at the inner canthus; then the eyelids should be fully opened, and by passing a probe or the handle of the scalpel under them, the extent of the mucous membrane (conjunctiva) on their inner surface and on the anterior part of the eyeball can be traced. The globe may then be removed by dividing the posterior ends of the muscles and the optic nerve, with others not mentioned here, also the conjunctiva in front of the ball, and such an examination of the organ made as may be desired.

In the present destructive mode of dissection, it will suffice to trace more particularly the attachments of the tendons, and then by dividing the organ into two equal halves, having the cornea in front, the position of the iris, that of the crystalline lens, and the extent of the anterior and posterior chambers, may be appreciated.

This is but a coarse manner of investigating what may be called the surgical anatomy of the eyeball: my limits, however, will not permit me to be more minute, and I must refer the student to an anatomical work, at the same time stating my conviction that, without a minute knowledge of what may be termed the descriptive and physiological anatomy of this organ, he cannot fully appreciate the physical changes produced by disease, nor the mechanical niceties of the operations which are required upon it. I shall, however, be somewhat more

particular on certain points of the anatomy in describing the operations on the eyeball and its appendages.

Now the skin or mucous membrane of the lids should be removed in such a manner as to display the cartilages: then the lachrymal sac may be exposed, and in doing so the tendon of the orbicular muscle may be noticed immediately in front of it, and a little below the course of the inferior lachrymal duct. A bristle or a small silver probe can be passed into the latter: the same should be done in the upper, and perhaps, too, it may be well to carry in the manner afterwards described (p. 441) a curved probe from the nose up the nasal duct into the sac, which may then be opened, and, the probe being withdrawn, another may be pushed downwards into the nostril.

The saw should now be applied to the lower jaw, a little to one side of the symphysis, and then at the anterior margin of the masseter: a common hand-saw will answer well for the purpose, but I strongly recommend the student to practise with the small instruments, such as are represented afterwards in the chapter on operations in this situation: the cutting forceps may here be advantageously brought into use also, and thus some experience may be acquired in the application of such instruments to these parts. A notch should first be made in each place above directed, the forceps should then be used to divide the inner plate, and so the portion being loose should next be separated by dividing the buccinator, the mucous membrane, and mylo-hyoid muscle. Before the saw is applied on these occasions it will be proper to remove two of the teeth, should they appear to be in the way.

The submaxillary gland may now be fully examined (if this has not already been done), and its duct (Wharton's) may be traced, by passing a probe or bristle into it, up to its opening beside the frænum linguæ: the sublingual gland will now also be perceived, between the tongue and the mylo-hyoid, and next the genio-hyoid and the genio-glossus muscles may be dissected, and their attachments to the genial processes examined: on the side of the tongue the fibres of the stylo-glossus may be observed intermingling, as it were, with those of the hyo-glossus.

When the masseter has been satisfactorily examined, it should be separated from the zygomatic arch, and also from the jaw, when the inferior attachment of the temporal muscle will be brought into view: the fibres should then be dissected from the coronoid process, or, what will be better, the bone should be divided vertically in a line from the base, where it has already been cut, passing directly in front of the condyle, and thus the process will be removed, when by a little further use of the knife the external and internal pterygoid muscles may be displayed: the former will be observed attached to the neck, the latter to the surface on the inner side of the bone opposite to the lower insertion of the masseter: to display either the bone must be twisted to one or other side, as may be required. In making the dissection it will be impossible to overlook the upper part of the external carotid, and its division into the temporal and

superior maxillary, the latter of which should be traced between the pterygoids, where it lies behind the neck of the bone, and forwards also until it gets into the pterygo-maxillary fossa. In clearing these vessels behind the ascending ramus of the jaw, several branches, sometimes of considerable size, (transverse facial,) may be noticed, some passing across the masseter, others into its substance; an ascending branch of the portio dura will also be found in the parotid, and now it may be observed how deep this gland penetrates, and how it fills up the space between the jaw and the mastoid process. The external lateral ligament, between the root of the zygoma and the condyle of the jaw, may next be examined; then it should be divided, as also the synovial capsule, and thus the interior of the articulations will be exposed: the two compartments formed by the inter-articular cartilage will be observed, and now it may be well to move the condyle as when the mouth is opened and closed: next the knife should be carried round the head of the bone, so as to disarticulate it, a proceeding which will be greatly facilitated by beginning from below, first dividing the internal pterygoid, then the external, and, lastly, the internal lateral ligament, and any part of the synovial capsule which may impede the removal of the condyle. In thus detaching the bones the positions of the upper part of the carotid and its two chief branches will be brought into view more fully than ever; but it may be observed that the separation can be effected without interfering with any of them,—a circumstance to be referred to afterwards in describing excision of this part of the bone on the living body.

Now the palate and throat may be examined: the part should be sponged out, and then the finger should be passed from the mouth into the pharynx: its point should be hooked up over the soft palate into the nostrils, then placed against the tonsils, and carried all round the surface, as also upon the upper aspect of the epiglottis. These parts, as far as can be permitted in their present condition, should then be looked at; next the side of the pharynx should be slit open, by dividing any portion of the buccinator muscle which may be left entire, the pterygo-maxillary ligament, and the constrictors, when a more complete examination can be effected. The anterior and posterior pillars of the fauces and the tonsil between them may now be seen on the side which has not been cut: the posterior openings of the nostrils, the pharyngeal extremity of the Eustachian tube, the upper orifice of the larynx, and that leading into the œsophagus, may also be perceived: and now, to complete the proceedings, an elastic bougie may be passed through one nostril into the pharynx, then it may be passed into the widest part of the Eustachian tube; then hooked forward into the mouth, then again passed into the pharynx, from whence it may be pushed into the larynx, and lastly into the œsophagus: it is well to exercise these manœuvres, so as to be able to appreciate similar movements on the living subject. The further investigation of the œsophagus and larynx has already been described

at p. 378, and the only other point of much surgical interest in this situation which in the present style of dissection deserves especial notice, is the relation of the internal carotid to the pharynx, particularly the outer part of the tonsil: this may be understood by an examination either on the side already laid open, or the opposite one, when the vessel may be observed passing at such a distance from the amygdala as to be quite free of the gland, and not at all firmly connected either with it or with the pharynx.

The posterior surface of the superior maxilla may now be cleared, and the finger should be carefully carried over it, so that the natural shape of this part may be fully appreciated by such a mode of examination: then a punch should be thrust into the antrum, immediately above the fangs of the anterior molar tooth; next the latter should be drawn, and the instrument again thrust into the cavity of the socket, when a part of the bone between the malar and the alveoli (canine fossa) should be scooped out with a gouge or cut away with forceps, and so the cavity in the superior maxilla will be laid open. The proximity of the fangs of the teeth to the interior, the thickness of the shell of bone, and the opening into the nostril at the inner side, should all be duly taken notice of. Next the saw should be carried from the frontal bone down through the hard palate, a little to one side of the mesial line, when the interior of the nostril may be exposed; but the parts cannot be separated unless the occipital bone be cut also, or a transverse division be made in its basilar process, — the latter, perhaps, being the best plan, as the foramen magnum and upper part of the spine can thus be left entire for future dissection. The course and level of the floor of the nostril should now be noticed, the fossa between it and the inferior turbinated bone should be looked to, and here the lower opening of the nasal duct, just within or covered by the anterior point of the last-named bone, may now be displayed: the fossa above the bone should then be examined, and here the opening from the antrum may be perceived: the middle and superior turbinated bones (portions of the cribriform) may next be touched with the points of the forceps or the forefinger, when a little pressure will evince how very fragile they are, and how easily they may be broken with the application of but a slight force.

The saw may now be applied to the lowermost cervical vertebræ: the spinal canal may be laid open between the division and the occiput, by removing the laminæ of the vertebræ, and the back part of the occipital bone may also be divided so as to permit the removal of the posterior half of the foramen magnum; and, lastly, the ligaments of the column in this region may be examined, care being taken to observe the singularly beautiful mechanism between the atlas, axis, and occipital bone: the manner in which the odontoid process is held in its position by the transverse (cruciform) and odontoid ligaments is especially worthy of notice, but I must refer the dissector to an anatomical work for a description of these structures.

CHAPTER V.

DISLOCATIONS. FRACTURES. OPERATIONS ON THE SCALP AND ON CRANIUM.

DISLOCATIONS in this region are few and of rare occurrence. The cervical vertebræ are occasionally displaced, either as the result of accident or disease. When the former happens, it is customary to suppose that the spinal marrow is so affected that immediate death is the result, especially if the injury is above the origin of the phrenic nerve. I have not myself seen any case of this kind, but I believe that there are few in the profession who doubt the truth of the current doctrine: it has been asserted, however, that such displacements may be treated like luxations in the extremities—that is, by extension and counter extension, and cases of the kind have been recorded in modern journals. The practice which has been proposed in such instances is not so novel as some people imagine. Heïster states that "what is vulgarly called a broken neck is generally no more than a luxation, though sometimes the vertebræ are fractured. If life should remain after such a luxation, which very rarely happens, the patient's head is commonly distorted, with his chin close down to his breast, so that he can neither swallow anything, nor speak, nor even move any part that is below his neck; therefore, if speedy assistance be not had, death ensues from the compressure or hurt of the medulla."

"But to repulse this unwelcome messenger, the patient is to be immediately laid flat upon the ground or floor; then the surgeon kneeling down with his knees against the patient's shoulders, is to bring them together so as to contain the patient's neck between them: this done, he quickly lays hold of the patient's head with both his hands, and strongly pulling or extending it, he gently moves it from one side to the other, till he finds, by a noise, the natural position of the neck, and the remission of the symptoms, that the dislocation is properly reduced."

That the neck may be straightened in this way I believe, but I should imagine that the injury to the spinal marrow would be such that this "unwelcome visitor" would keep his place. Heïster is certainly a very different authority on professional matters than Rabelais, yet by the above account one is forcibly reminded of the exploit of Panurge in replacing the severed head of his friend Episthemon.

In the upper part of the neck, where authentic and accredited cases have been observed by professional men, immediate death has ensued in instances of displacement. Thus, a person's head has suddenly dropped forward and life has become extinct instantaneously: in dissections of such cases, it has been found that the atlas and the head have been permitted to fall, in consequence of the rupture of the

transverse or cruciform ligament, the odontoid process remaining erect; the medulla oblongata has been in a manner transfixed by it,—at all events the contusion has been such as to cause the sudden event. Sometimes chronic inflammation has been previously known to have been present in certain of these cases; on other occasions, no suspicion of disease has been entertained, and there are good reasons for supposing that when the parts are perfectly healthy, a vast force is required to cause such displacements. It is imagined by many that in persons who suffer the extreme penalty of the law by hanging, the cervical vertebræ are broken or dislocated; but though this doubtless happens on some occasions, as is known from good authorities, Dr. Houston of Dublin has related several dissections of such individuals, where no perceptible injury had been inflicted either on the spine or its contents. It is well known, on the other hand, that a slow process of displacement and distortion may go on in this region, and yet the medulla oblongata and the spinal marrow below will retain all their functions: the changes go on so gradually that these parts become accustomed to their altered shapes, and the organs below remain in a vigorous condition. Similar facts are often observable in the inferior portion of the spine, and in a future page I shall return to this subject.

Fractures are much more common in this region of the body: they probably happen as frequently as dislocations; but here, as with the latter injury, the effect on the bone is not of such consequence as that on the contents of the canal.

Dislocation of the lower jaw occasionally happens, and in certain individuals the articulations seem so lax that the condyles are remarkably prone to slip forwards, which is the only course they can take. One articulation or both may suffer at the same time, and in either case the effect is, that the patient cannot shut the mouth. It usually is the result of gaping very wide,—a yawn has been known to produce it; and if any force is applied against the chin when the mouth is even moderately open, an articular surface is very likely to start forward. The following drawing (fig. 199) shows the appearance of the features under such circumstances, and the head of the bone may be supposed resting in front of the articular surface.

This condition may be easily remedied by passing the thumb into the mouth, and pressing the bone downwards and backwards by pushing against the molar teeth. One or both thumbs may be used as may be required, and it is recommended to cover each with a towel in case of injury from the sudden closure of the jaws.

The lower jaw is frequently broken, and the injury may be produced in various ways, though in all the violence must be very considerable. A fall on the part—a blow with a stick or with the fist—a kick from a horse, and such like violence, will produce it; and the accident may be accompanied with a wound in the cheek or not:—in any way it must in some respects be deemed a compound fracture; for as it is seldom that the fissure does not extend into the mouth, it may here be considered as being exposed to the air. The latter cir-

Fig. 199.

cumstance seems of little consequence, however, for it rarely happens that serious results, as regards the bone or its coverings, occur in such cases. The accompanying drawing (fig. 200) shows a fissure in a

Fig. 200.

part of the bone where it is very common, viz. in the mental region; sometimes it is further back, and occasionally a separation takes place as here represented, and towards the angle of the bone at the same time. The condyles were broken off in this instance,—a most unusual occurrence I believe,—but the patient, from whose body after death I took the preparation, had a fall from a great height, which caused most extensive injury. The symphysis is no unusual seat of fissure in young persons.

It is seldom that there is any difficulty in detecting the nature of such a case,—the pain on moving the jaw, the crepitus, and the irregularity in the teeth and alveoli, usually at once indicate what is wrong: nor is there much difficulty in the treatment; for whatever will suffice to keep the fragments moderately still will answer all that can be desired. The method which I have usually followed has been to shape two narrow wedges of cork about an inch and a half long, a quarter thick at the base and sloping away to a point, one of which has been placed on each side between the teeth, and then I have affixed a wetted and softened piece of pasteboard on the chin, which has next been drawn tightly up by means of a bandage carried from this part over the crown of the head: as the pasteboard has got dry, a kind of mould has thus been formed on the chin, which has obstructed all future movements so long as it has been kept on. The cork wedges have insured regularity as regards the teeth, and an opening has been left between the incisors whereby the patient has been fed upon soups and other fluid nourishment. Generally, however, the wedges have become loose, and in the course of ten or fifteen days the patients have become accustomed to restrain the movements of the part; and without taking particular pains about tightening the bandages afterwards, I have usually seen most excellent cures follow. Recently I treated a case of this kind in a boy, on whom, partly from his restlessness and partly in consequence of wound in the skin, it was impossible to adjust any apparatus in an accurate manner,—the fragments, though moveable at first, soon became in a manner fixed by the surrounding inflammatory swelling, and the case went on as favourably as could have been desired. When the cork is used, and indeed under any circumstances, the patient should be enjoined to rinse the mouth frequently, and a little tincture of myrrh put into the water occasionally may assist in keeping the gums in tolerable condition until more freedom can be taken with the parts. Various pieces of mechanism have been devised for this kind of fracture: a leather case to fit the chin and to fasten on the head by straps and buckles may be applied; a double-headed roller, having a slit in the middle to receive the chin, has been a favourite bandage: Mr. Lonsdale has invented an ingenious steel apparatus for the purpose; but for my own part, I should commonly prefer the pasteboard, cork, and bandage above recommended.

The nasal bones, from their exposed position, are often broken, by blows, falls, and such like violence: from the frequency with which united fractures are met with in the dissecting-room, I imagine that

such injuries occur less rarely than some seem to suppose. Usually the contusion is so great, that any examination with the fingers is productive of considerable suffering; fortunately, however, there is no need to persist long in the examination, for a slight touch will detect the mobility of the parts, which is as good a criterion here as crepitus. If there is displacement the fragments should be put in a favourable attitude: commonly this can be done on the outside, but it will possibly be necessary to introduce into the nostrils the end of a probe or a director covered with lint, so as to elevate any portion that may be depressed. Afterwards the patient must be kept quiet, cold cloths should be laid on the part, and if inflammation seems to run high, leeches should be resorted to. There is a danger here of inflammation extending from the ethmoid bone to the dura mater, and the most serious effects may ensue. In general I do not think there is much danger; but it behoves the practitioner to be on his guard, as it is known that the base of the cranium has sometimes been injured at the same time. Lately I had a case of fracture of the nose under my charge, which happened in a singular manner: the patient was a servant in the establishment of a dealer in bottled malt: a bottle in one of the bins burst with such violence as to dash the heavy bottom against his nose, and thus cause a fracture of a severe description. I watched this man with great care: about eight days after the accident he began to complain of deep-seated pain in the forehead: his pulse rose, his tongue became dry, and various symptoms led me to suspect internal inflammation. Immediately a dozen leeches were ordered to the forehead, a smart purge was administered, when in two days he felt quite relieved, and soon made an excellent recovery. Here possibly these means were resorted to in good time; for one could scarcely have expected such relief if the inflammation (supposing any to have existed) had been severe.

Fractures of the other bones of the face are comparatively of rare occurrence, and require no particular comment here. The last case of this kind which I saw, was occasioned by a mass of rubbish falling on the patient's head and face; the bones were extremely shattered, the frontal bone also having suffered: he died on the eighth day, chiefly in consequence of severe inflammation and suppuration throughout the whole face, which had also extended within the cranium under the anterior lobes of the brain.

Fractures of the cranium are of as frequent occurrence as any of those already alluded to in this part of the body, and are usually of much more serious import than any others, with the exception, perhaps, of those in the spine. The upper surface being more exposed to external violence most generally suffers; but the base of the skull is frequently the seat of such injuries. The fracture may occur immediately under the external force, or it may be directly opposite: thus, a blow on one side of the head may occasion fracture on the other, and an injury sustained on the vertex may cause fissure at the base. Sometimes there is merely a chink of slight extent, or

it may run over half, or more, of the cranium : at other times, there is a wide gap, occasioned either by extensive separation of the fragments, —a kind of expansion of the skull, as it were,—or by a portion being depressed : again, the solution of continuity may be in the body of a bone, or between two or more in the seat of a suture ; or it may extend from one to another across the latter. Occasionally the outer table may alone be depressed, as at the frontal sinuses, or possibly into the diploe, or it may happen that the inner table gives way while the outer resists. The scalp may or may not exhibit an external wound : the dura mater may or may not be lacerated : its largest artery (middle meningeal) may or may not be torn across : the sinuses may suffer or remain entire, and the brain itself can scarcely escape from a functional and physical lesion.

The circumstance of a fracture being simple or compound (in the usual acceptation of these terms) is of little consequence here : assuredly a compound one, *cæteris paribus*, must be deemed the worst ; but the injury done to the brain at the time of the accident, or the subsequent effects upon this organ, are what chiefly attract the especial notice and care of the practitioner. However, in the elementary and mechanical details even here, various general rules are applicable, which the young surgeon should be familiar with. First, then, it is known that such an injury cannot be sustained without a certain amount of that effect so well understood by the term concussion. This state is characterized by insensibility, slow and small pulse, quiet respiration, pale and cold surface, contracted pupil, and is usually contrasted with that termed compression, which is recognized by a full pulse, though slow, loud breathing (stertorous), surface probably hot, and of usual colour, pupil dilated, and the retina insensible to light, with paralysis more or less distinct.

Unless the injury be very severe, the patient soon recovers from the state of concussion, and his condition comes nearer to that of a state of health : it may happen that an excess of reaction, as it were, takes place, and inflammation within the cranium ensues. At first, the practitioner's object should be to rouse the patient from this condition : cordials, stimulants, warmth, and blood-letting, are the ordinary means : the latter plan is generally resorted to at the earliest period possible, and though in so far as the mere state of the pulse goes, the method is in contradiction to the usual doctrine of not bleeding in a state of shock, I believe that in some instances it may be of the utmost value. Professor Reid, of St. Andrew's, found that after producing concussion in a rabbit, the right auricle of the heart became unable to act in consequence of over-distention, and that the animal died under these circumstances : if, on the contrary, another was injured in a similar way, and a vein in the neck opened to lessen the quantity of blood in the vessels leading to the part, its action continued, and recovery took place. When the patient is roused, his condition must then be carefully watched, and should symptoms of over-action (inflammation) show themselves, the lancet,

and other active measures for subduing this disease, must be speedily and assiduously resorted to.

In concussion, unless the injury be immediately fatal, nature seems in a manner to struggle against such an event, the patient recovers to a certain extent, and then perhaps inflammation may run its course, or possibly the rally may be complete. Not so, however, with compression: this condition may not evince itself for hours, days, or even weeks, after the injury. If the skull is fractured, and a portion of bone be driven down upon the brain, it will almost invariably be coeval with the injury, and though occasionally this state goes off even under these circumstances, it more frequently happens that it leads on to a fatal termination, unless some interference on the part of the surgeon is successful. Sometimes in injury of the head a person seems at first to suffer from concussion; in the course of a few minutes, half an hour, an hour, or more, he, as it were, recovers from the shock, but for a brief time only,—he gradually becomes insensible again, and all the symptoms of compression become more or less distinct. Such has been the history of some instances when the middle meningeal artery has been torn: the circulation, which is always languid during the state of concussion or shock, has not been sufficient to force the blood between the cranium and dura mater; but as the heart's action has become more vigorous the extravasation has occurred, and the accumulation has caused compression. On other occasions, whether concussion has ever been present or not, and either without or with fracture, in the course of a week, a fortnight, or more, compression has come on in consequence of the formation of pus within the cranium.

All these symptoms, conditions, and causes, have been made by many authors to appear very distinct in so far as language and printing are concerned, but in practice the difficulties of diagnosis are often so great, that even the most experienced surgeon will occasionally be at fault: the co-existence of concussion and compression has been especially noticed by practical men, as also the impossibility of distinguishing which of these conditions is most urgent, and there are few indeed who can congratulate themselves on their invariable accuracy in the investigation of such cases.

A fracture in the cranium is seldom difficult to detect. If the skin is entire, the swelling resulting from the contusion may prevent a very accurate diagnosis, even in an instance where there may be depression; the hard "puffy" tumour which forms on these occasions may possibly cause deception; but unless there be symptoms of compression, the surgeon may in the meantime rest satisfied, and treat the case otherwise as reason and a moderate share of professional knowledge must indicate. He will seldom err in abstracting blood by the lancet or by leeches, and the usual antiphlogistic treatment, combined with rest and quietude, must be carefully kept in view, either to obviate or to cope with inflammation. If the scalp be opened by the injury, then there can be less trouble in detecting a fissure, more es-

pecially if there is a portion of bone depressed: the finger must be introduced into the wound, should a glance not suffice; and if it should be deemed necessary to facilitate the examination, the orifice in the scalp may be enlarged with a bistoury. In the instance where there is no external aperture in the scalp, should symptoms of compression supervene, or should it for other reasons be thought necessary to ascertain if fracture exists, the surgeon may be fully entitled to make an incision, and to proceed with the examination as he would in a case of compound fracture. By such a practice, it will be perceived that he violates, as it were, one of the standard rules of surgery, which inculcates the necessity of avoiding the exposure of the ends of fragments in cases of simple fracture; but here the circumstances are different from what obtains in other parts of the body,—it is not the compound fracture which is to be dreaded, but the injury on the contents of the cranium.

Supposing the case to be palpably one of fracture, and even fracture with depression, the practice need not differ from that which I have already alluded to, unless peculiar symptoms evince themselves; but the necessity for watching the patient should not be forgotten; if there is any occasion on which additional care on the part of the practitioner is necessary, this is an instance; and should any symptoms either of compression or of inflammation exhibit themselves, then he must resort to the appropriate modes of treatment. It sometimes happens that, combined with an open wound in the scalp, there is a comminuted fracture, and several portions of bone lie almost loose on the surface: here, I think, there need not be a doubt about the propriety of removing these fragments, as they can only act as sources of irritation, which may produce dangerous consequences on the dura mater. I should consider it highly culpable to leave fragments in this condition; and should scarcely have urged the necessity for the practice, had I not seen them allowed to remain in such a state, and thus, in all likelihood, promoting the fatal event which ensued.

If there be a wound in the integument, it must be treated as one would be in another part; it may be stitched, strapped, or poulticed, according to circumstances. Whether there is an opening or not, it is an almost invariable custom to apply cold; but should suppuration threaten externally, I should often prefer a poultice, under the impression that this process would counteract any suspected excess of vascular action within. Undoubtedly, according to established custom, I should always apply cold at first in these cases; but I should certainly place most of my faith in other measures, more likely, in my opinion, to avert or subdue deep-seated inflammation. In all severe injuries of the scalp or cranium, one of the first measures should be to have the hair around taken off, and in general it will be best at once to have the whole head shaved.

In a case of compound fracture with depression, although symptoms of compression should not be present, I should deem it proper practice to elevate the piece of bone, provided that could be done without

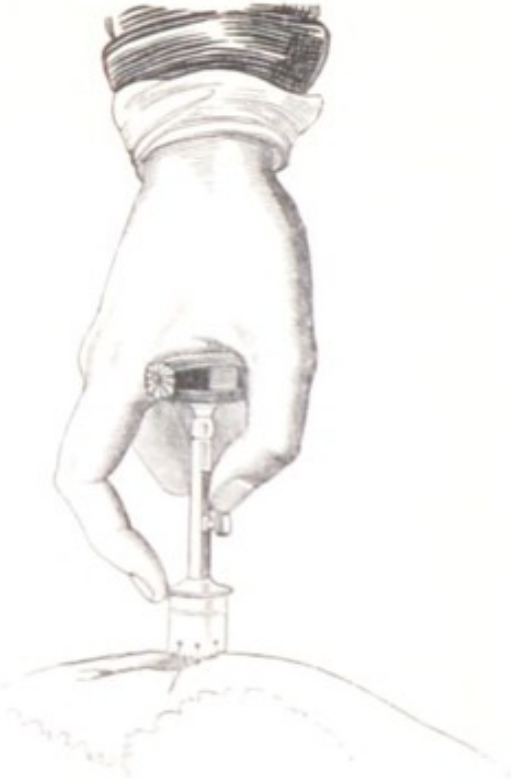
causing additional injury: there is no urgent necessity for this, however, unless the fragment be fairly driven into the brain, and it would only be in the event of compression occurring, whether in cases of compound or of simple fracture with slight depression, that I should make incisions to elevate the sunken bone.

If a person had received a blow on the temple, and if from the symptoms I suspected effusion of blood from the meningeal artery, I should not hesitate to perforate the cranium with a trephine, over the supposed collection; and in the event of compression coming on in the course of a number of days, and when suppuration might be suspected, the same method might be adopted. Here, however, it might be difficult to determine on the part to which the trephine should be applied. Where blood has been suspected, I have seen great hesitation on the latter point, and so, also, there may be the same in the supposition of an abscess being present. In the latter case, the wound on the surface would probably be selected, more especially if the bone around seemed diminished in its vascularity, or altogether deprived of vessels.

My limits will not permit of more than the above brief sketch of these most interesting subjects, and having others of equal importance, as regards the design of this work, still to refer to, I shall not dwell longer upon them, but will only state further, as I have already so frequently done regarding other matters, that the treatment of such cases must be conducted on those general principles of practice which any individual with a diploma is presumed to possess.

When a depressed portion of bone has to be raised, it is almost impossible to apply an instrument for the purpose with proper effect, without making an aperture in the cranium: if a foreign body, such as a musket bullet or other similar missile is the cause of compression, it may be necessary to make an opening to permit its extraction, and the same is required when blood or matter must be evacuated. A circular saw is generally used on these occasions; it is technically called a trepan or trephine, and in consequence the operation is named trepanning or trephining. The trephine put into the modern surgeon's Armamentarium is similar to that represented in the next drawing: it is worked by turning the hand backwards and forwards, but some even yet prefer the instrument of Hildanus, which is worked like the carpenter's or cooper's brace. I myself prefer the hand trephine such as is exhibited in figure 201, and it may be used thus: the scalp must be sufficiently opened by a , an , a , incision or any other that may be most convenient, next a punch should be used to make a small hole in the external table into which the central pin of the trephine should be placed, and then by rotatory motions the teeth should be carried into the bone: the external table

Fig. 201.



and the diploe may be cut with a bold and free movement, but caution is requisite when the inner plate is encountered: the central pin should now be drawn above the level of the serrated edge, and again by more cautious movements the vitreous table must be divided: when the incision is supposed to be nearly complete the instrument must be removed: an elevator should then be introduced so as to raise the loosened portion, and the rest of the operation must be conducted according to circumstances. When a foreign substance, blood, or matter, is sought for under the cranium, a circular piece of bone is thus removed; but in the case of depressed fracture, only a little more than a semicircular portion requires to be cut, and this, be it observed by the young student, is taken from the sound portion of bone, not that which is depressed; for the sole object in applying the instrument in a case of the kind is, to permit the introduction of a lever to elevate the portion at fault. In such a case I have known the cutting pliers used instead, or a small saw, similar to those afterwards represented for the operations on the jaws. In using the trephines commonly sold, it is necessary to raise them from the groove from time to time, so as to allow the particles of bone to be brushed away, but the blade being slit up and perforated in the manner represented in the sketch obviates this. However, towards the latter part of the proceedings it is proper to remove the teeth once or twice and to examine the fissure with the point of a probe, a strip of quill, or any other convenient article, so as to make sure that the dura mater is not in danger from the skull-cap being thicker on one side of the opening than on the other.

In the instance of fracture the operator can scarcely go wrong as to the proper part for applying the instrument, but in other instances he may discover that he has erred in his diagnosis, or he may then (not finding that which he has expected) think of opening another part of the cranium, either immediately contiguous or at a distance. Such proceedings are now rarely ever heard of, yet, under the desperate circumstances of the patient, I should consider the surgeon justified in making further search; provided always that he has some degree of reason on his side, (such as that the patient is not actually *in articulo*,

for I have heard of a zealous practitioner persisting in the use of the instrument until it was hinted that his patient was dead) and there is no lack of authority for such a course. Two, three, and four pieces —even a larger number—have often been removed with success; and Vander Wiel relates an instance where the trepan was applied twenty seven different times with success.

Supposing that nothing is found betwixt the cranium and dura mater, an opening may be made into the latter membrane; for though, in general, the case will be very hopeless in such an example, still the mere opening in this texture will not very materially increase the danger whilst it yet affords a faint hope of advantage.

The trepan may be applied to any part of the side or upper portion of the cranium, and a knowledge of anatomy will indicate where the bones are thick or the reverse, and also where the meningeal artery or the sinuses are in danger. The latter I should imagine may always be avoided: the former, if it is necessary to operate over its course, may possibly be cut across, as at the side of the cranium it often runs in a canal of bone instead of being merely in a groove: a small pin of wood in such a case would suppress the bleeding, and any escape that might happen ere this could be introduced, would probably be rather an advantage than otherwise; for, generally, those who require this operation have been in robust health previously, and (besides the positive advantage in most instances) can well sustain the loss of ten or twenty ounces of blood, in the event of such a quantity escaping from this source. The irregular thickness of the bones at different parts should be remembered, and the pressure of the teeth should be made light or heavy in proportion. At the frontal sinuses Sir Charles Bell recommended that the inner table shall be taken out with a smaller-headed trephine than that which has been first applied: the large external opening permitting the entire circumference of the latter instrument being placed directly on the surface within. Such an operation, must, however, be rarely required in this situation.

The wound here must be treated according to circumstances. Generally union by the first intention is promoted, but if clots of blood or other matter be expected to be discharged, the surface must be kept open, and warm-water dressing will probably be most advantageous. When the wound closes permanently, and the patient begins to move about, the part is usually protected by a piece of leather or metal laid over the cicatrix. In young subjects when one perforation only has been made, the aperture is often so well closed and protected by the firmness of the scar and partly by the formation of bone within the circumference, that ultimately nothing of the kind is required. If fungus (fungus cerebri) should follow the operation, pressure should first be resorted to; if this does not succeed, then styptics, caustics, ligature, or removal by the knife may be tried, one after the other, as the conditions may indicate.

Occasionally injuries of the scalp, with or without fracture of the bones, are followed by remarkable effusions of blood. In new-born

infants, on whom instruments have been used, such collections are sometimes observed. On grown-up persons I have seen some examples of large bloody swellings succeeding to blows. In one instance I made an opening in the skin of the brow in an old woman, (who had fallen down stairs and suffered great contusion of the scalp,) and evacuated more than eight ounces of clotted blood: in another, a boy, about twelve, a large swelling formed suddenly over the temple after falling on the part: here about ten ounces of fluid blood escaped through a small lancet puncture which was made, and then I applied compresses and a bandage, but in two days the swelling was nearly as large as ever: again I made a puncture and reapplied the pressure, which then had the desired effect. Doubtless a considerable branch of the temporal artery had been ruptured in this case, and had the second attempt with pressure not succeeded, I should in all probability have cut down upon that vessel where it passes above the zygoma and applied a ligature. I have seen an instance where a small aneurism by anastomosis, connected with a branch of the temporal artery, followed a blow on the part, and it was for a pulsating aneurismal tumour of the scalp succeeding to a wound over the occiput that Kuhl placed ligatures on the common carotids.

Besides the methods of abstracting blood by the lancet, already referred to in other parts of this volume, it is occasionally the custom to open the temporal artery for this purpose, and it is here that Arteriotomy (as such a proceeding is called) is usually performed. It may be done thus: A branch being selected, the thumb or forefinger of the left hand should be placed upon it so as to keep the skin steady, then the lancet, held as represented at p. 196, should be thrust into the vessel so as to cut it nearly half across in an oblique direction: the pressure should then be taken off and the blood permitted to spring from the orifice, and when a sufficient quantity has escaped, a firm pad should be placed upon the wound and retained by a bandage, drawn pretty tight around the head, which should be allowed to remain for three or four days. Generally the anterior branch of the temporal is selected for this proceeding, but sometimes the posterior is most convenient, whilst on other occasions the trunk itself is selected. In the adult the first of these commonly yields any quantity of blood which may be desired; in the young person, however, on whom these vessels have not attained the magnitude which they assume in advanced years, it may be difficult to procure enough. Sometimes it is well, when the scalp is thick, to make an incision about half an inch long over the vessel about to be punctured, and then introduce the lancet. The latter instrument may suffice for the purpose, or a scalpel may be used, and then the lancet, although there could be no difficulty in accomplishing the whole proceeding with a sharp scalpel or bistoury.

The pressure by pad and bandage, above recommended, may not on all occasions at once arrest the flow; in such an event it is customary to introduce the lancet again and cut the vessel completely across, and if this with continued pressure does not suffice, an incision should be

made in the seat of the puncture and a ligature applied on the bleeding orifice. I have known two necessary, one above the other below, in consequence of the free anastomoses of the vessels in this situation. If infiltration has taken place, possibly some trouble might be experienced in securing the vessel at this part, and perhaps the best course might be to make an incision about an inch in length above the root of the zygoma, over its course, and apply the ligature there. The vessel lies so close under the skin that its pulsations can usually be felt, and it will here be accompanied by one, or probably two, small veins, which of course should be held aside.

Besides the operation above alluded to, the surgeon has occasionally to make incisions, in instances of erysipelas, suppuration, and for the removal of tumours. Unless erysipelatous inflammation has run on to suppuration, it is seldom that in this situation incisions are resorted to; but when pus has formed there can be no doubt about the propriety of making them. No special rules are required for the guidance of the knife here, further than those referred to in the chapter on abscess. The same general observations which I have made regarding the removal of tumours in the introductory portion of this work will illustrate the mode of procedure in this region. Encysted tumours (wens as they are commonly called) are of most frequent occurrence here; but sarcomatous growths are also occasionally met with. It is seldom that cysts are seen on the scalp above the size of a walnut or billiard-ball, nor are solid tumours often met with of great magnitude. I have seen one of the latter kind larger than the fist removed from over the occiput. Occasionally such tumours are so fixed to the cranium, that the propriety of attempting their separation may well be called in question. If, however, there is reason to suppose that the growth is only on the surface, or, at all events, is not connected with the inner table or lining membrane, their removal may, under favourable circumstances, be resorted to. There is a cast in the Museum of the Royal College of Surgeons of an enormous growth on the right side of the head, which was successfully removed by Sir Everard Home. The tumour extended from above the level of the right parietal bone as low as the shoulder of the same side, and greatly exceeded the size of the head. It consisted of "fat mixed with a steatomatous substance" towards the apex, "and wholly of bone" where it was connected with the right side of the os frontis, and although two operations were required, (one performed on the day succeeding to the other), the recovery was complete. The operation was done in October 1816, and the patient, having for a long time after acted as a nurse in St. George's Hospital, yet lives. A drawing of the case is to be seen in Sir Everard's tract "On the Formation of Tumours."

Sarcomatous growths when of considerable size are usually in close contact with the pericranium, and this membrane often comes away with the mass. In the instances which came under my notice granulations sprung up from the bone; but it is not difficult to con-

ceive that necrosis might follow: or, should suppuration ensue, it is possible that matter might collect between the cranium and dura mater. Incisions may sometimes be necessary to facilitate the removal of necrosed portions of bone here, and they may also be required in the treatment of aneurisms by anastomosis, when such practice is resorted to, but no special rules further than those already given in different parts of the volume are applicable to this locality. In incisions required for the latter disease, the surgeon will of course be prepared for copious hemorrhage; but I may here caution the young practitioner, that the bleeding is usually very active from all incised wounds of the scalp, whether in a state of health or not.

The practice of puncturing through the fontanel with a small trochar and canula in cases of chronic hydrocephalus needs no particular notice here. It is a proceeding which can be thought of only in early infancy, while the over-distended cranium is as yet soft and pliable, and is certainly one attended with great immediate danger,—not from the puncture, which is a very simple matter, but from the inflammation likely to succeed. I have seen only one instance where the method was resorted to, and it occurred in the practice of my friend Dr. Wm. Campbell of Edinburgh. The patient was a newborn infant with congenital disease: a puncture was made a little to one side of the mesial line (to avoid the longitudinal sinus) a large quantity of fluid was evacuated, and a roller compressed the head to a natural size. No bad effects followed, but in the course of a few weeks the fluid had again collected: another puncture was made, and death from inflammation ensued.

CHAPTER VI.

OPERATIONS ON EYELIDS, ORBIT, AND EYEBALL.

Incisions may be required in the eyelids, and certain operations upon them are sometimes necessary. Some of these may be performed in the dissecting-room, and the nature of most of them may be appreciated by an examination of these parts on the dead subject. Inflammation in the eyelids usually causes great tumefaction, and occasionally lancet punctures, as in the case of erysipelas, are required; but these need no particular comment here. Sometimes freer incisions are necessary to permit the escape of matter, as abscess not unfrequently follows the latter affection. In such cases the lancet or knife should be carried in a horizontal direction, as the cicatrix will thus be less observable in the transverse wrinkles of the skin.

Various little operations are required in these parts on the living body which may be practised on the dead subject. For instance, a surgeon may be asked to extract one or more of the eyelashes in the case of trichiasis, and for this purpose each offending hair must be seized with well-pointed forceps (p. 7) and extracted by the root. Should others grow, or should the margin of the eyelid prove a source of irritation to the surface of the ball, and in the event of the latter condition (resulting probably from chronic inflammation, ulceration, and suppuration of the parts, or from diseased secretion of the Meibomian follicles) resisting the ordinary soothing, or stimulating treatment generally resorted to in such cases, then it may be deemed advisable to remove a small slip of the diseased part with the knife or scissors. Perhaps the latter instrument will be found most convenient in this situation where the textures, from their mobility and slenderness, offer little resistance to the edge of the knife. It occasionally happens when some of these affections of the ciliary margins heal spontaneously, that the aperture of the eyelids is so much diminished in size that the knife is required to open up the unnatural adhesions, but no particular directions for such a proceeding seem necessary.

In some instances the ciliæ are completely inverted (entropium) and the whole of them thus excite inflammation of the surface of the eyeball. This condition occasionally results from acute ophthalmia, and is remedied by those means which are of service in the latter affection; but sometimes it is present independent of this disease (excepting in so far as it itself excites the mucous surface), and then it seems to depend either upon a contracted state of the margin of the lid or of the edge of the orbicular muscle, or from a relaxed condition of the skin. Whether the latter is the cause or not, the entropium is easily remedied, as a last resource, by tightening the skin in this way: A horizontal slip of it should be cut away with scissors: then the edges should be brought into contact with stitches, and thus the eyelashes are turned

out and retained in their proper position. The slip of skin should be about an inch in length, and two or three lines in breadth: it may be seized, raised, and held steady with common dissecting forceps, or such as are made for the express purpose, with broad flat points, which include the portion of skin about to be removed. Scissors, such as those referred to in pp. 6 and 30, will answer for these proceedings, although most generally those having a slight concavity at the cutting part of the blades are selected. I have seen a portion of skin, of the extent above mentioned, destroyed by strong acids; but, from what I have said in the introductory part of this volume on the use of caustics as a substitute for incisions, it may be perceived that I should not recommend such means here. Other ingenious plans of treating this condition have been devised by Ware, Crampton, and others, but the plan above described I have often seen to answer admirably. The upper lid is most commonly affected in this way.

In other instances the eyelids are everted when the condition is termed ectropium. Sometimes it arises from tumefaction of the conjunctiva in acute ophthalmia (especially in a purulent form), on other occasions it seems to result from relaxation of the margin, and also of the mucous lining, whilst again it is often caused by contractions of granulations in the vicinity. It is most frequently seen in the lower eyelid, although inversion and eversion may be noticed on either.

In purulent ophthalmia the proper treatment of the disease serves to cure the eversion. Doubtless, the swelling in such cases is chiefly connected with the eyelids, but it may be also occasioned by the tumefaction of the conjunctiva on the surface of the globe, and it is in such cases that the mode of relieving tension, so strongly recommended by Mr. Tyrrell, may be most advantageously resorted to. The incision with lancet, knife, or scissors, should be made in a direction parallel with the course of the superficial blood-vessels; and thus, whilst relief is given by permitting the escape of serum, destroying some of the enlarged vessels, and lessening the distention of others, sufficient will be left to preserve the vitality of the cornea; and thus also, as that gentleman supposes, diminishing the chances of sloughing of this part, which is by no means unusual in this acute form of inflammation. If the incisions are made in the conjunctiva of the eyelid, they may be carried in any direction which shall be found most convenient.

When the eversion depends on chronic relaxation, such astringents as may bring the mucous surface into a more natural condition may be of service; but often it will be advantageous to remove a slip of the membrane by scissors: a portion about a line in breadth and three in length may suffice. At first, of course, there will be no benefit, but as the granulations on the wound contract, the margin of the lid will be gradually drawn into a proper position against the ball. When this does not suffice, then a piece of the margin of the eyelid should be cut out in this form, its edges drawn

together by a single stitch, when it will be brought against the orb at once, and if union occurs (which it almost invariably does) the affection is then more speedily cured than in any other way. The part removed includes a portion of the cartilage. The operation may be done either with a sharp-pointed bistoury or with scissors, such as those described by Maunoir, and, I need scarcely add, that the needles and threads for the sutures in these proceedings on the eyelids should be finer than might be used in most other parts of the body.

If the ectropium results from scars on the neighbouring parts, it will seldom happen, that much benefit will be conferred by surgical interference. It is, however, in such instances that the surgeon is most anxious to exhibit the resources of his art, as the condition, besides its unseemly appearance, is productive of great annoyance and much injury to the eyeball; for, in consequence of the constant exposure, the conjunctiva becomes affected with chronic inflammation, and the cornea itself at last loses its transparency. Attempts have been made to put matters right by dividing the cicatrices, wherever they seemed to prevent the eyelid assuming its proper place. After severe burns such trials have been made, but usually with little or no benefit; for, as the wounds have healed, the granulations have by their contractions brought the parts again into their previous mal-condition. In such instances a portion of skin might be raised from some neighbouring healthy part, twisted round, and laid in the gap of the wound at the cicatrix, so as to make up the deficiency occasioned by the original loss of substance. Such a plan has occasionally proved of benefit. I have often seen operations done in examples of this kind, and have myself occasionally performed them; but although I must admit that benefit has sometimes resulted, I must say, that in many instances I should not be very sanguine of any happy results.

Tumours are a more common cause for the use of the knife here: encysted steatomes are often met with, but frequently the contents of the cysts are thinner: sometimes a fluid of the consistence of cream is found within them, and now and then small hairs, similiar to eyelashes, project from their inner surface: in one instance the growth seems more in contact with the skin or mucous membrane than in another, and occasionally the bulk is such that it comes equally close to both surfaces.

When a cyst is small and close upon the mucous lining a cure may sometimes be effected by opening it with a lancet carried through that texture. For this purpose the eyelid must be everted in this way: A probe should he laid horizontally upon it above or below, according to the lid affected (the upper is the usual seat of such tumours): then the eyelashes should be seized between the forefinger and thumb, and partly by pulling them and by pressing in a proper direction against the margin the mucous surface is everted, when a lancet can be thrust into the cyst and its contents squeezed out. The lid may then be restored to its natural position. Possibly a collection may again form, and it may then be treated in a similar manner; but, in addition, the

interior of the cyst should be touched with a pencil of lunar caustic; or a portion may be cut out with scissors. Sometimes such growths may be dissected out with a scalpel, whilst the lid is thus everted, and although any of these proceedings may be comparatively easy in some individuals, they will cause much trouble to the surgeon in others: indeed, there are few patients who can keep the parts as still as the operator might wish, and there are some in whom the orbicular muscle becomes so affected with spasm as to make it almost impossible to conduct such operations in a satisfactory manner.

The supposed advantage of the above practice is to leave the skin without a scar; but in many instances it is requisite to remove the disease through an external incision. Here the wound should be made parallel with the wrinkles, as already stated, with reference to incisions for other purposes. Sometimes it will be easy to complete the operation without touching the mucous lining; in others, the whole thickness of the lid will be divided; and I have myself been startled at the first glance of the cornea appearing through the wound at a time when I did not imagine that the knife had passed so deep. So far as my own experience goes, I have not seen that more trouble results from such a complete division, although of course it is best to keep the lining entire, if this can be done. One or two stitches, so applied that the thread shall not come in contact with the eyeball, will keep the edges in accurate apposition. It is scarcely necessary to add, that in all such operations the succeeding inflammation should be carefully watched; it rarely happens that it extends to the globe, yet I have seen it do so, and great mischief result therefrom.

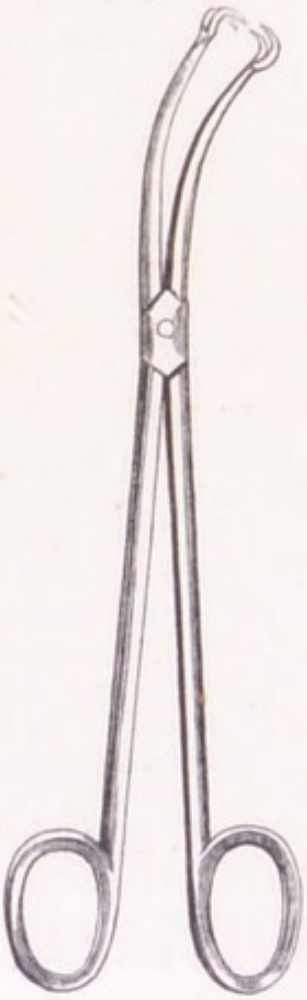
These proceedings are ranked among what are usually characterised as the minor operations of surgery; they are simple enough, certainly, yet the young surgeon will find that they require more nicety of manipulation, and try his patience more than those of a more formidable and more tangible kind. Where the parts are so moveable, a sharp knife is highly desirable, and the hook forceps (p. 27) will here be of great service in keeping the tumour steady.

Tumours occasionally form within the orbit which require removal. In many instances the diagnosis of such cases is difficult; first, as to whether the growth is malignant or not, and then as to its connexion. If the former, there is no time to lose, and removal should be proposed before all the parts around are implicated. Melanotic growths and those of a medullary character, supposing they can be discriminated, are such as these remarks apply to, as it must be highly desirable to operate before the eyeball is affected or any of its important appendages. Then, on the other hand, it may be difficult to determine in how far the latter parts are involved, or possibly whether, in consequence of the surrounding attachments to the orbit, it would be proper to interfere with the disease at all. As tumours in this situation increase in size, they generally cause protrusion of the eyeball: ultimately, by the stretching of the optic nerve, and possibly by altering the shape of the organ, causing loss of vision; and this may occur

whether the growth is connected with the globe or not. In non-malignant disease, unless the swelling is evidently increasing in size, and causing the changes last alluded to, a prudent surgeon would not think of urging an operation, which at all times must be deemed very dangerous in such a locality, from the vicinity of the eyeball, as well as of the dura mater and brain; but in a malignant affection, as the patient's ultimate safety is sacrificed by delay, there should be no hesitation about the necessity for an operation; and should there be evidence to show that the eyeball itself is involved in the disease, the course of procedure is sufficiently clear. Aneurism by anastomosis has now been frequently seen in this situation, and I need scarcely point out the necessity for an accurate diagnosis in such cases, as no attempt at excision would be justifiable. Since Mr. Travers' successful treatment by ligature of the carotid, the operation has been several times repeated, and with excellent success.

Occasionally encysted tumours have been seen in the orbit; some have been treated by puncture, others by excision. Solid growths have been more frequently met with, however, and though they may be in any side of the orbit, they are most common in the upper part. Sometimes the lachrymal gland has been the seat of adventitious growth; Daviel, Todd, Lawrence, and others, have operated in such cases; and Tyrrell relates an instance where a surgeon, in removing a tumour from within the external angular process, under the supposition that it was an affection of this gland, afterwards found the organ in a healthy condition, attached to one side of the mass. In operating in this situation, therefore, it may be well to proceed cautiously, so as if possible to preserve this organ and its ducts. Incisions in the course of the supra-orbital ridge will usually answer best in the upper part of the socket, but vertical incisions have been preferred on some occasions. Below, horizontal incisions also will probably be most suitable.

Fig. 202.



When the eyeball itself has to be excised, the operation may be done thus: The patient should be laid on the table with the face uppermost, and then, with a scalpel or bistoury, an incision should be made from the external commissure, half an inch beyond the margin of the orbit, when the eyelids may be more completely opened by an assistant, especially if the skin

be detached from the bone, above and below this wound; next the organ should be seized with a volsellum such as that here represented (fig. 202), and then the point of the knife should be carried between the eyelids and ball, so as to divide the conjunctiva; when, by carrying it deeper, and moving the disease from side to side with the volsellum held in the left hand, the removal may be completed by dividing the muscles, optic nerve, and other textures. It will seldom happen that there is either difficulty or trouble in this proceeding; and the hemorrhage will probably be easily commanded by stuffing the orbit after the operation with charpie or pledgets of lint. Afterwards caution must be taken to avert or subdue any high degree of inflammation, which, as may readily be perceived, must be more hazardous here than in many other regions.

Whether the tumour be large or small, the same style of operation will answer; if it is of great magnitude, there will be no necessity for the instrument to keep it steady, as the fingers alone may suffice for this; but whenever the growth is entirely confined within the eyelids, the hooks, as represented in the sketch, will, in my opinion, be found superior to any other. In rare instances it may be requisite to remove portions of the eyelids at the same time; but in general a surgeon would be loath to interfere in this way with a case where the disease had extended so far.

The student may, on the dead subject, practise the introduction of instruments into the lachrymal passages. By examining the little projecting angle near the inner extremity of each eyelid, the puncta may be observed, and a bristle with a smooth end may be pushed into each, when, by conducting it in a horizontal direction, it will pass along the lachrymal canal into the sac, and possibly into the nasal duct; the point of a slender pin may be used in the same manner, or a small silver probe, such as that recommended by Anel. These proceedings are occasionally required on the living body, in consequence of obstructions either from thickened mucus or from stricture.

Next the nasal canal can be examined from below upwards, by means of a common-sized silver probe. To effect this, the instrument should be bent at a right angle, about three fourths of an inch from its point, then this part should be carried along the floor of the nostril, until it arrives below the anterior extremity of the inferior turbinated bone; next it should be turned upwards, when, with a gentle movement, it will slip into the lower orifice of the passage, and may then be pushed higher, until it causes the skin to project a little below the inner canthus. The probe may now be removed; and if the eyelid, and particularly the orbicular muscle, be drawn towards the malar bone, a round cord-like projection will become apparent, below which if a puncture be made with a lancet, scalpel, or bistoury, in a direction downwards and slightly towards the nose, the lachrymal sac will be opened, when a straight probe can be pushed from the orifice down into the nostril.

Somewhat similar manœuvres may be required on the living subject,

when, from obstructions in the nasal duct, the condition termed stillicidium lachrymalis is present. If there be a fistulous opening in the sac, whether from previous puncture or from ulceration, the probe may be pushed downwards through it; and in such a case slender instruments may be used at first, when, as dilatation goes forward, they may be gradually increased in size. Catgut probes (bougies) have sometimes been used on these occasions—or steel ones have been preferred—and in other examples attempts have been made to overcome the obstructions by injections of water conveyed through a small syringe, recommended for the purpose by Anel, whilst in rare instances a column of mercury has been used with a similar object. From my own limited experience with these slender instruments of Anel's, I cannot express great confidence in their use; and Mr. Tyrrell seems to think them of but little service. Mr. Morgan has recommended a curved steel probe for the examination of the nasal duct, when it is made from below.

Supposing there is no opening in the sac at the inner canthus, and that an operation is deemed necessary to restore the proper course of the tears, it may be performed in the following manner: The patient being seated, the surgeon, standing behind or in front as he may choose, should, with his left hand, put the tendinous cord already alluded to on the stretch, and then push a sharp pointed bistoury into the sac immediately below this cord; this being done, he should next elevate the blade a little, to make room for a probe or style, which he should thrust through the opening in the skin into the sac, and from thence along the nasal duct into the lower part of the nostril. The position of the knife is exhibited in the accompanying figure (203); it will be observed that it is almost in a straight direction downwards, the upper part of the blade resting, as it were, over the notch in the supra-orbital ridge. The orifice in the skin may be of the same extent as the breadth of the blade, or the latter may be so managed, if it is desired, as to make it somewhat more. I have found in this proceeding some difficulty in passing the probe into the lachrymal sac; especially, when the knife has been withdrawn altogether; therefore, I recommend, that the point of the instrument should, although elevated a little, still be left in the sac until the probe is introduced along its flat surface. After the point of the latter has been introduced, it may even then be troublesome to carry it into the nostril; sometimes it will pass down the sac, at other times along its side; occasionally I believe it perforates the bone, and in other instances it is purposely passed through the osseous texture wherever

Fig. 203.

that can be conveniently done, and directly into the nostril, though the os unguis may be found the most eligible. Although in general it will be desirable to pass the probe through the nasal canal, it is perfectly proper, on some occasions, I conceive, to make an opening into any part of the nostril which seems most appropriate. The probe that may be used on the occasion is a common silver one; but it would be well at once to use what is termed a style, which is a short probe, of a length sufficient to reach from the orifice in the skin to the inferior nasal fossa, and having at its upper end a button-like head, to prevent it slipping altogether within the passage. This instrument may be slender at first, and thicker ones can be introduced afterwards, so as to dilate the opening gradually. A full-sized one may, however, be used at once, and retained or withdrawn according to circumstances. It is customary to keep this style in the duct for several weeks, during which the tears will flow partly by its side into the nostril, and partly, perhaps, over the eyelid, or from the orifice in the skin; then perhaps it may be withdrawn, when the tears will flow entirely into the nostril; it may, however, be found necessary to continue its use for a longer period, and occasionally it must be kept in ever afterwards. If removed, the orifice in the skin usually closes within a few weeks, although it continues open in some instances; and when there is a copious supply of tears, a drop or two will now and then escape; if worn constantly, it is customary to blacken the button-like head, or to have it coloured like the neighbouring skin. The style is usually made of pewter, which answers as well as silver or any other more costly metal. Sometimes instead of this solid probe a tube is introduced, of such length that it passes fairly within the duct under the skin, where it is intended to remain permanently. Mr. Tyrrell states that he has found such a plan to succeed very well.

Instead of the probe or style I have in some instances first introduced the point of a director along the side of the blade, and then have conducted a style down upon its groove. Dr. Lubbock, of Norwich, has proposed using a steel needle made for the purpose, something like a director, but having a sharp point, like that of the exploring needle referred to at p. 18, and that this should be thrust into the sac at first, instead of a bistoury, when the style can be immediately and with ease carried downwards along the groove. In using any of these instruments, the surest proof that the nostril has been reached is, that blood flows in this direction; but sometimes, to make certain that the point is fairly through below, a probe is passed into the nostril, and made to touch the one introduced from the sac.

On the eyeball itself several operations may be required on the living subject, but these can scarcely be practised on the dead. I shall here make brief allusion only to such proceedings, as works devoted solely to ophthalmic surgery must be consulted for more copious details.

Already the manner of making scarifications on the surface of the eyeball has been referred to (p. 437). Sometimes the surgeon's in-

terference is required for the purpose of removing foreign substances which get between the lids and ball, or actually penetrate the surface of the latter, such as particles of dust, insects, grains of powder, scales of iron from the blacksmith's anvil, &c.; but other rules than those which a knowledge of the anatomy of the organ, the use of instruments on such delicate textures, and ordinary mechanical principles will indicate, do not seem to require notice here. Sternutatories, and all means likely to excite a copious secretion of tears, may be of much service, by causing the latter to wash the mucous surfaces. Raising the eyelids, using a syringe and tepid water, a camel-hair pencil, or forceps, will usually ensure success.

If a cataract has to be removed from the axis of vision, the proceeding may be effected in various ways:—that by couching is, perhaps, the most common, and may be accomplished on the living body in the following manner:—The patient should be seated on a chair with a back sufficiently high to permit his head to rest against it, and an assistant should be instructed to keep it steady. Then the surgeon should sit or stand in front, according to the height of the seat on which the patient rests: next he should place the fore and middle finger of his right or left hand, as the case may be, upon the margin of the lower eyelid, and whilst pulling it slightly downwards should apply gentle pressure upon the globe with their points, and at the same time the assistant who holds the head should elevate the upper lid by a somewhat similar position and use of his fingers: thus these being opposite to those below will serve to keep the cornea uncovered and the ball itself steady: then the operator should pass the point of such a needle as that referred to afterwards into the interior of the eye by piercing the sclerotic about a line's breadth from the cornea on the outer side of the globe and nearly on a line with the commissures: a slight plunge is required to pass the instrument through the tough tunic, but as soon as it has entered it then passes readily along behind the iris, and when the point is visible through the pupil (which should have been dilated by the previous application of belladonna) it can then be placed against the opaque object, which may now be treated according to circumstances: if the lens be soft the instrument must be carried across it in various directions, and several portions should, if possible, be detached and pushed forwards into the aqueous humour either in the posterior or anterior chamber: if the cataract be hard, then the needle should be pushed against it in such a way as to force it downwards and backwards into the vitreous humour: if it is thrust almost straight downwards, without any other change of position, the proceeding is usually termed depression; if laid backwards so that its anterior surface is placed uppermost—reclination is the term to denote this manœuvre, and in either instance it will be observed, that the object is to make a clear passage for the rays of light towards the retina: this being done the instrument should be withdrawn, the eyelids closed, the patient kept quiet in a dark room, and every care taken to avert injurious inflammation, for a severe action of this kind

is what is chiefly to be dreaded after the operation. In two or three weeks, provided everything has gone on favourably, the light may be gradually admitted, and in the course of time the sight may become so perfect that the smallest print may be distinguished.

Here is an occasion where ambi-dexterity (p. 7) may be useful, although it is not absolutely requisite. If the operator is in front of the patient, he may use his right hand on the left eye, and his left on the patient's right globe: if, however, he has not confidence in using the left, he can stand behind the patient and then use the hand with which the necessary movements are most easily made. In every instance the little finger should rest against the malar bone, and thus the double object will be obtained of giving great steadiness to the hand, and permitting it to follow any slight movements of the patient's head, although every care should be taken to keep the latter as steady as possible. It is for this purpose that I recommend the high-backed chair, as being preferable to the breast of an assistant, although the latter is very frequently selected. Sometimes the patient is laid on a table face uppermost, and thus whilst greater steadiness is, perhaps, secured, the operator can use his right or left hand at will.

The needle which I prefer for such a proceeding is that commonly called Scarpa's; it is spear-pointed and slightly curved, and, in my opinion, answers as well as any other. Perhaps it may be more troublesome to disentangle it from the cataract after it has been couched, than the flat-shaped point of Saunders's instrument, although here I cannot speak from my own experience, not having used the latter on the living subject. With Scarpa's, however, I have noticed both with myself and others, that the cataract was occasionally raised slightly in withdrawing the point; but even in instances where the needle has separated readily I have often seen the lens rise again and require an additional push downwards. On this account it is well not to remove the needle entirely until it is seen that the opaque object continues in its new position.

The lens may be removed from the axis of vision by pushing the above instrument, or any other of a convenient sort, through the cornea and pupil, but there is an objection to this on account of the scar that might be left in the transparent cornea, and the greater risk of injuring the iris: the bad effects of the former might be avoided by keeping the instrument near the circumference of this part, but the iris would always be more or less in the way, and, moreover, no particular advantage seems to attend the proceeding to induce a preference over the other.

In general it is troublesome to get the eye so perfectly still as to enable the operator to pass the point of the needle into the exact spot he may wish, but when once it has perforated the sclerotic the globe is, as it were, fixed on the needle, and can thus be kept perfectly steady, however restless it may have been before.

Sometimes it is preferred to extract the cataract through an opening in the cornea, and the operation may be done thus:—The patient

being laid on his back, and the head, eyelids, and eyeball fixed in the manner already described, the surgeon, with his right or left hand as he may choose, passes a Beer's knife across the anterior chamber from one side of the cornea to the other, and by carrying the blade onwards, its back being about midway between the upper and under edge of that part, he divides one half of the circumference of the tunic, and thus makes an opening sufficiently large to permit the escape of the lens. To facilitate the latter object it is generally requisite to introduce a couching needle, or other such slender instrument, through this wound, and to touch the capsule of the lens in such a manner as to make an opening sufficiently large to allow the cataract to be forced through with a slight pressure on the globe; when this is done the pressure may be still further continued, until the opaque substance passes through the external incision. Possibly it may appear advantageous to pass a little scoop, or curette as it is called, behind the lens to expedite its escape. When this has been accomplished, and it is seen that the iris has not slipped through the wound in the cornea, the edges of the latter should be carefully placed in apposition, the eyelids closed, and the treatment afterwards conducted as in the instance of couching, being modified of course by circumstances.

It is evident that the knife in an operation of this kind can only be passed from the temporal margin of the cornea. It has been proposed to touch the front of the capsule with the point of the blade as it is being carried across, but there is a risk in so doing of the aqueous humour escaping, and as it does so, of carrying the iris against the sharp edge of the knife: it is therefore, perhaps, better not to attempt this, for in all cases, even when this is not done, the difficulty will be great enough to avoid this part. To lessen the danger it is necessary before operating to see that the iris has been opened to its fullest extent by the influence of belladonna. The section of the cornea may be made either on the upper or lower margin, some having preferred the latter as being most convenient, others the former, as the aqueous humour does not escape so readily, either at the time of the operation or afterwards. I need scarcely say that all the aqueous humour escapes with the lens, or probably before it is started from the capsule, and moreover, that if the pressure be not cautiously applied, part of the vitreous humour also may be squeezed out, possibly even the whole of it, as has happened,—when of course the organ is completely destroyed. Some (Mr. Guthrie for example) seem to put little importance on the escape of part of the vitreous humour,—indeed the gentleman whose name I have mentioned seems even to fancy that the loss of a portion of it is rather an advantage. Most authorities, however, appear anxious to inflict as little injury on the organ as the necessity demands. Immediately after the operation the cornea appears somewhat wrinkled and of a milky colour, but if all goes on favourably a full amount of aqueous humour is soon secreted again, and the cornea resumes its tenseness and transparency.

There are various other operations connected with the eyeball which

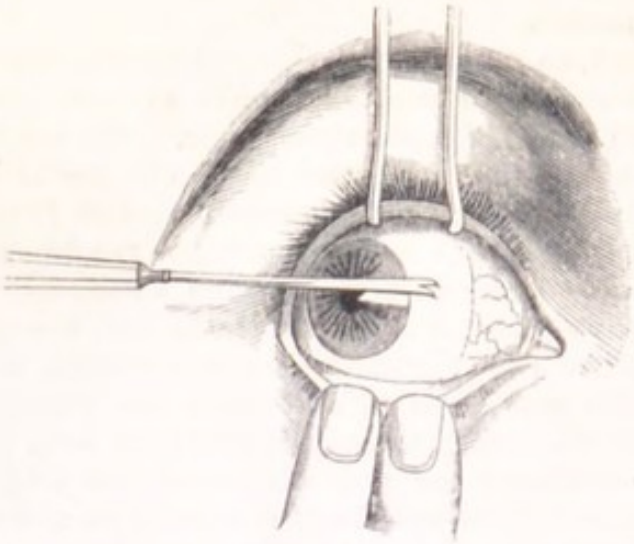
my limits will not permit me to dwell upon. The removal of foreign substances from the surface, the mode of using the lancet in dividing enlarged vessels—as in chronic inflammation, the manner of dissecting off a pterygium, of separating an encanthis, of removing a staphyloma, of making an artificial pupil, and conducting various proceedings on the iris, are all treated of at length in works devoted to ophthalmic surgery, but which, in a work such as this, where the use of the fingers and instruments forms such frequent subject of consideration, may on that account be omitted, to make room for other and, perhaps, more important matters.

One, however, I must not pass over without description, that is, the operation for strabismus, regarding which so much has been said, written, and done, within the last three years. The merit belongs to Dieffenbach of having discovered, that division of one or more of the muscles of the eyeball permits the others to restore it to its natural position ; thus, in strabismus convergens where the inner side of the cornea approaches or is concealed by the plica semilunaris, division of the internal rectus allows the other muscles to give the globe a more natural balance ; and so in that form termed divergens, the section of the external rectus puts all to rights. Since the principle has been established an infinite variety of modifications have been proposed and executed, and considering the zeal with which the subject has been cultivated, the success of the operation, its advantages and simplicity—both as regards its performance and results, it seems strange that such a condition as a confirmed squint should now-a-days ever be seen.

The operation may be done thus: Supposing that the right eye is affected with convergent squint, the patient should be seated on a chair, the eyelids should be held open with the fingers, or what will be better for the upper lid a Pellier's elevator should be hooked under it, and then a small double hook (made expressly for the purpose) should be passed into the sclerotic, or through the conjunctiva at all events, about a line's breadth from the inner margin of the cornea, both of these being held by an assistant ; the eye should then be drawn slightly outwards ; the surgeon standing in front should now seize, with well-pointed forceps, a fold of mucous membrane at the inner canthus, and with scissors such as those represented at p. 6, the points not being so sharp, however, he should divide the conjunctiva in a vertical direction as is represented in the next drawing, (fig. 204,) so as to make a wound about half an inch in length between two and three lines from the cornea: the tendon of the internal rectus will thus be laid bare and can then be divided with the same instrument ; next the hook should be removed, the forceps loosened, when if it be found that the eye is straight, and can no longer be turned towards the nose, the operation may be deemed complete. If, however, the squint still continues, the eye must be again fixed and the scissors re-applied, when some remaining fibre, which probably kept the organ in its wrong position, will be divided, and then all will be right. It may even yet be necessary to cut again, and some of the fibres of the

superior rectus have been divided on such occasions, with probably part, if not the whole, of the superior oblique. It has rarely happened that the squint has not been relieved in such instances, but in some the internal rectus of the other eye has been divided. Notwithstanding the proximity of the eyeball, as also extensive exposure of the sclerotic, it has seldom occurred that serious injury has

Fig. 204.



been done at the time, or that bad results have followed. I have myself seen one instance only where injurious inflammation and sloughing ensued, and have heard of a case where the sclerotic was punctured, though doubtless more damage may have been done than has come to light.

The same instructions may answer for almost every form of strabismus; but many other modes of operating have been preferred: thus, instead of scissors a small curved knife has been used to open the conjunctiva, then a curved director has been carried behind the tendon, which has been divided by running the knife along the groove; or sometimes the tendon has been elevated on a blunt hook, and then cut with a knife or scissors; but I shall not attempt to describe all the modifications that have been proposed, and shall only state my conviction, that the operation may be well accomplished in half a dozen different ways at least, and with as many different instruments; each, or all, being selected more, perhaps, to please the fancy of the operator, than from possessing any remarkable superiority.

CHAPTER VII.

OPERATIONS ON THE NOSE AND NOSTRILS.

THE skin of the nose in some individuals increases so much in thickness as to become a prominent swelling (Lipoma) which, besides its unseemly nature, causes great annoyance from its size and weight, for sometimes the top of the organ becomes so large that the possessor cannot see straight before him without turning the head to one side, and can neither eat nor drink without being obliged to hold the offending part out of the way. Such a condition may be easily remedied by paring away the redundant material, and leaving only the cartilages and some condensed cellular texture upon them. The wound in such a proceeding must heal by granulation; and, provided that neither too much nor too little has been taken away, a most respectable looking feature may still be left. Sometimes the morbid growth is entirely on the apex, at other times on one ala, and it is seldom otherwise than of a most ruddy hue. No rules need be given about such proceedings: the thickened parts may be dissected off in one mass or piecemeal, at the convenience of the operator: the finger should be introduced into the nostril to keep the surface steady, and at all times a good deal of bleeding may be expected, which will, however, cease with the application of cold.

Mr. Hey has related the history of a case of this kind, and among modern surgeons I believe that Mr. Liston has had a full proportion of such operations.

A deficiency of this organ is of more common occurrence than a redundancy, and, unlike the latter,—which among certain novelists, poets, and poetasters, has been rather a theme of admiration; its appearance is generally so unpleasant that the individual who has been unfortunate enough to be "curtail'd of this fair proportion," whether by disease, accident, or otherwise, is usually willing and anxious to submit to whatever may be thought likely to improve his facial aspect. It may be a question with both patient and surgeon in what manner this can be done,—whether it shall be by means of some artificial substitute of wax, wood, ivory, pasteboard, or other material, or that it shall be effected by a kind of transplantation of skin from a neighbouring part. If the latter is preferred, the surgeon is more immediately interested, as the work of restoration lies entirely with him. Supposing that the apex and alæ have been completely destroyed, or have sunk in such a manner that they cannot again be raised, a substitute for them may be made in the following manner:—The patient being seated, the surgeon first takes a portion of soft leather and cuts

it with scissors to the size which may be thought best, and of a shape such as the space within the dotted lines on the forehead in fig. 205:

Fig. 205.

next he lays this upon the brow and carries a scalpel round it down to the periosteum, leaving a portion of skin at the root of the nose untouched: this flap should be raised by dissecting close upon the periosteum, and then be allowed to lie with the cut surface exposed to the air until other steps have been accomplished. Now the knife should be carried in the course of the dotted line in the figure, down the sides of the old nose, and a deep groove should be made by keeping close to the bones, or even by paring out a portion of the skin: the cut surfaces should be carefully sponged with cold water, and should the blood continue to ooze, the whole must be exposed to the air for some time longer. When all bleeding has ceased, the flap must be turned down,—its root being twisted half round, so that the cuticle may still be kept outermost: the edges must then be accurately applied to the wounds on the face, and retained by two or more

stitches on each side. At this time the flap will be flat and loose, but it should now be raised by stuffing in portions of lint, until it projects to the full extent. A stitch should then be introduced at the lower part of the gap in the forehead, the open surface above being left to heal by the second intention.

The above proceedings require a good deal of nicety on the part of the operator, and various circumstances must be carefully attended to. First, the flap should be so large that, at the period of the operation, and for some weeks or months after, it should seem to be more full than there is occasion for: in the course of time it will contract so much that at last, when the newly-made organ has acquired its permanent shape, its size will not be greater than may be required. It should be remembered that as soon as the knife is carried through the line on the brow the skin which it has circumscribed will contract a little, and therefore due allowance should be made for this also when the leather is being shaped, and as the cheeks separate when the wounds are made on the face, the knife should not be placed too far from the mesial line, for fear of making the base of the new nose too broad. Then, care must be taken that the root of the flap is not left too narrow for fear of a deficient circulation, and it should neither be twisted hard, nor compressed by the stitch between the eyebrows. In order to bring the flap down to a proper position, and to obviate stretching and pressure, the root will sometimes require to be slightly elongated by carrying the incision a little lower on each side.

The bleeding from the wound on the forehead will be copious; but ligatures will seldom be required. The gap is very considerable at first; but in the course of time, especially if care has been taken in the dressings, the cicatrix will not be very conspicuous. The stitches on the cheeks must be removed on the second or third day, when, in all probability, complete union will have occurred: the free edges of the flap will heal by granulation, and until cicatrization has become complete the part must be carefully supported with lint, which may be introduced in such a way as shall conduce greatly to the ultimate shape of the organ.

After the lapse of three weeks or a month, when all the sores have healed, the root of the flap should be cut across. It will be observed that as yet the skin immediately under this part has not been touched: now, however, an incision should be made, so as to admit the upper extremity of the flap, which for this purpose must be cut in the shape of a wedge: this wound having also healed, and when the vitality of the transplanted skin seems vigorous, a new columna must be formed in this way:—The patient being seated, and his head held back, the surgeon, standing behind, should pass the point of a narrow bistoury into the root of the upper lip, a little to one side of the mesial line, and cut downwards until the instrument passes the free margin: again he should introduce it at a corresponding part on the other side, and, by carrying it downwards in the same manner, a portion of the upper lip about three lines in breadth, will thus be detached, except-

ing at its upper end: here the frænum must be divided, and the lip so far separated from the bone as to permit the slip to be put into the natural position of the columna. Next two or three hare-lip pins must be used to bring the edges of the lip together, so as to exclude this mesial portion: then the extreme point of this (the red margin) should be cut off, and a suitable surface prepared for it with the knife, on the inside of the apex of the flap, where a small prominence has purposely been left, as indicated by the line on the figure 205: the two should then be kept together by a twisted suture, and so the columna is formed. The wounds must be treated in the ordinary way, a small portion of lint being kept in the aperture of each nostril.

Various modifications of these proceedings must be left to the discretion of the surgeon. If a small portion only of the original nose is deficient, the edges may be pared for the reception of the flap instead of a groove being formed in the cheek as above described. In some instances, when the original nose is sunk, the aperture into the nostril is not sufficiently large; a portion should therefore be cut out at any convenient period, and perhaps this will be most fitting when the apertures of the nostrils are under treatment, for here the knife may be required to scoop out or enlarge each. At all times, as much of the old nose should be preserved as possible, as it forms the best foundation for the superstructure.

The operation here described, in so far as regards the formation of the flap from the forehead, is similar to that done amongst the native Indians, and differs from that of the celebrated Italian professor, Taliacotius, chiefly in this respect,—for he took the flap from the skin of the arm. The latter proceeding I need not describe, as, in so far as I know, it is never performed in the present day. The formation of the columna is in the manner recommended by Dieffenbach, who, however, twists the part so that the cuticular surface may still be outermost. But this seems to be a matter of little consequence: the mucous membrane soon becomes callous, and to lessen the risk of strangulation of the slip, I give a preference to the mode above detailed, which has been recommended by Mr. Liston.

The figure on p. 450 is a likeness of one of my own patients on whom a flap was formed in the manner described. The sunken state of the nose was occasioned by ulceration within, resulting apparently from scrofula. All diseased action had ceased ere I interfered; but some months afterwards, when there was promise of an excellent new organ, the disease appeared again, and so far marred the effect.

My friend, Dr. Handyside, of Edinburgh, whose patient she became after I left that city, informs me, that she ultimately went from under his care with the ulceration entirely healed. "The new organ remained healthy and well, though somewhat insulated (towards the alæ) from the surface to which it had previously adhered." Had I waited a few months longer in this instance, and if the disease had re-appeared I should have declined operating, for it need scarcely be stated, that no such proceedings should be attempted

until there seems good assurance that the ulcerative process has terminated.

In some instances the apex and alæ of the nose seem so entire, although sunken to a level with the cheeks, that the propriety of thus covering them may be doubted. Instead of doing so, Dieffenbach has elevated the parts again, by slitting them into three longitudinal portions,—the outermost incisions being carried in the course of the lines on the cheeks in figure 205,—then he has pared the edges of the slips so as to make each narrower within than without, like the stones of an arch ; next he has dissected the cheeks from the nasal margin of each superior maxilla, fitted the wounds closely by interrupted sutures, and then kept the whole prominently forward with a couple of long silver needles passed from one cheek to the other : but this latter proceding will be best understood by a reference to the next figures.

A patient of mine (a young gentleman who had been somewhat vain of his personal appearance previously, and not without good reason,) was left after severe ulceration of the interior of the nose, in the condition represented in fig. 206, the columna and the cartilaginous septum had

Fig. 206.

been destroyed, and the vomer had separated by necrosis. Here I imagined that a modification of the proceeding of the Berlin professor might be advantageously resorted to, and accordingly proceeded thus: The patient being seated, the point of a small scalpel was introduced under the apex, and the alæ were separated from the parts underneath; next the knife was carried on each side between the skin and the bones, as far as the infra-orbital foramen, taking care not to interfere with the nerves, when by passing the point of my finger below the nose, I caused the latter organ to be as prominent as could be wished. I now pushed a couple of long silver needles, which had been prepared for the purpose, with round heads and steel points, across from one cheek to the other, having previously applied on each side a small piece of sole-leather perforated with holes at a proper distance; then I cut off the steel points, and with tweezers so twisted the end of each needle as to cause the cheeks to come closer to each other, and thus render the nose prominent. Figure 207 further eluci-

Fig. 207.

dates the proceeding. Thus, by bringing the cheeks more into the mesial line, a new foundation, as it were, was given to the organ.

Adhesion occurred in some parts, granulations in others; in the lapse of ten days the needles were withdrawn, and, in the course of a few weeks, when cicatrization was complete, the nose presented as favourable an appearance as could reasonably have been desired. Now a columna was formed in the manner already described, and at last I had the satisfaction of producing such a result as that exhibited in figure 208. Here matters were still further improved by the addition of an

Fig. 208.

artificial eye, to make amends (in some degree) for the loss of the original one, which had been destroyed by ophthalmia some years before.

Occasionally only a small part of the tip of the nose requires to be renewed, sometimes an ala, in others a columna; in one case the nose may be awry, in another the bridge may be depressed, and for all these conditions the art of surgery may be made available. I need not dwell on these topics, however, (indeed my limits will not permit me,) and shall refer those who wish for more particular information to the work of Dieffenbach (on the Restoration of the Nose), whose

skill in rhinoplastics seems to be such that he will repair or rear up this most important feature with all the genius of a Telford, and finish his handiwork with the Phidian touch of a Chantrey.

Occasionally in children foreign bodies, such as pickles of grain, peas, beads, cherry-stones, and such like objects, get into the nostrils, and require removal. I have known a cherry-stone remain for years, and the case supposed to be one of diseased bone. A probe, a small scoop—such as the handle of a director, (p 18,) a blunt hook, dissecting forceps, or instruments similar to those in the next cut, will seldom fail, if judiciously used, in furthering the extraction of such substances.

When polypi in the nostrils assume such a size as to cause annoyance, whether from altering the tone of voice, preventing respiration through these passages, from protruding through the anterior openings, or so pressing upon the soft palate and into the pharynx as to cause difficulty both in respiration and deglutition, they should be removed by operation. In general, such an instrument as that here represented, (fig. 209,) will enable the surgeon to effect his intentions, thus:—The patient being seated, the blades of the forceps must be passed into the nostril, one on each side of the growth, if possible, when they should be closed over its roots, and then withdrawn by a twisting, pulling-motion, so as to separate the disease from the mucous membrane above. In some instances this can be done readily, and with one application of the instrument; at other times it must be introduced again and again, when the substance is removed piecemeal; and the best criterion of the operation being complete is, that the patient can breathe freely through the passage. Sometimes it is necessary to repeat the proceeding in the course of a few weeks or months, as the ordinary simple gelatinous polypus, unless it be thoroughly removed, is almost sure to grow again.

Fig. 209.

In certain instances when the tumour is of considerable size a ligature may be most advisable: this being drawn tight round the root of the mass will cause its strangulation, when it will separate in the form of a slough. Whipcord, catgut, or silver wire, may be used on these occasions, perhaps the two latter are best from their elasticity, and either may be applied thus: A por-

tion twelve or eighteen inches long should be doubled, taking care not to injure its elasticity at the bend; this part should then be pushed along the floor of the nostril until it reaches the pharynx, where it will be allowed to expand; and now the point of the forefinger should be passed along the mouth into the throat, and so managed as to push the gut or wire behind and above the growth; when this is accomplished the ends must be introduced through a small double canula, which should be slid along upon them as high up as the root of the disease seems to extend, and thus the noose will be further upwards than the finger can push it: one end of the ligature may then be fastened to the ring at the side of the canula, and the other must be drawn so tight as to obstruct all circulation in the part: it may then, if allowed to remain, be fixed to the ring of the tube, and tightened from day to day, until the separation is effected. I have frequently used the ligature as thus directed; but have almost invariably drawn it through the mass which has, therefore, been removed at once, and I have never seen reason to dread the hemorrhage which some seem to apprehend on these occasions. Sometimes I have found the part so compressible, that it came readily through the nostril in front; but occasionally I have withdrawn it by the mouth, and when the projection behind is large it is well to be careful in case of its dropping into the lower part of the pharynx, or possibly covering the orifice of the larynx. If it could be effected with safety, I should on all occasions separate the part at once, instead of leaving it to slough; but, if the latter were deemed most eligible, I should prefer a silver wire to any other ligature, and choose it, too, before the forceps which have been recommended by Sir Charles Bell and others for the purpose.

When a polypus is very large in front so as to have caused absorption of the nasal process of the superior maxilla, the nostril may be slit open, and the disease extracted through the aperture by means of the forceps. I have known a growth six ounces in weight successfully removed in this way; and were it necessary the upper lip also might be divided. The edges of the wound must afterwards be carefully approximated, and immediate union encouraged.

The diagnosis of tumours of this description is seldom difficult; the object being generally observable, especially in damp weather, in the anterior part of the nostril. I have known a bend in the cartilaginous septum mistaken for one, and have also seen the thickened Schneiderian membrane supposed to be a gelatinous polypus. In some instances large growths of the kind, in the back part of the nostrils, above the soft palate, have been entirely overlooked for years. Twice I have seen soft tumours of the antrum attacked with the forceps, under the impression that the disease was, in each instance, confined to the nostril. One of these cases occurred to myself: there was no swelling in the cheek, nothing to induce suspicion that the disease was not a common nasal growth; the other was similar in appearance and history; in both as soon as the anterior part was removed, and it was

ascertained by the finger, as also from the appearance of what had been taken away, that the disease was not one to be treated in this manner, the proceedings were immediately given up.

Recently I saw a case of large polypus in the nostrils, under the care of Dr. Smith, at Fort Pitt Hospital. The tumour had been of several years' growth, and projected prominently on the face on each side of the nose. In each nostril a large mass could be seen, and a probe could be passed with ease below and on both the outer sides; but as doubts were entertained regarding the attachments in the middle and above, it was not considered advisable to resort to any operation. Some weeks after the patient died; and my former pupil and assistant, Staff-surgeon Dr. George Williamson, obliged me with an account of the dissection:—"The tumour extended from the ethmoid bone to the condyles of the occipital, and was also attached to both sides of the septum. Two large pendulous bodies hung down into the pharynx. The turbinated bones were absorbed, but the mucous membrane which contains them was entire. There was no attachment to the outer walls of the nasal cavity. There was a large abscess in the left anterior lobe of the brain, with an opening leading from it into the nose."

Plugging the nostrils for epistaxis is often a more troublesome process than might be imagined. The student may practise this on the dead body and should not neglect to do so. On the living or dead it may be done in this way: A piece of sponge or rolled lint, something larger than the end of the thumb, having a bit of twine or cord attached to its centre, with the two ends, eight or ten inches long, hanging free, should first be provided; then the end of a common silver probe armed with a long portion of ligature thread should be pushed along the floor of the nostril until it is seen in the pharynx: the thread should then be seized with forceps and drawn forwards through the mouth, while the probe is withdrawn from the nose: this thread should then be attached to the two ends of the cord around the plug, and these should next be taken along the mouth behind the palate and thence through the nostril until the plug to which they are attached impedes their further progress, by being arrested in the posterior aperture: now the ends hanging from the anterior opening should be separated: a plug similar to that already used should be laid between them, and then a noose should be made to keep it close upon the aperture, and a knot being secured the operation is finished. Sometimes stuffing the nostril in front will obviate the necessity for the posterior plug; but when the latter is deemed necessary it is always proper to apply one in front likewise. There is no additional pain: it acts as a kind of fixed point towards which the posterior one can be drawn, and, moreover, closes the nostril as effectually in front as the other does behind. Both nostrils may be plugged if required in the same manner, and, on the second or third day after, the pads may be removed. Sometimes it will be difficult to dislodge the posterior one,

and it may be necessary to push a bougie along the passage for the purpose.

It may be found difficult to effect the introduction of the thread with the probe, which will be barely of sufficient length, and if a small flexible bougie is at hand it will suit better; but what will answer best is a piece of curved elastic watch-spring concealed in a sheath something like a common catheter. At the point of the sheath there is a bulb with an eye in it which is attached to the spring, and when this is pushed along the nostril, after the end has been carried into the pharynx, it can be made to project into the mouth in such a way that a thread attached to the eye may be readily laid hold of, or if it is preferred the eye can now be threaded with a small cord attached to the stouter one on the plug, and the rest of the proceedings can be accomplished in the manner described above. Such an instrument is to be had in the shops.

CHAPTER VIII.

OPERATIONS ON THE LIPS.

In operations for hare-lip, if the fissure be single, the proceedings may be conducted in this way: If the patient is young (an infant) a cloth should be wrapped round the chest, so as to confine the arms; a pillow-case answers the purpose well, as the legs also can thus be secured by slipping the patient into it; then the child should be held by an assistant, with its head resting, face uppermost, between the surgeon's knees; if he puts on an apron it will answer the double purpose of keeping his trousers free of blood, and preventing the child's head from falling too low; a little pressure with the thighs will enable him to keep the head more steady than by any other means; a sharp-pointed scalpel, or, as I prefer, a narrow straight bistoury, should then be passed through the lip, immediately below the nose, at the margin of the fissure, and carried downwards, so as to cut away the round edge of the gap and the blunt angle at the mouth; if this slip is still attached at the nostril, it must be separated by the point of the knife, which should then be run down the opposite margin in the same manner, and with the same care that the angle at the lower part is completely cut off; if the textures are closely adherent to the bone they should be slightly separated, when the margins will be more easily and more accurately brought into apposition, which should now be done by means of needles, such as those described at page 34; the further steps of the operation, as to the application of threads, cutting the needles, removing them, and for the after-dressing, being such as have already been described in the chapter on sutures, at the commencement of the volume.

In the person of older growth, a sitting posture will be equally convenient; and here the surgeon may stand behind or in front of the patient, as he may choose. I myself prefer the former, being thus less exposed to the spluttering. On all occasions the knife should be introduced at the part nearest the nostril, for the lip will thereby be kept perfectly steady as the instrument is carried downwards. Sometimes, to secure the latter object, the margins at the mouth are grasped between the thumb and forefinger by the surgeon or an assistant, as may be most convenient, and thus at the same time the labiál arteries are prevented from bleeding. It is seldom, indeed, that the hemorrhage from these gives any trouble; no time need be lost in attempting to suppress it by cold or by ligature; for if the lowermost needle is passed in close contact with each bleeding orifice, the pressure of the opposed surfaces will effectually stem it. Two or three, or sometimes four needles (as I have found necessary) will be required, according to the length or depth of the wound.

Some operators have chosen scissors for cutting the edges of such fissures, and others have used a piece of wood or horn, on which the lip has been laid, and pared with a bold stroke of the scalpel; but for my own part, I prefer the mode above recommended. Unless the lip is transfixed, it will be difficult to keep it steady in any other way: the action of the orbicularis, the levatores, and the zygomatici, is often such as to pull the lip from between the fingers, scissors, or off the piece of board; whereas if the bistoury is dexterously used in the manner described, the action referred to rather adds to the facility with which the incision can be made, by drawing the parts in some degree against the sharp edge.

The dotted lines in the accompanying cut (fig. 210) point out the course of the incisions in an ordinary case of this kind,—a single fis-

Fig. 210.

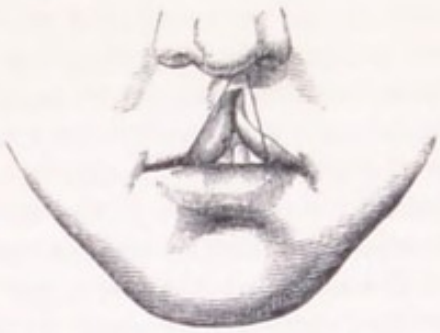


Fig. 211.

sure. Occasionally it may be necessary to extract one of the teeth, or perhaps two, to permit the edges being brought together; and in rarer instances a small portion of the jaw requires to be removed, with the cutting forceps. If this latter step be taken with young children, a heated iron should be in readiness, as possibly a vessel in the osseous texture may bleed more freely than might be desired in such patients;

of course, however, it should not be used unless the bleeding shows no disposition to stop.

In double hare-lip the lines of incisions, such as may in ordinary cases be required, are indicated in figure 211 ; but there will often be occasion for the surgeon to exercise his ingenuity and skill. Sometimes the centre slip is so narrow, and so thin from before backwards, that it may be well to remove it altogether ; at other times it may be advantageously carried upwards and slightly backwards, so as to increase the length of the columna, which is often, in this species of malformation, so short, as to add greatly to the flatness of the nose, which is sometimes very conspicuous ; in other instances it may be cut in the form of a slender wedge, which, while it separates the lips above, does not extend too far down to prevent them from coming into contact at the mouth. The alæ in the double fissure are usually so flat, that, in addition to the shortness of the columna already referred to, the nose can seldom be made such a prominent feature as when there is only a single fissure ; but even in the latter it is occasionally difficult to make both sides symmetrical. Some authorities have recommended that in the operation for double fissure only one should be operated upon at a time, and that the second proceeding should not be attempted till the lapse of some weeks at least. It seems to me, however, that the plan of closing both on the same occasion is decidedly to be preferred.

In all the operations for hare-lip which I have myself performed, whether single or double, I have never had reason to regret having cut away too much, but occasionally have wished afterwards that I had not been so sparing of the margins. This is mentioned for the sake of the young operator, who may probably feel, as I myself did, that he may not be able to bring the edges in sufficiently close apposition : on this score, however, he need be in no dread. If the needles are properly used, there is no necessity either for straps or bandages to keep the cheeks forwards ; and though occasionally a strap may be advantageously applied after the removal of the pins, to support the tender adhesions, even this may be dispensed with in many cases. It will, however, in general be judicious to protect the wound for a time in the latter way.

The period of life which I think most eligible for these operations is shortly after the child has ceased to suck, provided it seems in good health, and suffers in no way from teething. If he is allowed to grow up, he is usually very unmanageable until after the age of puberty ; but if possible the malformation should always be put right before this time, as there is a better chance of the jaw and nose assuming a good shape than after they have arrived at their full development. Indeed, there are so many advantages besides these,—as to speaking, appearance, &c., that it is wonderful why any surgeon can recommend delay in such cases after the first or second year of life. The proceeding may be effected at an earlier period ; I have myself operated at three months, and have in other instances seen the

child take the breast readily, with the pins still in the lip; but unless it be at the urgent desire of the parents, it may be well to wait for a few months. An erroneous impression (as I suppose it) prevails as to children being remarkably subject to convulsions while undergoing operations; and this is often urged as a reason for not interfering with hare-lips in early life. Doubtless convulsions have occurred in some of these cases, but similar effects have been produced in the adult, and by less formidable means, too. Sir Astley Cooper has referred to several examples of the kind, but I imagine they must be rare indeed. I once asked Dr. Abercrombie, of Edinburgh, the results of his experience on this point, and he could not bring a single instance to his recollection where convulsions could be fairly attributed to an operation. In my own more limited opportunities I have never seen a case of the kind, although I have performed much more severe operations on newly-born infants than that for hare-lip could possibly be: I here allude to cases of imperforate anus, where the gut has been deep, and when the proceedings have, in almost every respect, I should say, been equally severe as if for the extraction of a stone from the bladder.

Tumours of different kinds may form in these situations, many of which require no especial notice here. Lately I treated one of an encysted kind about the size of a hazel-nut on the inner side of the lower lip: a puncture allowed the escape of a straw-coloured glairy fluid: a collection again formed,—was treated in the same way, and after several similar proceedings a cure was the result. I have seen several such cases, and suppose them to be obstructed and dilated mucous follicles. But my chief reason for using the term tumour here is in consequence of the frequency with which malignant ulcers, in those advanced in years, are preceded by a scirrhous hardness. The red margin of the lip at last usually assumes a cancerous condition in such cases, and it is probably not till then that either the patient or surgeon takes serious alarm. Whilst I caution against heedless rashness in resorting to the knife in every case of suspicious character, I cannot but allude to the fearful consequence of unnecessary delay in such instances. In some respects an operation for a malignant disease must be considered as a last resource;—it is, indeed, all that the surgeon can do, but the phrase must be taken in a very different sense in such cases from that in which it is used with reference to amputations or the separation of foreign growths: for, as we know of no remedy but the knife for the removal of such affections, and that too before the neighbouring parts, such as the lymphatic glands under the jaw, become contaminated, the sooner an operation is resorted to the better. For further remarks on such subjects I must refer to the chapter on tumours, and shall here only state, that whilst I have seen numerous instances where both patient and surgeon have had reason to regret that a portion of the lip had not been removed at an earlier period, I have never seen an example where

it could be said that an operation had been unnecessarily performed. In one person who had an open sore on his lower lip on a hard basis for about two years, the surface cicatrized under the use of nitrate of silver;—six months afterwards, and while the part still remained whole, I was asked to remove a tumour from below the angle of the jaw, which was found during the operation to be a cyst containing a serous fluid: the disease seemed completely removed, but in less than two months a scirrhous hardness formed around the cicatrix, and ere long the patient died with great swelling and cancerous ulceration, such as are but too frequently seen in those in whom the verge of the lip has been removed after a too literal application of "the last resource."

Such conditions as those alluded to are usually found on the lower lip—the upper is rarely thus affected—and they may be near the corner of the mouth or towards the centre, sometimes so small that they might be covered with the tip of the finger; at others involving nearly the whole of the free margin. Incisions of this shape

will generally permit the removal of the whole disease, which will be comprised within the two lines: the surfaces can afterwards be brought accurately into apposition, and retained by one or two twisted sutures. Here I also prefer the bistoury, and generally transfix the lip below, although I am not so particular as with the hare-lip, for the fingers suffice to keep the parts steady. The labial artery should be secured by the uppermost needle in the manner recommended in the operation last referred to. When, however, nearly the whole lip is affected, as is here exhibited (fig. 212), if such incisions are made as those just alluded to there will be difficulty in bringing the edges sufficiently close, and although it is wonderful how much the soft parts will stretch on these occasions, it often answers well to cut the diseased surface away by means of an incision parallel with the margin of the lip. The part should be seized between the forefinger and thumb of the left hand, when the bistoury should be entered at one side and carried along between the sound and diseased textures until the separation is effected. Perhaps the labial artery at each end of the wound will require a ligature, or probably torsion may be serviceable here: in general, however, the stitches will suppress all bleeding. These should now be introduced by passing a fine needle (p. 29) from the margin of the skin to that in the mucous

Fig. 212.

membrane, and as each thread is tightened the two textures will be approximated, and thus a line of junction will be formed in the centre. Three, five, or seven stitches of the interrupted suture will probably be required, and by applying them carefully the union will be much more rapid and satisfactory than by allowing the cut surface to heal by granulation. At first, and for several weeks perhaps, the gap will appear considerable, but ultimately it will be far less conspicuous than might be expected. In instances of small ulcers, when the hard circumference has not been extensive, I have sometimes scooped off the part in this way, and afterwards the mark has been even less observable than in those where double lines of incision have been made as described in the preceding page.

Sometimes the lower lip is so extremely affected in these instances, and the portion requiring removal is so large that the saliva and mucus escape freely through the gap, and thus a most unpleasant condition ensues. Possibly some previous affection, such as the cancrum oris in children, may have left the chin in this state. Portions of skin have been transplanted from the arm, or from the upper part of the neck, and fitted into surfaces properly adapted for their reception; but several examples of such proceedings which I have observed have not impressed me favourably with their advantages. The skin is much more apt to slough here than in the reparation of the nose, and therefore should such attempts be made, the attachment of the flap must be left as broad as possible. On this subject, however, I must refer the reader to the works of the Professor of Bologna (Taliacotius) who seems to have been almost equally ingenious with his contrivances here as for those with which his name is so generally associated.

In one instance I succeeded in the following manner in improving a young man's appearance whose under lip had in early life been destroyed by ulceration. Two central incisor teeth, which projected forwards, were removed, and then a scalpel was carried close upon the periosteum of the chin so as to separate the cicatrix and the neighbouring parts from the bone: next I cut away the cicatrix by an incision of this kind, brought the edges into contact by stitches of interrupted suture, and thus covered over the gap which formerly existed, by bringing the soft parts from each side to supply the deficiency. The result was not altogether so perfect as could have been wished, as a part of the wound at the mouth fell open again; but, upon the whole, I was more satisfied with what had been done than if a flap had been brought up from the neck.

I was once asked if I could lessen the lips. A young man in whom these features were somewhat too prominent, importuned Sir George Ballingall and myself to do something for him, but we strongly ad-

vised him to rest contented. To this, however, for reasons which he did not choose to explain, he was not at first inclined, although he afterwards followed our advice. It was my intention to have cut a portion of a wedge-shape out of the thickened parts, immediately within where the lips join, about an inch and a half in length, a quarter of an inch or a little more in thickness at its middle, and tapering to each end: then I should have used stitches of interrupted suture, and doubt not that the patient would ultimately have been pleased. Any one particular about his personal appearance, and anxious for a *bonne bouche* of this kind, might certainly be gratified, although I should not in general be inclined to recommend any interference: nevertheless I shall take this opportunity of drawing the surgeon's attention to a very unseemly malformation called double-lip, which is characterized by a remarkable projection of the mucous membrane of the upper lip when the person who has it laughs, and which, in my opinion, might be very easily and effectually remedied by a proceeding similar to that above referred to.

CHAPTER IX.

OPERATIONS ON THE TONGUE, THROAT, EARS, PALATE, AND MOUTH.

VARIOUS operations may be required on and about the tongue. Among the latter I may allude to division of the frænum in children. Occasionally this part seems so short as to impede the free movement of the organ, and, usually when the child is at the breast, the nurse requests the operation to be done. For this purpose the common surgical scissors (p. 30) should be applied to the fold of mucous membrane close upon the symphysis: a division about an eighth of an inch will in general suffice, and there is no necessity for approaching the tongue so as in any way to endanger either the ranine veins or arteries. When the child is touched it will cry, and then, when the tongue is raised the scissors can be used: at this time the frænum is on the stretch, but to keep it thus, and also to prevent the mouth closing, the forefinger of the surgeon's left hand may be introduced and held against the lower part of the apex of the tongue

I have known the ranine veins punctured with a lancet in instances of cynanche in the adult.

An incision or puncture may sometimes be required in examples of obstruction of one or other of the salivary ducts. That of the parotid is rarely thus affected; but those under the tongue, especially that of the submaxillary gland, constituting the condition termed ranula, may require interference. Somtimes a hard concretion forms in one

or other of these ducts. I have one in my possession the size of a kidney-bean ; but more frequently the swelling, which is always more or less present, is occasioned by a collection of glairy straw-coloured fluid : in either instance the point of a lancet or bistoury will make way for the escape of the contents of the dilated duct, and afterwards, in all probability, the saliva will keep an opening for itself as it continues to flow into the mouth. Should this close and the swelling return, means must be taken, by cutting away a portion of the sac, and by inserting dressings into the wound, to prevent such an occurrence in future.

I have not witnessed any of the modern, so-called, operations for stammering, whether by division of the muscles attached to the genial processes, cutting wedges out of the tongue, or otherwise, and therefore, have had no experience in such matters.

Sometimes it is necessary to remove portions of the tongue for supposed scirrhous indurations or cancerous ulcers. Before resorting to mutilations of this organ it will be well to ascertain the effects of various local remedies and of constitutional treatment in such cases. The mucous membrane here sympathizes in a remarkable manner with functional derangement of the digestive organs, and often, when it may be least expected, a change of treatment will avert all cause of alarm. If the apex of the tongue is to be removed, it should be protruded between the lips, seized with hook-beaked forceps and divided by scissors or knife. The bleeding will seldom prove troublesome. If, however, the separation is required towards the middle of the organ, the dorsal arteries or the ranine may prove so, and a cautious surgeon will wisely prefer ligatures to the cutting instrument. He may proceed thus : The point of a needle in a handle, (p. 30,) armed with thin whip-cord, should be pushed through the tongue behind the seat of disease, and when the ligature at its eye is laid hold of by the fingers, the instrument should be withdrawn : next the cord should be cut, and then a firm noose can be tied on each side, so as to cause the disease to slough away. On the side of the tongue it is more difficult to accomplish such a proceeding, but when there is disease in this situation, unless it be limited indeed, it is seldom that the surgeon will interfere. I have known large portions of the organ removed with a free application of cutting instruments and no great trouble experienced from the divided vessels, yet, I think it would be well on all such occasions to take the chance of such an occurrence into consideration. Every one must have felt the trouble and difficulty of applying ligatures to the tongue after accidental injuries, whether for the purpose of securing vessels or approximating the edges of wounds. In one instance I secured the dorsal artery by passing a tenaculum deep into the muscular fibres and casting a noose of strong thread under the convexity of the instrument. The vessel had been wounded by one of the upper incisors, and had bled for ten hours.

M. Jules Cloquet has removed a portion of the tongue through an incision between the symphysis and the hyoid bone, and my excellent

predecessor, Mr. Arnott, has related (Med. Chirurg. Trans. Vol. XXII.) an instance, in which, by a similar proceeding, he successfully separated a very large part of the organ. A free opening was first made in the skin and other textures, and then ligatures were applied to cause strangulation and sloughing.

The uvula sometimes requires that a portion of it should be removed. When from chronic elongation its point falls upon the epiglottis or upper orifice of the larynx, it excites troublesome cough and otherwise may do much harm ; and supposing that astringent applications have proved of no avail, the patient being seated in a good light, his head secured on the back of a chair or held on the breast of an assistant, the free end should he seized with beaked forceps, a sharp hook or some such instrument, and then with a pointed bistoury or with scissors the apex should be removed. It is a good precaution to lay hold of the part previous to division, else it might drop into the larynx.

The amygdalæ occasionally are permanently enlarged : the condition gives rise to difficulty of swallowing, sometimes even of breathing, change of voice, hoarseness, deafness, and other ailments, and in the event of constitutional remedies and local applications having proved of no service, either as regards the state of the mucous membrane or tonsils, then a portion of one or of both glands should be removed. The proceeding may be accomplished thus: — The patient, seated as in the former operation, should be desired to open the mouth as completely as possible, when the swollen part should be seized with a volsellum with the claws set on one side of each blade as here represented, (fig. 213,) when, with a curved probe-pointed bistoury, (p. 67,) the requisite incision should be made between the claws and the side of the pharynx. The opposite tonsil must then, if required, be treated in the same manner. It will rarely happen that the bleeding does not cease in the course of a short time with the contact of the air and the use of cold water, or, in other instances the application of powdered alum. I have known a solution of creosote answer when the latter had produced no benefit.

Fig. 213.

When the left side is the seat of operation the surgeon can easily use the volsellum in his left hand and the bistoury in the right, but if the opposite tonsil is affected, unless he possesses more ambi-dexterity than most men, he may not so readily hold the

instruments in different hands: he will probably find it most convenient to hold them as above directed, and cut with the hands twisted across, the left being under the right.

I prefer such an instrument as that represented in the figure on the preceding page for these operations; but a common sharp hook, single or double (p. 9), or a tenaculum may be used. Sometimes I employ a forceps with claw-points made longer than those referred to at p. 27, and slightly bent at the ends, so that whilst the one tonsil is grasped, the convexity of the blades is in the other side of the mouth, and the view is neither obstructed nor is the instrument in the way of that which is to be used for cutting. Numerous ingenious contrivances have been devised for removal of portions of the tonsils, (many of which may be seen in the shops of Mr. Simpson and Mr. Weiss,) but I give a decided preference to those above recommended. The bistoury is, in my opinion, superior to scissors, although I occasionally use the latter; the blades should be rounded at the points, slightly curved, and the whole instrument should be sufficiently long to reach the throat with ease. When a bistoury is used, its heel should be wrapped round with a few turns of surgeons' lint, so that the lips may not be cut. Sometimes this instrument is carried through the swelling from above downwards, at others from below upwards, as may be done according to the taste or convenience of the operator.

Scarifications are sometimes made in the palate or fauces in severe inflammation, but such manœuvres require no special notice. Sometimes abscesses require to be opened here in examples of acute cynanche. For such a proceeding I use a long, narrow, sharp-pointed bistoury, with its heel and blade enveloped in lint to within half an inch of the point, as this saves the necessity for having a lancet set in a sheath, which some have recommended for this purpose.

At all times in cases of deafness the condition of the mucous membrane of the pharynx merits attention, for when there is much chronic thickening in this situation, the Eustachian tube will probably not perform its functions with full effect. But besides attending to the throat in such cases, the external ear should be carefully examined. Here collections of wax, pellets of cotton which may have been unwittingly allowed to remain, insects, seed-pickles, pebbles, and such like, may obstruct the passage: chronic inflammation may cause thickening of the lining membrane: there may be granulations projecting from it in the form of polypi, or possibly acute inflammation and abscess may have ended in caries or necrosis of part of the neighbouring bones. The ordinary principles of surgery will serve to point out the routine of practice in most of these cases. Syringing frequently with tepid water will often be of great service, but sometimes it will be necessary to resort to the use of instruments to extract foreign substances, or remove excrescences. There may be some danger in attempting to separate diseased or dead bone here, and the surgeon should have a good idea of its limits before using any violence. On one occasion I extracted, with the common dissecting forceps, a cap of brass, such as is often put

on the end of a pencil, which had been impacted for twenty-four hours; and in another, I removed with the scoop-end of a director a small, flat-shaped pebble, which had pressed on the tympanum, and caused deafness for ten years.

In modern times the cleft palate has been treated by Roux, Graefe, and others, in the manner of a hare-lip, *i. e.* the margins have been pared and brought together by interrupted sutures, so as to produce union by the first intention;—thus closing the fissure, and making the palate as if no such malformation had ever been present. In the pamphlet which Roux published on this subject many years ago, a variety of instruments,—needles, *porte aiguille*, &c., are described—but most of them may be dispensed with in my opinion. Staphyloraphe (as the operation is termed) may be done thus: The patient should be seated in a good light, and his head should rest on the breast of an assistant: the surgeon should then seize the portion of the uvula on one side of the fissure, with hook-beaked forceps (p. 27), draw it slightly forwards, and then carry a probe-pointed bistoury from the posterior border of the velum to the anterior part of the fissure in the soft palate, so as to make a clean-cut raw surface on its margin; then the other side should be treated in the same way: next a needle, set in a handle (p. 30), armed with a thread of the ordinary size for the interrupted suture, should be passed from below upwards on one side of the cleft, about a quarter of an inch from the margin: the thread being seized with forceps and pulled forwards, the needle should be withdrawn, re-threaded with the same end as before, and then pushed from above downwards on the other side of the fissure, at the same distance from its cut surface: two, or perhaps three, threads being introduced in the same manner, each should be tied in such a way as to keep the edges in close approximation, and the ends being cut off, the operation is accomplished.

Various modifications of this proceeding may be deemed advisable; thus, the threads may be introduced before the incisions are made: the latter may be effected with scissors instead of a knife: each needle may be introduced from above downwards, but all of these matters may be left to the discretion of the surgeon. I need scarcely say, that such an operation can be done only in the soft palate; but should the fissure extend further forward, as it often does, more especially in instances of hare-lip, the aperture in front can be afterwards closed with an artificial palate. Unless the patient is remarkably steady and determined to permit the operation to be finished, it will be needless to attempt it; and as such fortitude is not to be expected before the age of puberty, it will seldom happen that the surgeon's services are required before this period. Even when he has finished the proceedings in a most satisfactory manner, he must not be over sanguine of a fortunate result. Every precaution must be taken to prevent movement of the palate; the patient should partake of a meal immediately before the operation, and for the first two days should only swallow a little liquid, which he should allow to pass into the pharynx with the smallest pos-

sible drag on the stitches: at other times he should not permit the saliva even to pass backwards. The stitches should be carefully cut out (p. 32) on the second or third day, and on no account whatever should he partake of solid food, until all risk of the wound tearing open has passed away.

When a person grows up with this malformation, he, from custom, feels but little the physical inabilities of the part: he usually can swallow well, although perhaps when a child some of his food and drink would occasionally get into the nostrils. The first case in which Roux operated affords as good an example of the annoying nature of the defect, and the efficacy of the proceeding, as any that could be adduced. A young medical gentleman, with a tone of voice similar to that of those who have lost the soft palate by disease, asked the professor if anything could be done for him. Staphyloraphe was the result; and when the patient returned again among his friends, he was so greatly improved that (in so far as his voice was concerned) he could scarcely be recognised as the same individual.

The lower jaw occasionally becomes so closely bound to the upper, that the teeth cannot be sufficiently separated to admit of solid food. This condition may arise from inflammation and adhesion of the gums, more especially after necrosis of the alveolar processes: sometimes it is the result of chronic contraction of a muscle; occasionally it has been accompanied with anchylosis both here and in other joints, of which there is a remarkable specimen in the possession of M. Dubreuil, of Montpellier, in which however a similar condition was not present in any other part of the same skeleton; and in certain examples it is difficult to say what is the cause. Some years ago I had a patient with the mouth thus contracted, and in whom there was a portion of the lower jaw in a state of caries: the disease was not in such a condition that I could, with propriety, attempt its entire removal. A portion of bone, however, was excised, but little benefit resulted, and what there was might probably be attributed more to the use of a kind of screw-dilator, than to the partial removal of what I considered a source of irritation. Mott has succeeded in two instances in relieving such permanent adstrictions; and in the first volume of "The Provincial Medical and Surgical Journal," there is a case recorded wherein I was fortunate enough to produce a similar effect by dividing the masseter on one side with a narrow knife, passed from the mouth between that muscle and the skin. If anchylosis be the cause of closure, it is doubtful if the surgeon would be justified in interfering.

CHAPTER X.

OPERATIONS ON THE JAWS.

THE jaws and other bones of the face are subject to caries and necrosis. Perhaps caries is most frequently seen in the upper maxilla and contiguous bones,—necrosis oftener in the lower jaw; and the surgeon may occasionally show both great skill and dexterity in removing such sources of irritation. Such proceedings are usually very simple, although sometimes the sequestrum in the latter is so large as to cause the operation for its extraction to be almost as formidable as for the excision of a portion of the bone for tumour. If possible the diseased or dead portions should be removed through the mouth; but sometimes, especially in the lower jaw, free external incisions are absolutely necessary. I have seen the whole of one side of this bone, from the mental foramen to its neck, removed in a state of necrosis; and recently I extracted a very considerable portion of the base of this bone, being at the same time obliged to divide the facial artery. The swelling in such cases is usually very alarming to the inexperienced, but it soon subsides after the operation.

Abscesses (gumboils) frequently form in the vicinity of the alveoli, which for a time usually occasion considerable pain and swelling. I deem it good practice in these instances to make an early and rather free incision, as, besides the relief thus given, there is less chance of the matter getting into contact with the bone, in which event caries is not unlikely to be the result.

Tumours of various kinds form in connexion with the mouth and jaws. They may be on the gums, or in the bones; but when large, it rarely is otherwise than that both are more or less affected.

The term epulis is generally used to denote tumours of the gums: such growths are invariably of a sarcomatous character,—at one time the mass is soft and spongy, at another of a more solid kind,—probably medullary, and in rarer instances a melanotic deposit occurs. At first there is, perhaps, only a small spot on the outer or inner side of the gums, but gradually, unless the surgeon interferes, the neighbouring parts are involved, until at last the disease becomes extensive—implicating perhaps the whole alveolar processes in the vicinity, and even some of the more solid textures beyond.

The hard parts of the jaws are in some instances primarily affected: here the swelling may consist of solid bone—a kind of exostosis, or, it may be an osseous cyst containing a glairy or a serous fluid,—in one example it may be a mixture of spiculæ or laminæ of bone,

with the interstices filled up with a sarcomatous substance—the latter being in one case of a semi-cartilaginous character, and in another, of a soft, pulpy, medullary nature. At first the gum will not be affected; as the growth increases, however, particularly if it is of a soft character, the teeth become loose, and fall out, the gums swell and ulcerate, and then an ill-conditioned sore is formed, from which there is a most offensive discharge.

In the lower jaw one or other of these forms of disease is far from being uncommon. In the instance of epulis, however benign the growth may appear at first, the surgeon should not hesitate to propose its removal; for, although examples will be occasionally met with where the unhealthy action seems to cease, the greater number go on from bad to worse, and a more serious proceeding is ultimately necessary than would have been required at first. Once I saw a tumour of this kind, about the size of a walnut, connected with the gum within the incisor teeth: the patient had nearly gone her full time with child, and I did not, therefore, advise its immediate removal, although this might have been very readily accomplished, as it was attached only by a small neck: in the course of a few weeks after, she rubbed it off with the point of the tongue, and was never further troubled. Cases of epulis seldom terminate so favourably, however, and some energetic means (more so, even, than the female tongue) must be resorted to. The pain and uncertainty of caustics are, in my opinion, sufficient objections to such remedies, unless when the disease is very limited: in general it will be best to remove it by the scissors or knife; and, should the textures around be in a suspicious condition, it will be wise to remove them too: the cutting forceps may be required if the alveoli are implicated, and here the shape indicated by figure 14 (p. 12) will be found of great utility.

If the swelling is more in the body of the bone, it will not be so easily managed. Supposing it to be an osseous cyst, and that the surgeon has ascertained this by touch, or with an exploring needle, which may be advantageously used in some of these cases,—possibly by making a free opening between the gum and the cheek, thus allowing the fluid to escape, then stuffing the cavity with lint, and treating it as we should an abscess, the walls may gradually contract and consolidate in a firm cicatrix. Perhaps in some such instances a seton passed across the cavity might be of equal avail.

Such a case may, however, not go on so satisfactorily. A loose spongy mass may form in the place, or possibly it may be found that the bone around is in a condition in which a cure cannot reasonably be expected from such treatment. In other instances, the surgeon may see from an early period that a more formidable proceeding will be requisite. Now, the only course will probably be to remove a portion of the jaw throughout its whole thickness; but if this can be avoided, —if the base of the bone can be preserved, an attempt should be made to do so. I once succeeded in this object in the following manner: The patient, who had a malignant (melanotic) affection of the gums

and alveolar processes in the mental portion of the maxilla, was seated on a firm chair, and an incision was made directly downwards from each angle of the mouth, as low as the base of the bone: the lip and soft parts between these wounds were then dissected towards the neck; next, the posterior bicuspid tooth was extracted on each side, and a slight notch made with the saw, such as is delineated on the next page; the same instrument was then applied in a horizontal direction midway between the alveoli and the base, and, a notch being made, the cutting pliers (fig. 14, p. 12) completed the separation. The external wounds were then brought together by the twisted and interrupted sutures, a piece of lint was laid along the cut surface of the bone; union occurred on the face, granulation and cicatrization within,

Fig. 214.

and a perfect cure was the result. The above drawing (fig. 214) exhibits the part which was removed. I heard of the patient years after, and he still continued well.

The great advantage of such a proceeding is, that less deformity results than when the entire depth of the chin is cut away: the sides of the bone are prevented from falling inwards, as they invariably do in the other case: the jaw, in short, was left as if all the front teeth had dropped out,—just as may be seen in aged persons,—and there was sufficient foundation to affix a saddle with false teeth, had the patient chosen, whereby the lip would have been supported in its natural position. I have been induced to allude to this case, both because such a mode of operating is less generally known than by perpendicular division of the entire thickness of the bone, and also from supposing, from what I have myself seen, that it might be advantageously adopted in some instances where more severe measures might be contemplated. The steps above described might be more troublesome towards the back part of the alveolar ridge, yet by judicious incisions externally they might be accomplished in a satisfactory manner.

In certain cases it is absolutely necessary to remove the base as well as the alveoli, and, supposing the disease to be in the mental portion

of the bone, the proceeding may be accomplished thus: After the first incisions have been made as above directed, the flaps should be dissected from off the inferior margin, and then a notch with the saw should be made in a perpendicular direction on the anterior surface of the bone: next the straight-cutting forceps should be applied,—one blade within the inner table, the other in the groove,—and the bone be divided: then the soft parts within — the digastric, part of the mylo-hyoid, the genio-hyoid, genio-hyo-glossus on each side, and mucous membrane—being cut across, the separation will be effected, and the wound may be dressed as already described, or as circumstances may indicate. To make room for the blade of the forceps being applied within, it may be well to run the knife up at that part so as to clear a space; but, unless the forceps be large and coarse, this step need not always be attended to. The bleeding, probably, will not be at all troublesome: possibly each labial artery may require a ligature; but the twisted suture, which should always be used at this part of the wound, will usually compress them.

Instead of dividing the bone as above recommended, a chain-saw has been used for the purpose by some operators. The instrument is delineated in Dr. Jeffray's work on the excision of carious joints; but, notwithstanding the success with which it has been used by such a high authority as Mr. Cusack, I give a decided preference to a small dove-tail saw, (p. 10,) or to such a one as is here represented (fig. 215).

Fig. 215.

A similar instrument has been advantageously used by Dr. Warren in many of his operations; and, to one accustomed to cut with such tools, there is no difficulty in notching the bone in the manner directed. The handle is about three inches and a half long, the blade the same, and may be a quarter, a half, or a whole inch in depth. A back is required, as the plate is very thin, on purpose to permit the teeth being twisted outwards as in a properly-set saw.

It has been remarked, that when the attachments of the tongue to the chin have been divided, the organ has been suddenly drawn back so as to endanger suffocation: the point should therefore be kept steady by an assistant, who can use his fingers, forceps, or hooks, as may be required; or, what answers best of all, a thread should be passed through the apex, and a loop being cast, the part can thus be kept in a proper position. This appears an additional severity; but it is a

wise precaution, and in my opinion should not be omitted, particularly in operations where larger portions of the bone are removed.

In dressing the wound within the mouth, care should be taken, by inserting a due quantity of lint, to keep the sides of the bone from falling inwards: the internal pterygoids and the remaining portions of the mylo-hyoids will conduce to this effect, the disadvantage of which is, that besides causing the deficiency at the lower part of the face to be more conspicuous, it removes the teeth from the line of those above. Mr. Nasmyth of Edinburgh contrived a simple and ingenious instrument to obviate this change in position: it consisted of a double silver case to contain the upper molars and those below, which was made to fit on previous to the operation, when the jaws were nearly closed. This machine was used by Mr. Liston on several of his patients, and answered the desired object. It is perhaps, however, best adapted, or at all events most necessary, in instances where the whole of one side of the maxilla has been removed.

The latter object may be accomplished thus:—The patient being seated as in the preceding operation, and supposing the portion of bone about to be removed to extend from the angle near to the symphysis, the knife should be carried down the lip from about its centre to the lower margin of the chin, when it should be run along the base of the bone as far back as the angle, and then slightly turned up along the posterior border: the flap thus marked out should be turned upwards by dissecting it from the tumour: next an incisor tooth should be extracted,—perhaps the last molar also,—and the dovetail saw, or that exhibited on the preceding page, should be used to effect a fissure in the bone in front and behind the disease, when the forceps should be applied as already directed, and the separation will be completed by dividing the attachments of the soft parts within, viz. the mylo-hyoid, part of the internal pterygoid, perhaps, and the mucous membrane.

In the incision below the jaw the facial artery must be cut: the knife, however, may be so lightly carried over this part, that it need not be divided until the flap is being raised, when it can be secured with a ligature, or commanded with the finger of an assistant: in the latter case, a thread must be applied ere the wound is closed. It is not likely that any other vessel will prove troublesome. When the knife is swept boldly along the base of the bone, this artery is sure to be divided, and occasionally, as I have seen, the gush of blood is very copious; yet even in such a case I have found at the end of the operation that a very diminutive stream continued: whether large or small, a ligature should invariably be applied; for if it is not, bleeding is almost certain to ensue when the patient gets warm in bed and recovers from the immediate shock of the operation.

A flap might be made by passing the knife in a horizontal direction parallel with the teeth from the angle of the mouth to a little above that of the jaw, and another downwards in the course of the symphysis, but the external wound might thus be too small, and the cicatrix

would be more conspicuous than that following the incision above advised.

Sometimes disease is so situated that the angle of the bone, with a considerable portion—perhaps the whole—of the ascending ramus has to be removed. If a small part only of the latter is affected, the incisions already described—at all events carrying that over the posterior border a little higher—will permit the application of the saw and forceps. The bone in this situation is somewhat harder than in front, and from this circumstance, as also from its position, there will be greater difficulty in using either of these instruments. The shape of forceps indicated in figures 15 and 16 (p. 12) will be serviceable at this part. When the jaw is interfered with here, the proximity of the external carotid must be remembered.

If the disease extends so high as to approach the neck of the bone,

Fig. 216.

it will probably be best to disarticulate. The tumour may be small or large,—may involve little in front of the angle,—include the whole of

the body on that side, or possibly even the chin and a considerable extent further round. Supposing it to be of a size such as is last represented, (fig. 216,) the proceedings may be conducted in the following manner: The patient being seated as for the other operations, the knife should be carried from the lip downwards, backwards, and upwards, as indicated by the dotted line on the drawing: the facial artery being secured in the manner already indicated, the bone must be divided in front with saw and forceps, as also described in a preceding page, when the mass must be drawn outwards (to one side), so as to permit the point of the knife being carried along its inner surface: the anterior attachments of the tongue, (supposing division of the bone to have been effected further round than the symphysis,) the mylo-hyoid, the mucous membrane, the internal pterygoid, the masseter, the temporal, the external pterygoid, and, lastly, the lateral ligaments and synovial capsule should all be divided successively, and so the separation will be accomplished.

If the tumour is small, in all likelihood the articulation may be in a natural condition; but under such circumstances, as the mass will probably be tolerably firm, it can be advantageously used as a lever, whereby the action of the temporal muscle may be opposed, the coronoid process drawn downwards, and the condyle, in a manner, twisted out, after a slight application of the knife to such ligamentous fibres as are thrown on the stretch. In one instance in disarticulating on the living body a solid bony tumour, I found that the condyle actually separated from the periosteum on its inner side, and this part of the proceeding was therefore accomplished with great facility. If, on the other hand, the tumour is larger, the mouth may have been kept open for some time before, and the temporal muscle may therefore be easily reached, while the stretched state of the joint may possibly enable the separation of the condyle to be readily effected. In such a case the lever force is not so much to be trusted to, as the growth will probably be so soft as to tear across: this I have seen happen a little below the neck of the bone, where the large mass separated, and the condyle with the coronoid process, and some remaining portions of disease, were then dissected away.

Sometimes the cutting forceps have been used on the coronoid process and neck of the bone, and the parts above have been left. I should in general, however, prefer removing them as being a simpler proceeding, and not in any way causing either additional pain or danger to the patient. One authority has recommended that the joint should be opened in front; another that the knife should be entered behind; for my own part, I should begin here at any point which seemed most convenient. The main source of apprehension regarding this step of the operation has been the proximity of the internal maxillary artery; but there need be far less dread on this score than many have imagined. If the point of the knife is kept close upon the bone the vessel can scarcely be touched; and should it actually be divided the bleeding can be readily restrained with the finger, until a ligature

can be cast around it. When the condyle and neck are separated, the artery lies in a large wound, whose depth is not so great as to prevent the orifice being seized with forceps, or transfixed with a tenaculum; but if the operator thrusts the knife deep behind the ascending ramus, so to wound this vessel, the root of the temporal, or perhaps even the external carotid itself, and is afterwards awkward and slow in effecting the removal of the bone, the bleeding might be very copious. To avoid such a danger, it may probably be best to proceed from before backwards; and as in this way the temporal muscle should be separated from the coronoid process, there will thus be less difficulty in effecting that process of twisting which I have recommended.

Besides the external maxillary artery, which must of necessity be wounded, the transverse facial branches must be divided by the vertical part of the incision over the ramus: these will bleed profusely for a minute or two;—probably ere the wound is closed not one may require a ligature; but here, as in all other parts of the body, it is well to act on the safe side, and better, therefore, to apply two or three ligatures too many than one too few. The most of the branches of the portio dura will also be divided, and the features will be drawn to the opposite side in a conspicuous manner, though ultimately this condition will become less observable.

A fold of lint, small in proportion to the size of the tumour which may have been removed, should then be placed in the wound; over this the edges should be approximated, and held together by stitches of interrupted suture, a needle and twisted thread being, however, kept in the end of the wound at the margin of the lip. Some straps may be of advantage, by closing the gaps between the threads; and here, perhaps, the isinglass plaster may be advantageously used, as it is less likely to cause irritation than the common resinous adhesive kind. The saliva from the divided ducts of the parotid, and also from the sublingual and submaxillary glands, may be allowed to take its own course: perhaps it may flow into the mouth; possibly it may ooze in whole or in part through the wound at various points; but, in the latter event, the external apertures will ultimately close, though in some instances not till the lapse of several weeks.

Everything before, during, and after the operation, regarding the proper position of the portion of jaw which is to be left, the tongue, the dressing of the wound, &c., &c., must be attended to and conducted according to rules already laid down.

I have recommended the sitting posture as being most convenient, for the blood is thus permitted to escape from the mouth. Sometimes a patient will faint, and must then be laid on his back,—indeed, whether or not it is always best to do so as soon as the disease has been removed. It has often happened that these proceedings have been retarded by sickness and vomiting; and, considering their severity, I need scarcely point out the propriety of having wine at hand contained in a vessel (such as a teapot), with a spout of sufficient length to permit the contents being poured into the back of the mouth.

The accompanying drawing (fig. 217) represents the profile of a girl, from whom I removed a considerable portion of the lower jaw by

Fig. 217.

disarticulation, nearly six years ago. My friend and former assistant, Dr. Richard Mackenzie of Edinburgh, writes me regarding her present condition as follows:—"The features are slightly twisted, but little or no paralysis exists. It appears as if the portio dura had not been divided. She can wink with either eye, and turn the mouth with nearly equal facility to either side. The lower incisors are drawn considerably behind those of the upper, but she can push the chin forwards so as to bring the opposite teeth nearly into contact. The portion of the jaw which was removed is supplied by ligament, and the divided end of the bone cannot be distinctly felt."

Since 1812, when Dupuytren first removed a portion of this bone, the operation has been very frequently repeated, and with admirable success. The chin, the part sustaining the molares, the ramus, one half of the bone, two thirds, and even the whole from condyle to con-

dyle, have been separated. Among British surgeons few have done as much in this way as Mr. Cusack of Dublin: Mr. Liston has also operated in numerous cases; and Mr. Syme, in the last edition of his Principles of Surgery, gives a drawing of an enormous growth in this situation, "one of the largest, if not the largest, which has been removed in this way." The tumour weighed many pounds, and its separation was attended with signal success: years after I saw this patient in excellent health, and a high stock covered the deformity so well that the loss of so large a portion of the maxilla was scarcely observable.

Tumours of the upper jaw may, like those last referred to, be connected with the gums, the alveoli, the harder portions of the bone, or possibly with the interior of the antrum: indeed, making allowances for the differences in position, shape, and other physical characters between this and the lower maxilla, there is considerable resemblance between the diseases of each.

Occasionally abscess forms within the antrum, which is accompanied with great pain until an opening is made through the outer wall by means of a small trochar and canula. There may be some difficulty in detecting the presence of matter; for, unless there be a considerable accumulation, and that for some time, too, the cavity will not alter at all in shape. In some instances, however, the outer (or anterior) wall may bulge forward, and fluctuation may actually be detected, in which case there need be no hesitation about making an opening at the most convenient part, either with a stout knife, punch, or trochar, as may be deemed best; but when the matter is encircled with firm bone, the condition may not be altogether so distinct, although from the general œdema in the cheek, the intense throbbing pain in the antrum, and perhaps rigors, the surgeon may generally suspect the true nature of the ailment. Under such circumstances, he will seldom do wrong if he puncture the cavity immediately above the first or second bicuspid tooth. Before doing so, however, it will be best to extract any stumps or diseased teeth immediately below, as possibly the inflammation and suppuration may be at the root of a fang. With stumps removal should at once be resorted to; but if a tooth is sound, or tolerably so, it may be a question as to whether it should be removed or not. If there is great tenderness on pressing upwards it should be extracted.

Sometimes in suppuration here the alveoli become carious, and portions of them require to be removed, but no particular instructions about such operations seem at present required.

A variety of circumstances will regulate the character of any operation which may be necessary for tumours in this situation. On all occasions, whether in the lower or upper jaw, every care should be taken to make the external wounds, if any such be requisite, of a size so small and in such a position as to produce the least possible amount of disfigurement afterwards. At the same time the operator should not hesitate to make a free external opening should this seem needful

at first or afterwards found necessary, and though it is impossible to place them where they will not afterwards be seen, the disfigurement from such wounds is wonderfully little, more especially if compared with the projection occasioned by large tumours in this part of the face.

So far as my own experience enables me to judge, I should say that small tumours connected with the gums and alveoli can be more readily removed from the lower jaw than the upper, without the necessity of any wound in the lips. In the vicinity of the incisors this may readily be done by the application of the knife and forceps, but further back any attempt of the kind will be attended with great trouble to the surgeon, and probably much pain to the patient, in consequence of the stretching of the mouth and the necessity for more frequent application of the forceps than might be required were there a freer external opening. Supposing an operation demanded for a growth of the size of a walnut or larger, situated towards the anterior part of the maxilla, and there being an evident necessity for a larger external aperture than the natural size of the opening of the mouth, it may be accomplished in the following manner :—The patient being seated and his head supported by an assistant, or against the back of a chair, an incision should be made with a scalpel or bistoury from the margin of the upper lip to the root of the ala ; then the mucous membrane and cheek should be dissected off the tumour as far upwards and backwards as its bulk renders necessary ; and possibly to effect this the external wound must be carried a little higher in a line straight upwards from that already present : then an incisor tooth and a bicuspid or molar must be extracted, and the point of the knife carried through the mucous membrane of the hard palate and every soft texture which it can reach, where it is intended to effect the separation : next the small saw (p. 474) should be applied to notch the alveoli in front and behind, and it may be well also to make a groove above the tumour with such a blade as this (fig. 218) (similar

Fig. 218.

to that usually termed Hey's, or those figured in Scultetus) which from its limited length, and also from the narrowness of the stalk between the blade and the handle, can be more readily used on such a part : then the cutting forceps should be applied, and the separation may thereby be completed. The different shapes of forceps already so frequently alluded to (p. 12) may be of great service on such an occasion, as, from the manner in which the blades are bent near the handles, they may be applied to some parts more conveniently than those which are straight.

If the tumour is solid throughout, the whole mass must, if possible, be included in these sections; or if any part remains, it must be cut away with the forceps or gouge. Sometimes swellings of considerable size form in the alveoli here, which contain fluid of a serous character: if, therefore, there is any reason to suspect one of this kind, it might be advisable, as a preliminary step, to puncture it through the gums with a knife or trochar, and should the disease prove so, it may be possible to cut away a portion of the anterior wall of the cyst without interfering with the lips at all. I have seen one instance where this might have been advantageously done. The nature of the tumour was mistaken, however, and only discovered during the steps of the operation after the external incision had been effected. In this instance the crown of an incisor tooth was found in the upper and back part of the cyst, a circumstance which I have twice observed in such operations on the adult living body. Were a cavity laid open in the manner above referred to, the future treatment should be conducted in the manner already described for similar cases in the lower jaw.

In puncturing a tumour it is possible that but little resistance might be offered to the progress of the instrument after the outer shell had been perforated, but it would be wrong to conclude on that account that it was a cyst: it might be a soft gelatinous mass, or one of a medullary character,—in the gum, alveoli, or possibly from within the antrum, and in such cases there need be no hesitation about the propriety of removing the entire disease, supposing it to be within reasonable reach.

The size of the tumour may from the first make it apparent that more extensive incisions than those yet described will be required. The swelling may not only protrude in front, but it may be observable in the mouth and in the nostril, and by the elevation and protrusion of the eyeball it may be apparent that it also extends upwards: there will in many instances be difficulty in appreciating the extent of the disease backwards, whilst in others there can be none in perceiving that it protrudes into the posterior nares and occupies the upper part of the pharynx. It will often be a nice question to determine in how far the tumours are malignant or otherwise, and even when such a conclusion is drawn, the further question as to the extent of their surrounding attachments may demand serious consideration. As to certain of these features the reader is referred to the chapter on tumours; but there are many circumstances connected with the growths under consideration which demand some separate consideration here. Most of such cases seem to have their origin in or immediately about the antrum, and when the growth is actually within, the cavity will, in all probability, be filled ere there are any external symptoms, and when therefore it does protrude in any of these directions in which it is first most readily detected, the chances are, that it will also have encroached more or less on the posterior parietes. But it is often difficult to ascertain the exact origin of the

disease; for though it may to all appearance occupy the whole of the antrum it may be connected with only one or other side of its circumference. Fortunately, in the greater number of cases it will be in front; it may, however, be behind and above; again in others it may involve almost the entire extent of the superior maxilla, and in all, as it increases in size, the external projection will become more and more apparent. Softness and rapidity of growth are, in my opinion, most indicative of malignancy in such cases; and if combined with these the limits are indistinctly defined, and there are constitutional indications of such a growth, the disease is evidently one of a serious character. If, on the other hand, the swelling is hard and slow of increase; if the distinctions between it and the surrounding parts are apparent; if the person seems otherwise in good health, and in nowise disturbed by the swelling excepting by the inconvenience resulting from its bulk, then there may be every reason to suppose that it is benign in character. But, as already stated, there may be doubts about its connexions behind and above, and now possibly the history of the disease may throw some light on this feature; for, if the swelling has first become conspicuous in front, and then gradually extended backwards along the palate, and upwards and inwards to the nostril, whilst there has never been deep-seated uneasiness, or pain, or feeling of obstruction in the back part of the nasal passage, there will be good reason to suppose that it has no intimate connexion with (*i. e.* that it does not involve) those structures. Even yet, however, the surgeon should not be contented, and before giving a decision should pass a probe along the nostril and ascertain if it projects behind, and should also carry the point of his finger behind and above the soft palate so as to make a careful examination there too, and if he finds no swelling, or only a round solid mass similar to that in front, with a fissure (however small) between the tumour and the base of the cranium, he may be well assured that the growth involves only the superior maxilla, or at most part of the palatine, spongy, and malar bones.

But cases occur which in their early stages the most experienced may be uncertain about, and growths will sometimes project of a great size externally, whose deeper connexions it may be impossible to ascertain until an operation is performed. Sometimes, however, enormous tumours will protrude on the face from the upper jaw, when, nevertheless, the hard palate, especially the palatine plate of the palate-bone, the inner walls of the antrum, and the floor of the orbit, are so natural in condition, that it is impossible to deem the growth deep-seated. In the museum at Fort Pitt there is a specimen of a large osseous shell connected with the anterior wall of the antrum, which, doubtless, on the living body, must have produced a hideous appearance, in which, however, maceration shows that almost the entire of the hard palate, the inner, upper, and posterior walls of the cavity are in a natural condition. But perhaps few cases so well illustrate the enormous magnitude which such tumours will sometimes attain without

involving the deeper parts of the bone, as that referred to and delineated in Mr. Liston's Practical Surgery, where the diseased mass extended from the eyebrow to below the level of the lower jaw, and yet the textures behind were not implicated; for the entire disease, weighing several pounds, was most successfully extirpated, and, in my opinion, with greater facility too, than I have observed with others of a less formidable size. In Dupuytren's collection of diseased bones there are several remarkable examples of large growths in the superior maxilla, some unconnected with the parts behind, others extensively so, and some involving a considerable portion of the frontal; some of these are exhibited in the published catalogue of the preparations; but indeed there are few museums now-a-days which do not contain examples of the kind.

Supposing a tumour connected with the upper-jaw of a larger size than that for which I have yet described an operation, and that a proceeding of the kind is necessary, it may be accomplished in the following manner: The patient being seated with his head as previously described, an incision should be made from the margin of the upper-lip towards the nostril, and then from the ala, as high as within half an inch of the inner canthus of the eyelids; next the cheek should be laid open from the angle of the mouth (or near it) as far as the zygomatic process of the malar bone, and, if necessary, an incision at right angles with this one should extend from the external angular process of the frontal bone, towards the neck of the lower jaw; now the flap between the nose and the wound in the cheek should be dissected from off the tumour, and turned upwards on the brow; then that portion of the cheek below and behind the wound should be turned downwards, and the mucous membrane divided, so as to expose freely the interior of the mouth. The extent of the disease being now more appreciable, provision may be made for the application of the saw and forceps. An incisor tooth, perhaps two, may be extracted, and then the mucous lining of the hard palate should be cut a little to that side of the mesial line on which the disease is situate, as far back as the soft palate, at whose anterior margin a transverse division should be made between that just effected and the back of the last molar tooth; then with one or other of the saws already referred to (p. 481) the alveoli and palatine plate of the superior maxilla should be notched,—almost divided,—from below upwards, when the cutting forceps should be used to complete the separation. But before the saw is laid aside, the operator should ascertain what may be required above; for if the malar bone is sound, and also the orbital plate of the superior maxilla, they should both be left; and for this purpose a notch must be made across from the nasal process of the latter to the outer margin of the former, and then the forceps should be used, first to complete the division between the mouth and nose, next to cut through the nasal process of the superior maxilla, and then to pass along the horizontal groove already made with the saw, below the orbit. If, on the other hand, it is found impossible to save any portion of the os malæ or of

the floor of the orbit, the saw need not be used after its duty has been fulfilled on the hard palate; but the forceps, after having succeeded it here, must then be applied to divide the nasal process of the maxilla between the nostril and inner side of the orbit, then to the zygomatic process of the malar, and lastly to the frontal or orbital process (as may be found convenient) of the same bone, when the tumour should be forcibly depressed with the fingers, so as to cause it to start from its place; this being accomplished, a few additional touches with the knife will serve to divide the remaining soft textures, when the separation will be completed. If the orbit has to be opened in this manner, of course it will be requisite to make a slight dissection, to permit the eyeball and its appendages to be held out of the way of the forceps and fingers.

In operations for small tumours, the surgeon has been recommended, in making the wound on the surface, to stand in front of the patient; but in applying the saw, it will usually be best to stand behind, and in the operation last described he must change his position too; indeed, he must move about in such a way as to suit his convenience; for the surfaces are so irregular, whether in a natural or diseased condition, that he is obliged to do so, else he will cramp the movements of his own hands.

The incisions through the cheeks are generally followed by profuse bleeding, but it soon ceases from the small vessels, and the facial can be commanded at first with the fingers and afterwards with a ligature. The vessels behind never give trouble, unless part of the tumour has been left after the larger mass has been removed; and in such a case the actual cautery may possibly be required. I once saw Sir George Ballingall use several large balls of heated iron here, in an instance where he removed a large growth from the site of the antrum, when a portion of it was found to be so deep, that it was deemed advisable to endeavour to destroy it in this way, and when, moreover, the hemorrhage was so copious that the cautery was considered requisite to stem the flow. It has occasionally been the custom to tie the common or the external carotid before proceeding to attack such growths, but experience has proved that this is altogether unnecessary. Before the branches of the internal maxillary reach the back of the tumour, they are so small, that when cut or torn across the escape of blood is trifling.

It is scarcely necessary to observe that in the early part of the operation the infra-orbital nerve is cut as it passes out of its canal: at the latter stage, as the tumour is being turned out, the nerve should be divided at the back part of the floor of the orbit to prevent its being dragged or torn. Nor need I do more than remark that, as the gap is now great between the tongue and the eyeball, it is necessary in dressing the wound to stuff the cavity with lint: this being advisable both to assist in restraining bleeding, as well as to keep the eyeball from falling too low, and the cheek from sinking too much in. The wounds on the surface must be accurately brought together by

the interrupted and twisted suture, and as the interior has to heal by suppuration and granulation, the subsequent treatment must be through the opening of the mouth.

Fig. 219.

The accompanying drawing (fig. 219) exhibits the face of one of my patients, with the lines of incision. The tumour, though sufficiently large to cause great deformity (rather more, in fact, than is here represented), was far from being of that magnitude at which they occasionally arrive. It was fortunately of a hard description, more, in fact, like an exostosis than what is usually called osteosarcoma, and although firmly fixed, in consequence of the thickened state of the surrounding processes of bone, was successfully dislodged, and months afterwards the girl's appearance was as represented in the next likeness (fig. 220). The patient was under my care in King's College Hospital; her case was published in "The Lancet" for February and March, 1842; and now, after the lapse of eight months her countenance is still further improved.

Operations for the removal of tumours connected with the upper jaw are by no means so modern as some seem to imagine. Such a

proceeding is said to have been accomplished so far back as the seventeenth century ; and about the middle of the last one White, of Man-

Fig. 220.

chester, removed a large growth from this situation. The disease was of a soft character, interspersed here and there with spiculæ of bone, and such as from its external appearance and history, the modern surgeon would not feel much inclined to interfere with. It "occupied the greater part of the left side of the face, extending from the lower part of the jaw to the top of the forehead, and from the furthest part of the left temple to the external canthus of the eye," the latter organ "being thrust out of its orbit, so that it lay on the temple." The tumour was partly cut, torn, and scooped away; and, although "the optic nerve was denuded as far as the dura mater, and this membrane, and the pulsations of the brain were apparent," and though the patient "was so incommoded by the fœtid matter flowing into her mouth, that she was obliged to lie on her face several weeks, to prevent suffocation," she ultimately made an excellent recovery, gaining at the same time the use of her eye. These proceedings were,

however, very different from those which characterize what may be called the modern operation. Instead of cutting into the mass, the surgeon now usually cuts beyond the disease, just as when he is removing a malignant growth elsewhere; for, although he may feel assured that, strictly speaking, the disease must be so, he generally acts as if it were, more especially as in many instances it may be difficult to decide the question, and accordingly then he selects for division the processes of bone on the circumference of the tumour, and thus removes the whole, or the greater part of the maxilla at the same time. Dupuytren claimed to be the first to propose and execute this operation, but beyond a doubt it was first performed in this country by Mr. Lizars in 1826: since then it has been frequently repeated by our own countrymen, and in all parts of the world where surgery is cultivated. M. Gensoul's name also stands high in the modern history of the proceeding; but such operations have now been so often and so successfully accomplished, that I need not refer to other names on the present occasion.

I believe that there are few matters of importance which have been omitted in this section on the Head and Neck. Of what is usually called Dental Surgery I have made no especial mention; nor have I dwelt at much length either upon the Eyes or Ears, as the treatment of the affections of these organs is in many respects deemed each a separate department of surgery; and what I have omitted otherwise may, I imagine, be easily understood by any one versed in a knowledge of anatomy, and the principles of surgery. For example, chiefly in consequence of the arrangement fóllowed with reference to the face, I have had no proper opportunity of making allusion to division of the branches of the fifth pair of nerves as they issue from the respective foramina above and below the orbit, and on the chin. Any one acquainted with anatomy can have no difficulty in effecting such proceedings by subcutaneous incisions, and a knowledge of pathology and surgery will sanction the use of the knife, when it is found that the painful disease, tic-douloureux, resists all other means. Indeed, the affections of the nerves in this situation appertain so much to the practice of physic, that I have almost purposely omitted any notice of them. To show, however, the student the value of a correct knowledge of anatomy, whether he intends to be physician or surgeon, I shall, besides recommending to his attention Sir Charles Bell's work on the subject, refer to a case which has lately been in King's College Hospital, under the care of my colleague, Dr. Todd. The patient had lost all power of raising the upper eyelid on one side (the affection termed ptosis), and in addition had no power in moving the eyeball, excepting in performing abduction of the organ. Here one ignorant of the groundwork of pathology, anatomy, would have been totally unable to account for the lively action in this direction, when a first year's student might perceive that, whilst there was an affection of the third pair of nerves, as indicated by the paralysis of three of the recti and levator palpebræ muscles, the sixth retained its functions, and gave power to the external rectus.

PART V.

OF THE CHEST, ABDOMEN, AND PELVIS.

CHAPTER I.

CHEST.

DISSECTIONS. DISLOCATIONS. FRACTURES. OPERATIONS.

THE chest presents fewer features of interest to the surgeon than most other regions of the body. There are no points of surgical anatomy which may not, on a glance or thought, be appreciated by any one acquainted with what is usually called descriptive anatomy. To follow out the arrangements of other parts of this volume, however, I shall make a few observations on the dissection of this region, and then on those matters of surgical interest which I deem worthy of notice on such an occasion.

The mode of dissecting the broad muscles behind and in front has already been described in the section on the Superior Extremity, and supposing that the deeper examination is now contemplated, it may be conducted in the following manner:—The subject should be placed on its face, with a block under the chest, and the remaining muscles on the back of the spine may be examined. The sacro-lumbalis, longissimus dorsi, spinalis dorsi, will be easily displayed; but before they can be seen, the serrati must be cut across with the aponeurosis extending between them; and in the lumbar region the strong tendinous structure, from which the latissimus dorsi may have already been separated in the dissection of the upper extremity, should now be laid open, to expose the united portions of the sacro-lumbalis and longissimus dorsi. The slips, in connexion with the upper ends of these (cervicalis ascendens and tranversalis colli) may next be displayed, as also, the lower part of the complexus; but as these, with the semispinalis, the multifidus, and other smaller muscles in this situation, present no remarkable features of surgical interest, it is not necessary to occupy space upon them at present. Now, however, that the posterior aspect of the

spinal column is in a manner cleared, the ridge formed by the spinous processes from the seventh cervical vertebra (v. prominens) should be carefully traced with the eye and finger, and it may be well, also, to remove the whole of the muscles to ascertain how the spinal marrow is protected behind. It may then be perceived that in the dorsal region the laminæ, and oblique position of each spinous process, completely close in the canal in this situation, but that it is more or less open in the spaces between the laminæ elsewhere.

The subject being now laid on its back, the cartilages of the six superior ribs, with the exception of that of the first, should be divided close to the ends of the bones, and the sternum along with them should be raised from below upwards; to effect which, the cartilage of the seventh rib should be cut in an oblique direction towards the mesial line: the upper ends of the recti muscles must also be cut across at the same time, when the ensiform cartilage, sternum and sterno-costal cartilages, should be raised at the same time, partly by tearing the loose cellular texture in the anterior mediastinum, and also by dividing the pleura on each side where it lines the interior of the latter-named cartilages. In effecting the latter object, the extent of the pleura forwards, and consequently that of the cavity of the chest, may be appreciated. The sternum may either be broken across at the junction between the body and upper end, and turned upwards, or else dissected from between the first ribs, and entirely removed. In either way the dissector may perceive the position of the internal mammary artery immediately within the cartilages, where they are about to join the sternum, and also the extent of the pleura upwards, as well as downwards. But, to trace the latter membrane more completely, the ribs should be divided in a line between the anterior end of the first to the middle of the eighth or ninth, and their anterior extremities removed. The division may be effected with the saw or cutting pliers. Now the hand should be passed into the back part of the serous cavity, and the extent of the pleura downwards and upwards may be more fully ascertained. Below it will be found to line the inner surface of the twelfth rib, and above it will now be perceived to project somewhat higher than the level of the first, — a feature of some surgical interest with reference to the neck, which has already been alluded to in the preceding section of the volume.

The position of the heart and the large blood-vessels immediately connected with it must of course attract notice, but as it is presumed that the dissector is already acquainted with the elementary anatomy here, it is not proposed to refer particularly to them on this occasion. The most casual observer cannot but be struck with the limited extent of the chest, as it is now exhibited: its comparative want of capacity above, and the manner in which it is filled by the vault of the abdomen below, (the diaphragm,) cannot escape notice, and the extreme narrowness of the space between the diaphragm and the three or four inferior ribs should not be overlooked. If the scalpel or bistoury be thrust between any of these ribs, it will at once be perceived if it

penetrates deep in a horizontal direction, that it not only enters the chest, but actually perforates the diaphragm, and appears in the abdomen.

Such examinations may be made of the anterior mediastinum, heart, and large blood-vessels, lower part of the trachea, bronchi, and of the posterior mediastinum and its contents, as may be thought proper; and then these being removed or held aside, one or more of the intercostal arteries should be traced,—perhaps that between the seventh and eighth rib may be chosen: its course from the side of the spine, under the pleura, and along the lower margin of the rib above should be displayed, and when it passes between the intercostal muscles, the innermost of these should be removed along with the pleura costalis, so as to permit a view of the vessel as far forward as any branches of magnitude can be traced. About the middle of its course it begins to leave the groove on the lower margin of the rib, and soon divides into branches until it is no longer of a size to attract special attention from the surgeon.

A portion of the spine with two or more of the ribs should next be cut out with the saw, when the inter-vertebral substance and articular surfaces on the vertebræ can be examined, as also the attachments of the head and tubercle of one of the ribs to the side of the column and the anterior part of the point of a transverse process.

Dislocations (in the ordinary acceptation of the term) are rarely met with in the chest. Occasionally the cartilage of one or more of the ribs may be driven inwards by great violence, and detached from the sternum, or there may be separation between the rib and cartilage. Sometimes these injuries are unaccompanied with others; but most frequently they only form part of a severe bruise of the chest, and in conjunction, perhaps, with broken ribs, wounded lung, and injured spine. Sometimes the posterior end of a rib is detached from the spine, but this is even more rare than the last, as the shaft is so much more likely to give way.

It is scarcely possible to imagine a dislocation between the vertebræ on the dorsal region: they are certainly separated in some severe injuries; but here the principal feature will be with reference to the spinal marrow and the violence otherwise done to the spine and neighbouring parts.

Fractures of one or other of the bones of the chest are of much more frequent occurrence: indeed, the ribs, perhaps, suffer more frequently than any other bones. There is seldom much difficulty in detecting such an injury; the fall or blow which has occasioned it, and the subsequent pain, will excite suspicion; possibly the patient may feel the surfaces grating as he breathes; but, at all events, the application of the fingers will put the circumstance beyond doubt. Sometimes, however, the examination gives so much pain that the surgeon may not deem it necessary to be very minute, nor is there an absolute necessity for being so, for whether there is fracture or only contusion, the treatment should be nearly the same.

When the sternum is broken there will seldom be difficulty in per-

ceiving the fissure, though there may possibly be but slight separation, and very little mobility. Sometimes the outer table of this bone is driven into the cancellated structure without fissure occurring; but, unless complicated with other injury, such an instance, supposing it to be detected, would not differ in any material respect (so far as regards the treatment) from a severe contusion.

In dislocations of the ribs, as above referred to, and in fractures, whether of these bones or of the sternum, the surgeon has little else to do than to encircle the chest with a broad flannel roller, so as to keep the fragments steady during respiration, which process will then be carried on almost entirely by the movements of the diaphragm and other abdominal muscles. In the course of ten or fifteen days the bandage may possibly be dispensed with, although it will often be required much longer. The necessity for watching the state of the pulse and other precursory symptoms of inflammation should not be overlooked on such occasions, as the excited action in and around the seat of injury may possibly extend to the pleura. Leeches to the part, cupping, or even general blood-letting, may possibly be requisite. It cannot be doubted that in many of these injuries the pleura must be lacerated, and in such cases the probability of bad results should always keep the practitioner on his guard.

Besides injury of the pleura costalis, it not unfrequently happens that the pleura pulmonalis, with a portion of the lung itself is injured, in instances of fracture. Here the circumstance is generally made manifest by the escape of air from the lung, and perhaps, too, by the appearance of blood through the aerial passages. The latter circumstance is not always to be depended upon as indicative of the lung having been torn by a spicula of bone; but when there is a fracture without any object having penetrated the chest from the surface, accompanied by the escape of air, there can scarcely be a doubt about the mode in which the lung has been torn. The air at first escapes into the cavity of the chest, in all probability, during expiration; then, as it accumulates, gets through the fissures in the pleura costalis, and makes its way between the fragments into the cellular texture around, from whence it spreads in all directions under the skin so long as it continues to escape from the lung. This condition, which is technically called emphysema, more frequently follows penetrating wounds involving the lungs; but when it presents in fracture it calls for additional vigilance on the part of the surgeon. Its presence in the subcutaneous cellular tissue is readily detected by the fingers; the feeling of crepitation, such as when air forms during putrefaction in the dead body, can never be mistaken. Sometimes even swelling is conspicuous, more especially if there be extensive effusion. In some instances of severe fractures of the ribs, when the chest has been much crushed, I have known the air extend as low as the wrists and ankles, and up the neck to the face and margin of the scalp, causing enormous swelling. Usually, however, in ordinary fracture, if there is emphysema, it is to a trifling extent. Perhaps the best treatment

is to apply a pad over the seat of injury, and to retain it by means of the flannel roller, put on as in the common case. The abstraction of ten or fifteen ounces of blood will seldom be amiss; and should it happen that the difficulty of breathing increases, and the resonance of the chest is at the same time greater, the bandage must be removed, and cannot again be applied until the lapse of two or three days. At this time the wound in the lung will have healed,—the open cells will at all events have been closed by lymph,—the air will probably have diminished in quantity, and soon the chest may be enveloped again. Emphysema in itself cannot be considered a serious condition; it indicates a severe and even dangerous injury of the chest, and on that account the case must be treated with great circumspection. In extensive diffusion of air immediately under the skin, it might be advisable in some instances to make punctures with a lancet, though this need seldom be resorted to. If the case does well otherwise, the air will ultimately (*i. e.* in the course of three, five, or eight days) entirely disappear. It is customary in such cases to say that it has been absorbed; but from what we know of its injurious effects in the circulation, it is, with me, difficult to imagine that it all goes off in this way, and I am inclined to suppose, that there must be a process of cutaneous exudation as well.

If the dorsal portion of the spinal column has been fractured, or two of the vertebræ have been separated from each other, the injury is almost as hopeless as those in the cervical region, already referred to. Such accidents must invariably be accompanied with serious lesion of the spinal marrow, and the aid of surgery will seldom, if ever, prove of any avail. The patient will be paralysed below the seat of injury, and though, perhaps, perfectly sensible, and able to use his arms freely, he will have little or no power over the muscles below; the integuments will be insensible to touch; the sphincter ani will have little or no power; the bladder will be paralysed, with consequent retention; and often there will be continued priapism. The state of the bladder will render the catheter necessary at regular intervals, (perhaps twice or three times a day,) and as the patient will always rest in the position in which his body is placed for the time, and moreover will require great attention as to cleanliness, all care must be taken by means of pillows, and attention to the bed-clothes, to prevent injurious pressure on certain points, and to keep the skin as dry as circumstances will permit.

Extension has been applied to the column in some of these cases, and pressure has been laid upon the gibbous point by way of forcing the protrusion at the back (which is often conspicuous) into its proper position. The wooden bed (scamnum) of Hippocrates has been used for the purpose, and Oribasius alludes to such practice. No harm, in my opinion, can accrue from a moderate attempt at extension, although its ultimate utility may be doubted; but the idea of forcing the protrusion into a proper position seems preposterous.

Mr. Henry Cline proposed to remove one or more of the laminæ in

these cases; but neither the example in which he did so, nor several treated in the same way by Mr. Tyrrell and others, did well. The analogy between such injuries and those of the head where there is depression of bone, though in some respects close, is widely different in others; thus there may be extensive depression on one side of the cranium without any such condition on the other; but in the spine, when the column is broken, the irregularity will probably be as much on one side of the canal as on the other, consequently, pressure on the spinal cord may just be as great and as destructive in front as behind. However, it is possible to imagine an instance where a lamina is driven in without the body of the vertebra being affected, and, as the case may be in any way almost hopeless, it might be deemed advisable to give the patient the advantage of this poor chance.

In dissecting the muscles of the back, it will be perceived that there cannot possibly be any difficulty in dividing, by subcutaneous incision, almost any which the anatomist may desire to reach. Within these three years, it has been proposed to divide one or all of these on one side of the spinal column in cases of lateral curvature. M. Guerin has been the most zealous advocate for this practice, and it has been performed by him and others in a variety of instances, on the supposition that there is an analogy between this condition and that of club-foot. I have had no experience of such a method of treatment, and from all I have seen on the dead and living body, feel strongly prejudiced against it as a general practice. The more rational mode of endeavouring to improve the vigour of the patient's frame (supposing her to be a miss of nine, twelve, or fifteen years of age) by local friction, change of air, habits, and diet, and also of giving the spine an opportunity of resuming its natural symmetry and elasticity by taking off the weight from above,—which can only be properly done whilst the body is in a horizontal posture,— seems to me infinitely to be preferred to the method alluded to.

Occasionally the surgeon is required to make an opening through the walls of the chest to permit the escape of fluid. This is sometimes deemed necessary in extensive accumulation in hydrothorax, at other times for empyema, where the pus fills the greater part of the cavity of the pleura, or probably occupies only one portion of the side of the chest.

In hydrothorax, the operation (paracentesis thoracis, as it is called) may de done thus: The patient being placed on the margin of a bed or table, and leaning slightly over on the sound side, the surgeon should select the seventh or eighth rib a little in front of the angle, and should then draw the skin upwards, and bring what was formerly opposite the lower margin on a level with the upper; next, with a scalpel, he should make an incision about an inch and a half long, through the skin, cellular texture, external and internal intercostals, until he reaches the pleura, which he should open by a small puncture with the point of the knife, or, if he chooses, with a trochar. When the fluid is evacuated, the skin being let go will slip over the internal orifice

like a valve, and thus there is less chance of air getting into the cavity than if the wound were made straight into the chest. If the operation is performed higher up than is here recommended, some of the fibres of serratus magnus will come in the way, but no harm can accrue from their division. It will be remarked that, by keeping on the upper margin of the bone immediately below, whilst cutting between the ribs, there is no danger of interfering with the intercostal artery.

If the operation is done for empyema, the proceedings may be nearly of the same character. The same situation may be selected, or any other more convenient spot. Sometimes in such cases the matter causes more marked protrusion between certain ribs than elsewhere, and such a point may be selected. I once operated in a case of the kind between the first and second rib; but here the disease was more like abscess in the upper region of the chest, for, in consequence of adhesions, the matter was limited to this part. In this instance I passed a bistoury straight into the sac, having pulled the skin slightly upwards, and a similar mode will answer either for this affection or hydrothorax, instead of the process of dissection which has been described above.

In all instances it is very desirable to perform these operations without permitting air to enter the chest. In hydrothorax this may be accomplished, but in empyema it will be found exceedingly difficult. In the former example the lung will rise as the fluid escapes, but in the latter this is very doubtful, for often the surface of the pleura pulmonalis is so coated with an adventitious layer of organized lymph as to prevent the lung rising at once, if, indeed, it ever will do so. In such a case it has been proposed to use a syringe to exhaust the matter, and at the same time, by creating a vacuum to give the best possible chance for the lung to rise. Should this happen, it will probably not be to the full extent, and, in the event of the patient surviving, the chest will ever after be smaller on that side than on the other. Whatever care may be taken to prevent the ingress of air, the occurrence is extremely likely to happen.

The bleeding during the performance of any of these operations will be very trifling. The only vessel of magnitude in such parts being the intercostal, which may be avoided by the instructions given. In one instance in the dissecting rooms I found an artery about the size of an intercostal, passing from the subclavian in a direction downwards, between the ribs and pleura, exactly in the line of the incisions described.

Portions of the sternum and ribs have been removed in consequence of caries, but no particular rules are here required for such proceedings. In caries or necrosis of the sternum a crucial incision might probably enable the surgeon to apply the gouge with the desired effect. Large portions of this bone may be thus removed: but there is scarcely any necessity for doing more than allude to the important parts in the vicinity — the pericardium behind, the pleura and internal mammary artery at the sides, and the large vessels at the upper part of the an-

terior mediastinum are all dangers so palpable, that the smallest amount of anatomical knowledge will point them out. Portions of ribs have been removed in many instances, for caries, necrosis, or tumours, and with excellent success. Generally, these proceedings have been accomplished without injury to the pleura, but this membrane has, in some of these cases, been accidentally opened; yet the patient has done well. A case of the kind is referred to in The London and Edinburgh Monthly Journal of Medical Science, for August 1842. M. Jacquet, in removing enlarged and carious portions of two of the ribs, (succeeding to fractures of these bones, occasioned by a blow five and thirty years before,) opened the pleura, yet, in reading a paper on the subject before the Society of Natural and Medical Sciences of Brussels, he exhibited the patient perfectly cured. Of course it would be highly desirable in such operations to avoid this, and fortunately it may in general be accomplished.

CHAPTER II.

ABDOMEN AND PELVIS. DISSECTIONS.

THE posterior aspect of the abdomen presents few features of interest to the surgical anatomist, and such as they are, they can readily be appreciated by those familiar with the descriptive anatomy of this region. Neither does it seem necessary to refer particularly to the mode of dissecting the parietes in front, as all students of the first year's standing must be acquainted with such proceedings. The course and nature of the linea alba on the mesial line, and of the linea semilunaris on each side, will already have been pointed out to him, as will also the different regions both by name and shape; and the particular viscera occupying each will all be known. The dissector of surgical anatomy may, if he chooses, repeat the dissection and examination of these parts, and he may again look into the abdomen. In the dissection of the chest, allusion has been made (p. 490) to the narrowness of that cavity at the lower part on each side, and the convexity of the diaphragm upwards has been specially noticed, and now in the abdomen it may be observed how high the peritoneal cavity projects. In consequence, it often happens in wounds of the lower part of the chest (a stab with a clasp-knife, for example), that the peritoneal cavity and some of the abdominal viscera are injured, even in instances where the length of the weapon may have been such as scarcely to have excited a suspicion that so much damage had been done. I have known a short blade pierce and transfix the pleura,—passing through the lower part of the lung at the same time,—perforate the diaphragm and its peritoneal investment, and wound the stomach.

Some points of surgical anatomy will be particularly referred to in future pages; meanwhile, the attention may be at once directed to the inguinal and crural canals.

The parts of inguinal hernia may first be dissected, and, if possible, a male subject should be selected for the purpose. A semilunar incision, its convexity being upwards, should be made from the anterior superior spinous process of the ilium to the symphysis pubis, and the skin should be dissected downwards a little below the line of Poupart's ligament. When the skin only is raised, a layer of fat and cellular membrane will be observed, and midway between the crest of the ilium a small vein will be noticed passing from above downwards. If the subject be well injected, an artery will be seen in the same situation. These are the superficial epigastric vessels. If an incision is made from near the symphysis through the skin of the scrotum (or labium), a portion of the layer of subcutaneous cellular texture already displayed will be seen extending in this direction, destitute, however, of fat, which is often conspicuous above the scrotum and Poupart's ligament. The membrane now exposed is termed the superficial fascia, and were the skin dissected off in all directions to a much greater extent it might be traced everywhere beneath it. It is chiefly of importance in this situation, however, as it is one of the coverings of the hernial sac. The membrane should be cut through in the line of the first incision, and turned downwards, so as to display the lower part of the tendon of the external oblique muscle; it will be found but loosely attached to this tendon, and may therefore be separated with a few strokes of the knife. Towards the pubes the finger should be pushed under the membrane into the scrotum, and if the portion thus elevated be divided, the spermatic cord will be found beneath. The finger should now be passed under the cord, which should then be drawn downwards, so as to put the cellular texture above on the stretch. This texture should then be divided by cutting cautiously round the cord, close upon the tendon of the external oblique, when the opening in this tendon, with the cord passing through it, will be observed. The membrane which has been thus divided is generally named the intercolumnar fascia. The margins of the opening should be made more distinct by detaching this texture, which will be found connected more or less firmly with the circumference of the aperture.

The opening may now be observed to be formed by the splitting of the fibres of the tendon of the external oblique; one part being attached to the tuberosity of the pubes, the other to the symphysis. The separation generally occurs between two and three inches upwards and outwards from the pubes; but at the commencement the fibres are kept together by a transverse layer, which passes from the upper extremity of Poupart's ligament towards the mesial line, where it spreads out and is lost on the surface of the tendon. The fibres of this layer have a slight convexity downwards, are tolerably distinct above, but towards the pubes differ little from common cellular texture; and as they become weak the opening in the tendon of the external

oblique becomes more and more distinct. The upper and outer margin of the opening is bounded by this tissue, the under by that portion of the os pubis which is between the tuberosity and symphysis, whilst each side is formed by the tendinous fibres passing respectively to the above-named points. As the opening is not parallel with the vertical line of the body, the terms upper and under, outer and inner, may lead to some confusion; but they can scarcely be misunderstood if the parts are before the reader, as they are supposed to be at present. It will now be observed to be more of an oval shape than circular, and that it lies nearly parallel with Poupart's ligament. The margin nearest to this texture is generally called the inferior and outer, while that nearest the mesial line is named the superior and inner: they are often also termed the pillars of the ring. The spermatic cord will be seen to hang over the lowest margin, partly on the tendon and partly on the pubes, which is remarkably smooth in this situation.

The tendon of the external oblique should now be divided in the line of the first incision, and turned downwards. It will be easily separated from the muscular fibres of the internal oblique; but some care will be required to take it off the tendon of this muscle, with which in many subjects it is intimately connected. The cord should now be laid hold of below the opening, and put upon the stretch, when it will be noticed lying within the aperture behind the tendon, immediately above and nearly parallel with Poupart's ligament. If the finger is passed under the cord in this situation so as to detach it from its loose connexions around, it may then be ascertained that the space in which it lies, usually denominated the inguinal canal, is bounded in front by the tendon of the external oblique; behind by the fascia transversalis, which, though thin, is nevertheless distinct in this situation; above by the lower margin of the internal oblique muscle and its tendon, which towards the pubes gets a little behind the cord; and below by Poupart's ligament, whose attachment to the bone may now be perceived to be much broader than could have been imagined from an external view. At the lowest point of attachment of the internal oblique to Poupart's ligament a few muscular fibres will be observed to pass downwards on the cord, forming the cremaster. They can be easily separated from the cord, but should be left untouched at present. If the subject be corpulent, a quantity of fat will be found in the canal, which must be removed ere the boundaries can be distinctly displayed.

The internal oblique should now be cut across from its lower margin about two inches upwards, in a line with Poupart's ligament, and half an inch from it; the transversalis muscle should also be divided in the same course, and both should then be turned upwards in a single mass (for it answers no good purpose to separate them for the present purposes of the dissection) from the condensed layer of cellular texture between the last-named muscle and the peritoneum. This membrane (named transversalis fascia) will be more advantageously seen if the under part of the muscles be dissected from it towards Pou-

part's ligament, in doing which, the cremaster may be raised from the cord: in this situation the fascia will be observed to be of considerable density and firmness, but towards the mesial line it is scarcely so distinct. If the cord be again put on the stretch, and an incision made round it close upon the transversalis fascia, an opening will be displayed in this membrane, through which the cord will be seen passing. The texture divided by this last manœuvre has been named the infundibuliform fascia, or fascia propria, and the opening exposed is the upper extremity of the inguinal canal;—that in the tendon of the external oblique being the lower. This opening will in general appear circular, and its outer margin will be the most distinct; its inner, however, is the more interesting, as the epigastric artery will be found close behind it. An incision should be made through the membrane to expose this vessel, and notice should be taken of the manner in which the cord hangs over it.

The finger should now be passed into the abdomen through an incision in the linea alba, or, what will answer better, the cavity may be laid open (if this has not already been done) by carrying the knife in the line of the original incision through the skin; the point of the finger should then be pushed against the aperture in the fascia transversalis; it may next be placed behind the opening in the tendon of the external oblique;—the first of these movements will indicate the commencement of the common or oblique hernia, the second the direct form of the affection. The fascia transversalis and peritoneum may now be separated, when the course of the epigastric artery, with its accompanying veins, one on each side, may be more fully examined.

An inguinal hernia must protrude in the first part of its course either on the outer or inner side of the epigastric artery, and in the latter case the sac will not be covered by the layer of cellular membrane which is attached to the opening in the fascia transversalis; neither will it have the cremaster muscle over it, as is the case when the sac passes through the upper opening of the canal. In this latter instance (the common inguinal hernia), the sac passes through the opening in front of the cord, and of course behind the internal oblique muscle (the transversalis and this muscle being considered as one, as above described), and as it passes downwards it occupies the same relative position to the cord and cremaster, whose fibres are consequently in front of it, and usually spread over the surface. In the case of direct hernia, the sac protrudes immediately under the tendon of the internal oblique (the conjoined tendon or tendons of this muscle and the transversalis), or it carries this part along with it by gradual dilatation, and appears at the external aperture of the canal, having only passed across its lower extremity. The cord may be found in front of the sac in this case, or it may be behind; and in some rare instances, in either kind of hernia, it may be split, one part being in front, the other behind the tumour. In both forms of the protrusion it will be observed that the superficial and intercolumnar

fasciæ must cover the sac, and the difference between the thickness of the cremaster muscle with the cellular texture binding its fibres together, and the infundibuliform fascia, on the one hand, and the fascia transversalis with the cellular texture between it and the sac on the other, is so little appreciable as to be unworthy of notice in a surgical point of view.

An inguinal hernia may be so small as scarcely to be observed,—nay, it may be so very minute, as not even to be detected during life,—as I have known in two cases, where all the symptoms of strangulated hernia were present, when the most careful examination was made by very competent surgeons without the protrusion being detected until dissection after death, or the sac may be so capacious, as to contain a large proportion of the contents of the abdomen; the protrusion may not pass so low as the aperture in the tendon of the external oblique, as was the case in the instances above alluded to, or it may, as must happen in all large tumours of the kind, pass to the lowest part of the scrotum. There may be an inguinal hernia without it being a scrotal, or in other words the protrusion may not have passed down to the scrotum; but a scrotal hernia must of necessity pass through the lower end of the inguinal canal; hence it will be observed that the scrotal hernia is merely a larger form of protrusion through the inguinal canal.

When there is difficulty in reducing a hernial tumour by the taxis, the propriety of bending the patient's body forwards, and raising the thigh, so as to relax the abdominal parietes and Poupart's ligament, may now be observed, by placing the body and thigh in different attitudes; and the direction in which the necessary pressure must be applied during the taxis, may also be understood from a consideration of the course of the canal.

The anatomy of crural or femoral hernia may now be examined, and if possible a female subject should be chosen for the dissection. If a different body is selected from that on which the inguinal canal has been laid open, incisions similar to those recommended for the display of the latter (p. 497) should be made; the skin should then be removed from the upper and fore part of the thigh, five or six inches below Poupart's ligament; and to permit of this an incision of six inches in length should be made down the front of the limb from the anterior superior spinous process of the ilium, and another from the tuberosity of the pubes along the inner margin, as low as it is wished to remove the skin; the subcutaneous cellular membrane will then be displayed, and may be perceived to be a continuation of the superficial fascia already described. The superficial epigastric vein may now be traced lower; other small veins will be observed in this membrane, and if the subject be minutely injected, the corresponding arteries may also be remarked. The fascia should next be dissected downwards, as the skin has been, and the aponeurosis (fascia lata) displayed. In this part of the dissection the different small vessels, already remarked, must be divided, and when the membrane is raised numerous

lymphatic glands will be observed imbedded in its substance; some of these may have already been noticed on its outer surface, and unless the aponeurosis of the thigh be very clearly dissected, several will be left upon the latter; these, however, had better be removed also, for although it is occasionally the custom in the first stage of the dissection of the parts of crural hernia to cut away the superficial fascia, and leave the glands and small vessels—with various small twigs of nerves which may also be seen here, I deem it more advisable to remove them all with the membrane.

Towards the inner margin of the thigh, a little below Poupart's ligament, a portion of cellular substance should be left in this stage of the dissection, and about two inches below the ligament the upper end of the internal saphena vein will be seen passing into this structure; several lymphatic glands may also be observed in this situation. The vein should be displayed as low down as the dissection extends; it should then be cut through, and turned upwards, when the fascia lata will be seen stretching across the front of the thigh. If this membrane be examined at the part where the vein is dipping into the cellular texture above, it will be perceived to terminate abruptly in a rounded concave margin, which looks towards Poupart's ligament. This margin should be traced, and it will be noticed on one side to spread out into that part of the fascia which covers the pectineus muscle, (the pubic portion of the fascia lata,) and on the other to extend upwards and outwards, so as to form a crescentic margin looking towards the inner aspect of the thigh, having its upper extremity or horn attached to Poupart's ligament. This has been named the iliac portion of the fascia lata, and will be observed to cover the femoral vein and artery, which lie a little nearer the ilium than the margin referred to. This margin is not always very distinct, and at all events a little dissection is requisite to display it distinctly. Some cellular tissue will be noticed attached to it and the pubic portion of the fascia, and filling in part the hollow which is formed by the latter being so much lower than the level of the iliac portion. When this membrane (which is usually called the cribriform fascia) is removed, the margin is more defined, and the pubic portion of the fascia lata is seen lying in close contact with the pectineus muscle, whilst the hollow is rendered very distinct. A lymphatic gland is often found in this situation, and it must be removed with the cribriform fascia.

If the point of the finger is now thrust into the upper end of the hollow under Poupart's ligament, it is in the crural canal or ring,—in that situation through which the crural or femoral hernia descends. At this stage of the dissection the thigh should be raised and extended alternately, so as to exhibit the enlarged and diminished size of this opening during these movements.

To get a clear view of the opening, the ligament of Poupart should be divided about midway between its extremities, and the inner end laid over towards the pubes; this portion will now be seen to have formed the anterior boundary of the canal; the broad attach-

ment to the linea innominata, termed Gimbernat's ligament, which has a crescentic margin looking towards the femoral vessels, will be observed to form its inner boundary; the horizontal ramus of the os pubis, covered by the pubic portion of the fascia lata and the attachment of the pectineus muscle, will be found to limit it behind; whilst outside it is bounded by the common femoral vein, which, however is covered by the sheath of cellular membrane common to it and the artery. The sheath in this situation is formed by the continuation of that which covers the external iliac vessels, and is strengthened by a prolongation of the fascia transversalis. With a special dissection it is easy to make the last-named membrane appear as if it passed downwards as a kind of funnel upon the femoral vessels, to be attached to their sheath an inch or more below Poupart's ligament; hence the description occasionally given of the crural hernia descending in the sheath of the vessels. It might be supposed from this that the sac of the hernia is in contact with the femoral vein; but it will be found on all occasions separated from it by a distinct layer of cellular texture, which undoubtedly should be considered the proper sheath of the vessels.

If the finger is now passed into the abdomen, and pushed downwards into the situation of the crural opening; it will be observed that its point is covered by the peritoneum and some loose cellular texture over it, which is evidently part of the fascia transversalis; a little additional cellular structure may occupy the situation of the opening. It will now be seen that the following parts must cover a crural hernia; the skin, superficial and cribriform fascia, with those textures last referred to as covering the point of the finger when thrust from above downwards. It is in vain, however, to distinguish those textures individually on the living body during an operation; and, however distinct they may appear to the anatomist, and however easy he may suppose it to make them out one after the other, the surgeon looks upon them all as one covering, which may be in some instances of considerable thickness, and in others so thin as to require caution with the knife in dividing the integuments, lest by a little rashness the sac and bowel are opened at the same time, as has occasionally happened.

A crural hernia is seldom larger than a hen's egg, though occasionally seen of much greater size. I have in my possession a specimen where nearly one half of the small intestine was found in the sac; and I have seen and operated on others nearly of a similar size. Occasionally the tumour is so very small, as to be scarcely distinguished on the most careful examination with the fingers; indeed, in several instances I have cut down in the supposed seat of a tumour of this description, having been induced to do so more from the existence of most of the symptoms of hernia, and a slight swelling and tenderness in the situation of a crural hernia, than from the presence of any well-defined tumour; and fortunately in each of these a protrusion of a knuckle of small intestine was discovered.

The anatomy of the other species of hernia does not require parti-

cular notice here, nor does it seem requisite to refer in any marked manner to anomalous tumours of this description. The ordinary knowledge which every medical man must possess will at once lead him to appreciate the coverings of an umbilical protrusion, and also those rarer forms which occur in the pelvis between the bladder and rectum, or between the latter organ and the vagina, as well as those in the obturator and sacro-sciatic foramina. Neither need any especial notice be taken of protrusions of part of the abdominal viscera into the thorax, whether through the natural apertures or through wounds, nor of those examples where the caput cæcum descends in such a manner that its posterior surface is so placed in the hernial tumour as to be uncovered by the peritoneal sac. For all such matters the reader is referred to works devoted exclusively to the subject, at the head of which may be placed those of Sir Astley Cooper and Mr. Lawrence, which are each so complete as to leave little more for their successors to accomplish.

The examination of the surgical anatomy of the abdomen and pelvis may now be continued. The intestines should be removed, and the peritoneum be stripped off the iliac arteries and lower part of the aorta. The external iliac should be traced from Poupart's ligament upwards; some cellular membrane will be observed to form a sheath for it and the vein, which latter will be found on the inner side of the artery, both being situated on that part of the psoas magnus muscle which forms the soft brim of the pelvis. The internal iliac should next be exposed, by stripping the peritoneum a little downwards into the pelvis; half an inch or an inch of the vessel may be observed, after detaching a small quantity of cellular tissue; perhaps the gluteal, the obturator, or others of its branches may be seen, and the vein may be noticed on the upper side of the artery nearest the bone. The common iliac may next be traced: it will in general be perceived to lie on the side of the fourth lumbar vertebra; the cellular texture surrounding it forms a small proportion to the size of the vessel; the vein will be found on the mesial side, especially as regards the left one, but the right will be chiefly behind. In connexion with all these arteries, numerous lymphatic glands may be observed, more especially at the lower end of the external iliac, where they are often of considerable size. In stripping off the peritoneum, the ureter will be raised at the same time; but if the two be replaced, the latter will be observed to pass into the pelvis obliquely, over the lower end of the common iliac or beginning of the external. The position of the aorta should next attract attention; at its bifurcation, which is usually opposite the upper margin of the fourth lumbar vertebra, it will be nearly in the mesial line,—perhaps a little to the left; and, if so, the right common iliac will be somewhat longer than its fellow; the vena cava will be on the right side of the artery, and not in very close contact with it; a quantity of condensed cellular fibres, mingled with branches of the sympathetic, and with lymphatic glands, may be noticed in contact with both vessels, more especially the aorta, and this vessel

itself will be observed to be in a manner bound to the spine by the lumbar arteries which it gives off.

The vessels may then be cut away, and the psoas magnus (and parvus if it be present) should next be dissected from the spine, care being taken to notice the slip which passes upwards behind the diaphragm. In removing the middle portion of this muscle the fascia iliaca must be divided, and the strength of this membrane should now be noticed where it is connected with the inner lip of the crest of the ilium. This and the iliacus muscle may then be removed, and the attention may next be devoted to the pelvis.

If the subject is entire, the feet and ankles should be bound together, as for lithotomy (described in an after page); and, the subject being a male, a staff should be passed along the urethra into the bladder, which should then be held at right angles to the pubes by an assistant, who can scarcely be dispensed with on the occasion.

Before commencing the dissection, the tuberosity of each ischium, and the distance between the two, should be carefully noted. The ascending rami should be traced with the finger, which can scarcely be made too familiar with these parts: its point should also be introduced within the anus, so as to accustom it to feel the staff in the membranous portion of the urethra, the prostate, and the bladder above and behind.

The assistant should hold up the scrotum, and the dissector should then make an incision from immediately behind the testes, along the raphe of the perineum to within half an inch of the anterior margin of the anus; from this the knife should encircle the anus, and from the posterior part of this incision a cut should be made as far back as the coccyx. The blade should then be carried from the posterior extremity of the wound first made, an inch and a half outwards, to each thigh, when the different flaps thus marked out can be raised. The skin only should be taken off: around the anus it will be found remarkably thin, and here the sphincter muscle will be displayed. To cause the latter to become prominent, it is usually the custom to distend the lower end of the rectum with hair; but the nearer the parts are allowed to remain to their natural condition the better. If the cellular substance is now freely removed behind, the anterior (lower) margin of the gluteus maximus may be observed; but as the principal features of the dissection lie in front, the chief attention may be given in this direction. Here a dense layer of cellular tissue (superficial fascia) will be noticed between the bones, which may be traced backwards until it is lost in the cellular and fatty substance which occupies the space between the anus and the tuberosities, and forwards into the cellular tissue (dartos) of the scrotum. This fascia should be divided by incisions similar in course to those made in the skin in front of the anus, and on being raised the accelerator and erector muscles will be displayed, and also (if it be present) the transversus. The triangular space between these should be examined; and here as the parts are, or probably while removing the fascia, the su-

perficial perineal artery and nerve may be observed. If the point of the finger is thrust deep in this space, it will meet resistance from a ligamentous texture, which may possibly be seen by holding the bulb of the urethra a little to one side, and separating it slightly with the point of the knife:—this is the lower part of the triangular ligament. The accelerators and erectors, with the transversales, may now be removed, when the bulb of the urethra and the crura penis will be displayed. If a careful dissection be made in the inner margin of one of the erectors, close upon the bone, the common pudic artery may be exposed, and can be traced backwards as far as may be chosen. If the tendinous structure between the bulb of the urethra, or rather the acceleratores and the anterior margin of the sphincter, be now divided, the latter, with the anus and lower part of the rectum, may be turned back, so as to permit an examination of the membranous portion of the urethra and the lower surface of the prostate. It will be better, however, to delay this part of the examination until a lateral section of the pelvis has been made, to effect which the dissector should next proceed.

The feet and hands being untied, the saw should be carried through the left os pubis in a line with the tuberosity and the descending ramus, and placed in a direction somewhat parallel with the latter: then the left leg should be forcibly abducted, so as to loosen, and in a manner tear open, the sacro-iliac junction: the knife must be used to complete the section, and the loosened portion of the innominatum should be separated by itself,—every texture being so cut as to leave it as much as possible in its natural position.

The bladder should now be slightly distended with air passed through a ureter by a blowpipe or catheter; and first the obturator internus should be cut away, when a layer of strong aponeurotic fibres (obturator fascia) may be observed on the surface, from whence it has been raised: this will have an abrupt termination below where it has been divided from the ischium, and above it will be joined with the other textures which have been cut from the osseous brim of the pelvis. At its lower margin the common pudic artery and internal pudic nerve may be observed. This layer, which by some has been described as one from the pelvic fascia, should then be cut off, and by the removal of some cellular tissue, the outer surface of the levator ani will be displayed. The lower attachments of this muscle to the anus, rectum, and that of the opposite side, may at present only be looked at: it should now be turned downwards,—for which purpose it may probably be necessary to separate the peritoneum from its upper end,—when a layer of aponeurosis will be observed on its inner surface, possessing such strength towards the pubes and neck of the bladder, and so reflected upon the latter, that the point of the finger can neither be pushed down nor up. The levator muscle may now be cut across midway between the bladder and rectum, and its ends either completely removed or turned down and up. In either case the outline of these two viscera will be made more distinct, but care should be

taken in meddling with the upper and anterior part of the muscle not to interfere with the fascia which lines it. With some cautious dissection, the muscular fibres of the rectum, the neck of the bladder, and prostate gland, will be displayed by raising a pretty dense layer of cellular substance interspersed with fat: the membranous portion of the urethra, with the muscular fibres (Wilson's) surrounding it, the triangular ligament, with the urethra passing through it, the bulb in front, and Cowper's glands behind, may all be exposed, and behind and below the prostate the vesicula seminalis may be divested of its tough cellular investment, while a little further back, and somewhat higher, the ureter and vas deferens may be exposed.

The finger should now be slid down between the bladder and rectum, and the extent of the peritoneum in this situation most carefully noted, with reference to its attachments to both. Now the rectum should be separated from the neck of the bladder in the manner described on the preceding page, and the triangular space, bounded by the vas deferens on each side, the peritoneum behind, and the prostate at the apex, can be examined.

The attachment of the pelvic fascia to the prostate and neck of the bladder may next be looked to. If the membrane be seized between the fingers, and drawn to one side, it will be observed to be firmly attached to the prostate about its middle height, more of that body, however, being visible below than above. The fascia may here be noticed to split into two, one layer—the more distinct of the two—passing upwards, backwards to the neck of the bladder, and forwards to the symphysis, the others passing downwards to the under part of the gland, and also to the vesicula. It is by no means difficult to trace from this layer a slip which passes to the side of the rectum, and which may be considered different from the cellular substance already removed from this situation.

As yet the dissection will have been conducted entirely on the left side: if the bladder be now stripped from the right os innominatum, and the fingers be passed down in the space between them, it will be seen how complete the partition is which it forms between the upper and lower part of the pelvis. This point will be referred to afterwards in regard to lithotomy.

The bladder may now be more fully distended with air than hitherto, when, as it rises above the pubes, the extent of surface uncovered by peritoneum may be observed. The anterior ligament of the penis should now be separated from the symphysis, and the crura should be dissected from the rami of the pubes; then the connexions of the bladder to the bones, the ligament under the angle of the pubes, and any other attachment still remaining should be cut through, when the bladder with the urethra and penis, and the rectum, may be removed from the pelvis.

The rectum should now be separated from the bladder, and ere it is thrown aside, should be cut open, when the appearance of the mucous membrane, with its various folds and projections, should be noticed.

Next the attachment of the peritoneum to the bladder should be more carefully examined than previously, also the entrance of the ureters, the whole circumference of the prostate, and the vesicula seminalis with the vas deferens on each side. An opening (with scissors) should then be made in the anterior part of the bladder, and the interior should be surveyed, with reference to the entrance of the ureters, the projection (if there be any) of the third lobe of the prostate, and especially the orifice of the urethra, which latter may be perceived to be a little above the lower end of the viscus. The scissors may now be carried through the neck of the bladder, the upper part of the prostate, and along the membranous portion of the urethra, and through the middle of the corpus cavernosum, so as to lay open the canal throughout its entire course. The apertures of the mucous and other ducts may next be examined; but in such an investigation, a work containing the descriptive anatomy of these parts should be consulted, and therefore I will not dwell longer upon them.

The ligaments of the pelvis may next attract attention. Those between the sacrum and innominatum require no particular mention here; but the main strength of the articulation may be observed to consist in the close junction of the two bones by intervening cartilage, which is firm in itself, and firmly attached to both. The articulation is very frequently anchylosed in old persons. The sacro-sciatic ligaments and the obturator need no special notice either, and those of Poupart and of Gimbernat, as also the triangular one between the rami of the pubes, have already been referred to.

CHAPTER III.

DISLOCATIONS. FRACTURES. INCISIONS. LIGATURE OF ARTERIES.

DISLOCATIONS are of rare occurrence in the pelvis, and can only happen under extreme violence, which will at the same time produce fracture. The latter is an injury which is occasionally met with, and is usually so severe in character that death often results, either within a few days from the effects upon the pelvis or abdominal viscera, or at a later period, in consequence of suppuration in and around the fissures.

When any portion of the pelvis is fractured, the violence is commonly so great, that other organs suffer seriously besides the bones, and, formidable though the fracture may be, it may perhaps not be the most important feature of the injury: thus the bladder, part of the intestinal tube, or other abdominal viscera, may be ruptured, — perhaps the spine may be broken, — a thigh-bone, — in short, such cases are often complicated in the manner alluded to. The fissures may run in almost any direction: above the acetabulum they can generally be detected by external examination, and by seizing the crest of the ilium: below—in the pelvic portion, if some force to the tuberosity of the ischium does not indicate the seat of fracture, the finger passed into the rectum will usually do so, more especially if it be in the ramus, in the coccyx, or lower end of the sacrum.

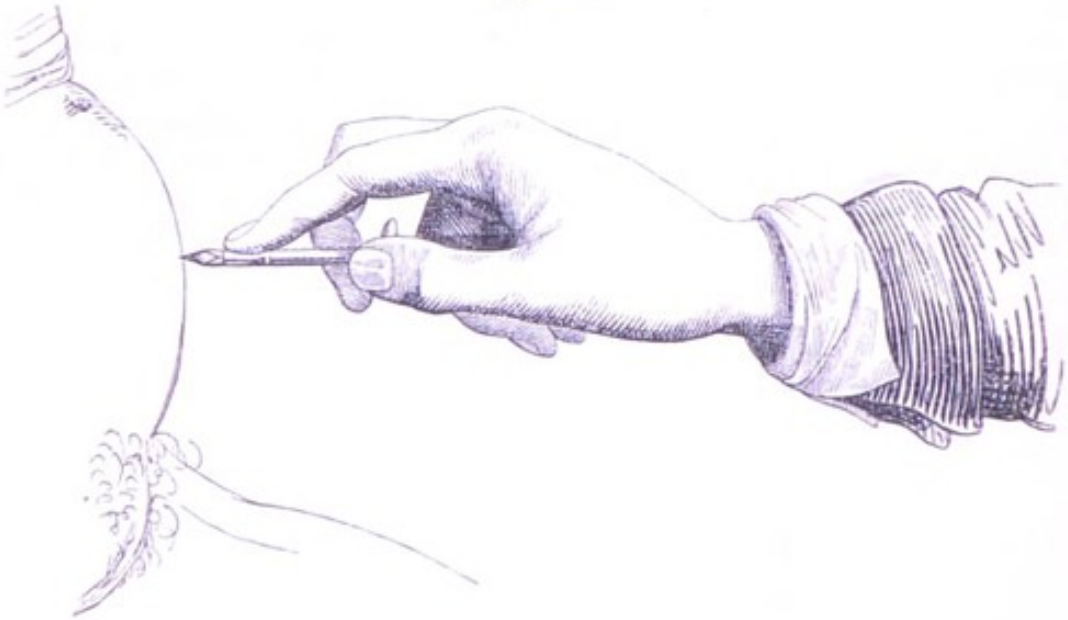
The treatment in cases of this kind is to attend to the condition of the viscera within, in such a manner as the principles of surgery indicate: thus, if severe inflammation ensues, leeches, cupping, warm fomentations, and such other measures as are usually employed to arrest that process should be resorted to: again, should the bladder or urethra (as might happen) be ruptured, the propriety of introducing a catheter, and retaining it, cannot be doubted; then, to keep the parts as still as possible, the pelvis should (at first, or as soon after topical blood-letting as is convenient) be enveloped in a flannel roller. Sometimes a long splint, such as that described at p. 295, may be of service, more especially if it be sufficiently long to reach the chest. It is scarcely necessary, after all that has already been stated about fractures elsewhere, to point out the necessity for keeping the patient's body as still as circumstances will permit.

Incisions are required for various purposes in and about the abdomen and pelvis. The young surgeon will probably be called upon at an early period of practice to make an opening into the peritoneal

cavity to permit the escape of fluid in ascites. The operation (paracentesis abdominis) may be done in the following manner: The patient should be seated on the margin of a chair, and the upper part of the abdomen should be encircled with a folded table-cloth or sheet, the middle of which should be laid over the stomach, and the two ends being made to cross each other behind, should be given each to an assistant, who should be directed to pull them with moderate tightness, by which the tenseness of the parts below will be increased. The surgeon then, resting on one knee, or seated on a low chair, should pass a trochar and canula through the linea alba about an inch and a half below the umbilicus, so as to penetrate the abdominal cavity: this being accomplished, he should withdraw the trochar, allow the fluid to pass through the canula into a bowl held in the hand, or a pail between the patient's feet, and when it has entirely escaped, he should close the wound with some adhesive strap, place a folded towel on the part, bring the sheet down upon it, and fasten the loose ends of the latter by pins, or with a needle and thread, after carrying them in front. It is usually considered that as the fluid escapes, and the pressure on the vena cava becomes less, there is a probability of the patient fainting, and hence the necessity of always keeping up pressure by gradually tightening the cloth encircling the body, and afterwards keeping it fastened for a time, until the parts become accustomed to their new condition.

In passing the trochar in the above proceeding, some considerable force is required—a kind of plunge,—and it is well to guard against the point passing too deep, by keeping the forefinger within half an inch or so of it, as represented in the drawing (fig. 221). If the instru-

Fig. 221.

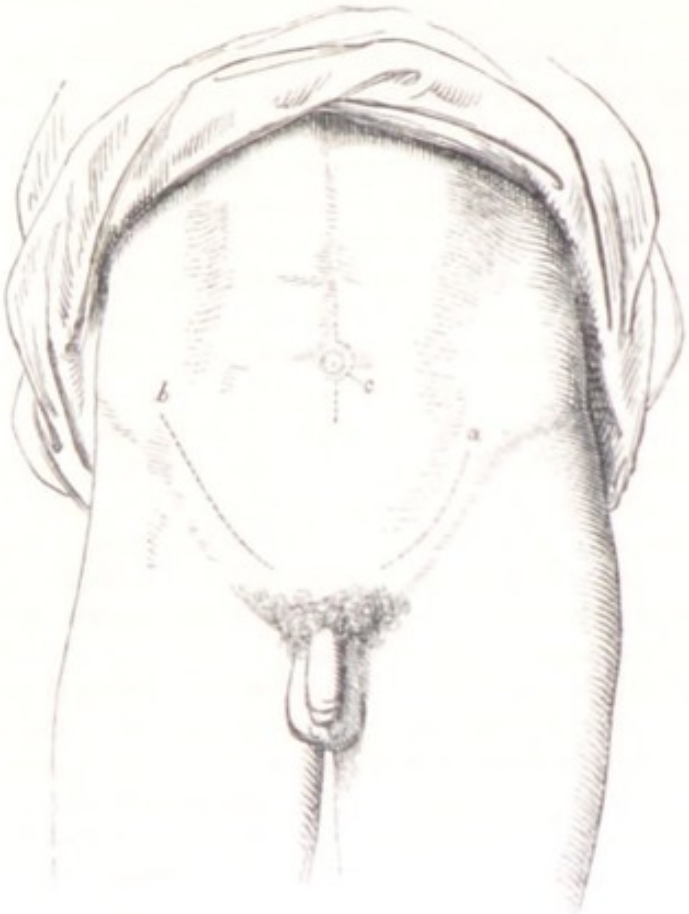


ment is small, *i. e.* under a quarter of an inch diameter, it will not be troublesome to pass it ; but if it be larger than this, it will be well, before the puncture, to make an incision through the skin, about half an inch in length, which will greatly facilitate the entrance of the awkward point of the trochar.

This is an operation which must probably be repeated very frequently on the same individual, and in future punctures the cicatrix of the preceding one may be selected, or, what will be better, the instrument may be passed a little higher or lower, at the will of the operator. If he goes above the umbilicus, however, he must remember the proximity of the liver, which in such cases is often much enlarged ; and if he makes the wound nearer the pubes, he must be certain that the bladder is not over-distended. It is occasionally the custom to make the puncture in the linea semilunaris, about midway between the anterior spine of the ilium and the umbilicus ; but when this part is selected, it is usually in cases of ovarian dropsy, when the projection is of often more prominent on one side than the other. The proceeding in either place, and in either disease, is so much alike, that I need not refer particularly to the latter. The orifice usually heals by the first intention, but sometimes the serum collects so rapidly again, that it bursts forth within a few hours, and continues to run for some days, until the wound closes by granulation.

Ligature of the external iliac artery may be effected on any part of that vessel. Usually its lower third is selected, unless the surgeon is obliged to reach the vessel higher up. The operation may be performed in the following manner : The patient being laid on a table, with his shoulders and knee slightly elevated, an incision about three inches and a half long (marked *a* on fig. 222,) should be made, about an inch above, and parallel with, Poupart's ligament, one end being opposite the anterior superior spinous process, the other a little above the opening in the tendon of the external oblique : the skin, fascia, and superficial epigastric vessels being divided, the tendon just named should then be cut to a similar extent,—this being usually accomplished upon a director pushed under the texture through a small opening cautiously made, although there is no great occasion for such an instrument: now the lower margins of the internal oblique and transversalis must be looked for, and the point of the finger (or that of the director) being passed beneath them, they should be divided about half an inch upwards, when the fascia transversalis will be exposed, almost exactly over the internal abdominal ring : a slight scratch with the nail or point of the knife will make an opening here, which may be extended by a kind of laceration so as to permit a view of the iliac fascia where it covers the psoas muscle, when the artery will be discovered on the soft brim of the pelvis, having perhaps a small twig of nerve in front of it, and covered by a thin layer of cellular tissue, forming a kind of sheath for it and the vein. The latter lies close upon the artery, and it will be best, after making a slight opening in the sheath, to insinuate the point of the needle from within outwards, so as to avoid the vein : the

Fig. 222.



thread being fastened in the usual way, and the wound closed with a couple of stitches and straps, the operation is completed.

If the opening in the fascia transversalis is made close upon Poupart's ligament, the peritoneum will scarcely be disturbed. There is some advantage in this ; but, on the other hand, the epigastric artery may be in the way—it has, in fact, been wounded in such a case,—and, besides, by securing the artery so very low down, the proximity of the retrograde current of blood through this vessel might possibly prevent the closure of the main artery: it will, therefore, be better even to disturb the peritoneum by stripping it off the vessel somewhat higher, and there need be the less hesitation about this, as experience has shown that little additional danger is occasioned thereby.

The proceedings above described resemble in most respects those recommended by Sir Astley Cooper, but the external incision may be, if it is thought proper, carried more parallel with the course of the artery, as practised by Abernethy in his first operation. The peritoneum is, however, in greater danger in the latter method, and most authori-

ties seem to prefer keeping rather towards the crest of the ilium, so as to avoid the risk of opening the serous cavity ; for, although the latter has actually been done with impunity, (as happened to Mr. Tait,) there can be no doubt of the propriety of carefully protecting the membrane.

Since 1796, when Abernethy first secured this vessel, the operation has been very frequently performed, and with such success, that the surgeon may undertake it with far greater confidence of a fortunate issue than in similar operations on other large arteries.

It may be necessary to apply the ligature higher up than has been recommended ; and the only additional instructions required here for such an instance are, that the external wound should be placed half an inch or so higher, and that the peritoneum has to be more extensively stripped from the vessel, which lies somewhat deeper than at the lower third of its course.

Since 1812, when Mr. Stevens of Santa Cruz first tied the internal iliac for supposed aneurism of the gluteal artery, the operation has been repeated in at least four different instances, in two of them with a fortunate issue, so that it has been successful in three examples out of five. The proceeding may be accomplished through the incisions last recommended, only it will be necessary to interfere with the peritoneum still higher, and possibly it may be necessary to make a freer external wound. Half an inch or more of the vessel can thus be exposed, and with care the needle may be carried round it without danger to the vein, which lies behind and above.

In 1827, Mott successfully applied a ligature to the common iliac artery for aneurism in the inguinal region. The operation had been performed once previously by Gibson in a case of gun-shot injury ; but the patient died on the sixteenth day after. It has since been done by Crampton, Syme, Guthrie, Salomon, and other surgeons, with a degree of success sufficient to warrant its repetition in future instances, and the proceedings may be accomplished in the following manner :—A wound in the skin, from six to eight inches in length, should be made nearly parallel with the upper end of Poupart's ligament and the crest of the ilium, and about an inch and a half nearer the mesial line than these parts : its lower end being from one to two inches below the anterior superior spinous process. The external and internal oblique, transversalis, and transversalis fascia being divided to a similar extent, the peritoneum must be stripped from the fascia iliaca towards the mesial line, and (the ureter with it) must be raised from the vessel to permit the point of the needle being carried round it, which should be done a little above its bifurcation.

In the operation on the upper end of the external iliac, on the internal, or in that last described, the fascia transversalis will be found of greater strength than at the internal abdominal ring, and will probably require a freer application of the knife than in the latter situation. The peritoneum will, in all likelihood, separate as readily from the fascia iliaca and the front of the psoas muscle as it does

on the dead subject. Indeed, from the admirable description given by Sir Philip Crampton, it appears that the resemblance on the living body to the proceeding on the dead is greater than in most other operations on the large arteries; for, with the exception of the bleeding from the external wound, and the muscular parietes, (which will probably have ceased ere the deep parts are exposed, although possibly the superficial epigastric and branches of the circumflexa ilii may require ligatures,) there may, in reality, be nothing to obscure the view of the vessels. Sometimes, however, an aneurismal tumour may be so high as to bulge through the opening, and the peritoneum, with the bowels within it, may also do the same. Mott had great difficulties to contend with from both of these circumstances, but overcame them by making a very large external wound (eight inches) and holding the projecting parts aside by means of curved spatulæ and a wooden board three inches broad, either or both of which being more convenient in the wound, perhaps even more safe, than the fingers of assistants.

Letter *a* on the preceding figure (222) marks the line of incision for the lower part of the external iliac, and *b* shows that for the upper end of this vessel, for the internal, or for the common. Letter *c* in the same drawing shows the course of the incision which was made by Sir Astley Cooper when he placed a ligature on the abdominal aorta. After opening the peritoneum, dividing the linea alba an inch and a half above the umbilicus, and as much below, Sir Astley, by scratching with his nail at the root of the mesentery, was enabled to insulate the artery, and carry a thread round it. A similar operation has been performed by Mr. James of Exeter; but both were unsuccessful; and more recently another attempt by Dr. Murray has been equally unfortunate. In the latter instance, instead of opening the peritoneal cavity, the vessel was secured by reaching it behind the membrane, somewhat in the manner above recommended for ligature of the common iliac. Such a method is doubtless best in dogs, in whom the vessel is usually reached by an incision parallel with the outer margin of the quadratus lumborum muscle; but, in my opinion, a wound sufficiently long could not be made between the crest of the ilium and the twelfth rib on the human subject, and in such an incision as that for the common iliac the depth from the surface would be so great, that there would be vast difficulty in conveying the thread round the vessel. When Mott secured the common iliac, the distance of the artery from the external wound was "the whole length of the aneurismal needle;" it would therefore be considerably greater were such an attempt made on the aorta.

Since John Bell's celebrated case wherein he tied the gluteal artery, which had been cut across in a punctured wound, a similar proceeding has, I believe, been effected by Mr. Syme, although I have not heard that the operation was so formidable. Mr. Bell first made an incision through the skin and "great fascia of the hip," two inches and a half in length, into the large collection of effused blood; this not sufficing, it was made "eight inches long"; then the patient being in danger of

bleeding to death, although "in a moment twenty hands were about the tumour, and the bag was filled with sponges and cloths of all kinds," the intrepid operator "ran the bistoury upwards and downwards, and at once made an incision two feet in length," by which he was enabled to secure the open vessel. The patient ultimately recovered, although he was so exhausted from loss of blood, that he could not be removed from the operating theatre of the hospital for some time after.

For such operations no rules are required further than those inculcated in various parts of this volume, nor do I consider it necessary to occupy space by describing the ingenious dissecting-room proceedings whereby it has been proposed to carry a ligature round the common pudic artery where it lies behind the spine of the ischium.

CHAPTER IV.

HERNIA. OPERATIONS.

A HERNIA in a state of strangulation is that form of the disease which is usually of most interest to the surgeon. Under ordinary circumstances the management is principally confined to the patient and the truss-maker. The surgeon may sometimes, however, be consulted regarding certain tumours, whose nature may be doubtful; and though it seldom happens that he has much difficulty in the diagnosis, cases are occasionally met with which may require more than usual care in their examination, and in some instances there is a degree of carelessness evinced, and such hasty conclusions are drawn, that much anxiety on the part of the patients and friends is sometimes caused by those who form too hasty opinions. I have known a truss ordered by a practitioner of great eminence and great experience of children's complaints, in an instance of a boy about five years of age, where the testicle was presenting at the lower opening of the inguinal canal, and where there was no apparent disposition to protrusion of the bowels; and very recently an example has come under my notice where the testicle, in a somewhat similar case, had been completely wasted away by the continued pressure of a truss. Again, I have known the truss ordered and worn in instances of hydrocele and cirsocele in the adult, and although in the first of these affections little harm might accrue—excepting the anxiety of mind occasioned by the supposition that a rupture is present—it will be evident that the latter must in all probability be increased. The history and diagnosis of such diseases need no especial notice here, and the hernia in a state of strangulation may therefore at once be taken under consideration.

One of the most common tests of hernia is the presence of a tumour, but this cannot always be appreciated, as has already been stated in p. 500; but there are certain symptoms usually denoting the state of strangulation which can scarcely be overlooked: the pain in the abdomen—often of a gnawing, dragging kind,—nausea and vomiting, obstinate constipation, swelling of the bowels, thirst, feverishness, excited pulse, perhaps small and wiry, are all palpable symptoms of a strangulated hernia, more especially if a tumour of the kind be present. If the surgeon has not been aware previously of the existence of such a disease, the symptoms should be sufficient to induce him to question the patient on the subject, and should he also be in ignorance, a strict examination of all the ordinary seats of such protrusions should be instituted. If a tumour be present, there will be pain in it from the first, which will probably extend from thence over the abdomen, and now the protrusion will be more tense than usual, and ere long will be tender to the touch:—there may be inflammation on its surface as well as within. All the symptoms above enumerated may be present independent of hernia, or the tumour may be so very small as to be overlooked, or of a doubtful character: if, however, there be a distinct swelling in the ordinary site of this disease, there need be little hesitation about the cause of the patient's sufferings.

Supposing the case to be one of hernia in a state of strangulation, as it is evident that the protrusion is in all probability the chief cause of the distressing symptoms, the first object with the surgeon should be, to return it into the abdomen by means of the taxis, as it is technically called, viz., applying his fingers, and pushing the parts into their natural position,—the method of effecting which, in an ordinary case, will be afterwards explained. But it will often happen that this manœuvre cannot be accomplished at once, and therefore certain means must be resorted to in order to facilitate the process. Usually the first step in the treatment of such a case is to administer a purge by the mouth,—this being done chiefly to ascertain if the intestinal canal is really obstructed, and partly, also, under the idea that the excited action produced thereby in the muscular fibres of the intestine, may draw the protruded portion within the abdominal cavity again,—and either before or after a purgative clyster is also resorted to: then antispasmodics are given by the mouth and *per anum*, opium being administered in either way, and tobacco being given in the form of clysters and smoke, and a relaxing effect is further produced by the warm bath. Occasionally warmth is applied to the tumour by itself, but more frequently cold is put upon it by means of ether or ice. Sometimes leeches are placed upon the swelling, and generally blood is abstracted by the lancet, more especially if the strangulation be very recent, and the patient young and robust. The taxis often succeeds after one or more of such measures have been adopted; but in many examples the efforts are unsuccessful, and the surgeon has to determine what is best to be done next. Still unwilling to put the patient to the hazard of a cutting operation, he may repeat some of these accessory means.

Purgatives, in my opinion, invariably add to the patient's distress, by increasing the already excited action in the intestines above the seat of stricture: great quantities of tepid water introduced into the large intestines by a long flexible tube attached to the enema syringe, as recommended by Dr. O'Beirne, may be of greater service, although not much to be relied upon either. A repetition of opiates and antispasmodics will seldom do harm, and occasionally while the patient is under the influence of one or other of these, the worst symptoms will disappear, and the taxis may now be successful, — indeed, in some instances the swelling recedes spontaneously. It may often be a question how long such efforts shall be continued; and here the surgeon must be guided by a variety of circumstances, which his general professional knowledge will lead him to appreciate. If the patient be young and plethoric, the tumour small, hard, and tender, the abdomen tense and painful, the pulse small, quick, and hard, if there is incessant vomiting, and occasional hiccup, coldness of the extremities, great depression of strength, and general distress, there should be little time lost in pursuing such methods, more especially if any of them have been tried before; but if, on the other hand, the symptoms are not so urgent they may be persisted in for hours or for days. In one instance strangulation may produce fatal effects, although relieved within a few hours; in another, the condition may be present for many days, and yet permanent relief may be afforded by the taxis or by cutting. On one occasion a surgeon will at once feel convinced that the taxis will not succeed, while in other examples he may see no impropriety in continuing his trials in this way for half an hour, an hour, or more, with or without the adjuncts above alluded to. In hospital practice these preliminary measures have commonly been tried before the surgeon sees the case, and on these occasions he seldom delays as long as he otherwise might.

To accomplish the intention of the taxis in an example of inguinal hernia, the patient should be laid on his back, and a cushion should be placed under the shoulders, whilst the thigh is bent towards the abdomen; the surgeon should place his fingers on the tumour so as to raise it a little, if it be down as far as the scrotum, and at the same time to apply pressure upon a large extent of its surface: he should then push upwards, outwards, and towards the peritoneal cavity, and if the attempt is to be successful, the contents of the sac will diminish, at first in an almost imperceptible degree, but towards the end of the operation, with great rapidity, and with a peculiar guggling noise. To prevent a recurrence of the protrusion, a truss should be afterwards worn at all periods when the patient is in the erect posture, or employed in any kind of exercise or labour. In many instances, when there is great tendency to protrusion it may even be advisable to keep the instrument on whilst in bed. If one has been worn for a long period, perhaps from infancy, and if the protrusion has never been large, it may probably be laid aside at last; but there may be danger

in doing so, even though the original sac may have been completely obliterated by the long-continued pressure.

If, then, it is found impossible to reduce the contents of the sac by the taxis, the use of the knife becomes absolutely requisite, and it is my opinion that, in the majority of cases, the sooner it is resorted to, when once the surgeon is satisfied that he cannot relieve the patient in any other way, so much the greater chance is there of success attending the operation. The instruments for this proceeding are, a scalpel, a director, and a curved probe-pointed bistoury, with other apparatus and assistants such as are usually required for capital operations. Whatever be the size of the hernia, a wound through the skin of three or four inches in length will, in general, permit of the due performance of the future steps; if the tumour be small a shorter incision than this will scarcely suffice, and if large, a longer one will not facilitate the movements of the surgeon much, whilst it may increase the patient's danger considerably by the exposure of additional extent of textures. It may, however, be requisite to increase the length of the external opening in particular cases. The patient being on his back, with the knees (more especially that on the affected side) and shoulders slightly elevated, the surgeon, standing between the legs or on whichever side is most convenient, makes an incision through the skin over the neck and body of the tumour, its upper extremity being nearly midway between the anterior superior spinous process of the ilium and the tuberosity of the pubes, about one inch and a half above the level of Poupart's ligament, and its lower about the middle

Fig. 223.

part of the scrotum, as indicated in the accompanying drawing (fig. 223); the cellular membrane should next be divided in the same

line, and to nearly the same extent, so as to lay bare the outer surface of the sac: a small aperture should be cautiously made in this membrane, which should then be fully laid open with the probe-pointed bistoury; the apex of the forefinger of the left hand should now be passed upwards to the neck of the sac, and the bistoury laid flat upon it; the point of the latter should then be cautiously insinuated beneath the stricture, which must be divided by turning the edge and pushing it upwards and forwards, so as to cut the anterior part of the neck of the sac, and all structures over it which seem to cause or assist in forming, the stricture: the knife being withdrawn, the bowel is then to be pushed gently upwards until it recedes into the abdomen, when the wound must be stitched, and covered with a thick broad compress (a soft towel answers very well), which should be retained by means of a roller passed in the figure of 8 round the thigh and pelvis. The two hands and the bistoury are here represented in the usual attitude

Fig. 224.

on these occasions. The edge of the knife may be supposed to have been turned towards the stricture, and it will be evident that its point may be raised either with the right hand, or with the forefinger of the left. It has been the custom of some teachers to recommend that the point of the bistoury should always be kept close upon that of the finger, and that the stricture should be divided by describing part of a circle with the right hand,—a manœuvre which evidently could not be accomplished in a deep-seated stricture, as it often is, without making a much more extensive wound than the circumstances demand.

These instructions will give a general idea of the style and nature of the operation; but to make the description more useful, it will be necessary to treat at greater length of the various steps, and also to refer to the ordinary appearances presented by each texture as it is exposed and divided.

If the hernia be of recent formation, the cellular tissue and fat will differ little in appearance from the ordinary condition in their natural state; but if the protrusion has been of long standing, in all

likelihood the structures between the skin and sac will be much attenuated. Towards the neck of the sac, however, the textures will resemble the natural condition of the abdominal parietes. After the division of the skin, it is customary to raise a little cellular tissue with the forceps, and to cut it by carrying the knife horizontally; a director is then passed into the little opening thus made, and pushed under a thin layer of cellular texture in the direction of the incision through the skin, and the part thus raised is divided by carrying the point of the knife along the groove of the director; by similar proceedings the subjacent structures are incised, until the sac is laid bare; in some instances the director being used perhaps only once or twice, and in others four or six times, according to the thickness of the parts or the boldness of the operator; a small aperture should then be made into the sac, by cutting cautiously with the point of the blade; or if there is any fear of passing so deep as to endanger the contents, the forceps and knife should be used as when the cellular texture has been divided in the previous steps of the operation: a probe pointed bistoury, such as is represented at p. 67, should then be passed into the opening, and carried upwards and downwards, so as to expose the contents.

It is not easy in many instances to distinguish between the outside of the sac and the cellular texture over it; but in general there is no difficulty in perceiving when the sac is opened, partly by the escape of fluid effused from the serous surfaces, as well as by their comparative smoothness. In some the fluid is in small quantity, but in others it is to the extent of many ounces, particularly when the hernia is large, and has been for a considerable time in a state of strangulation, and it is commonly of a dark colour. The protruded parts are in general easily recognized, as much by their colour as the smoothness of their surface. In some few examples the colour is scarcely different from that of the natural condition, but in most it is of a dark brown, similar to that of chocolate. In some cases the sac of an inguinal hernia is scarcely thicker, if at all, than the peritoneum in its usual state; but often it is considerably so, both in this respect and in density.

In opening the sac, there is no occasion to carry the incision so high as its neck, nor so low as its fundus; if the tumour be small, this latter step can scarcely be avoided; but if it be large, the incision should never be carried so far, unless there be something peculiar in the case, such as the adhesion of part of the contents to the surface of the sac, when it may be advisable to use the knife more freely.

If the hernia is of recent occurrence, and has protruded in the course of the cord, it may be requisite to pass the point of the finger a considerable way up the canal, before the seat of stricture can be ascertained; a portion of the tendon of the external oblique may even require to be slit up before the neck of the sac can be examined in a satisfactory manner; but if the disease has been of long standing, even if the descent has been through the whole canal, the upper or

inner opening (in the fascia transversalis) is in general not far distant from that in the tendon of the external oblique, having by a gradual process passed downwards (or been in a manner dragged by the weight of the protruded viscera) until it has come nearly opposite the latter part, so as to have made the passage from the sac into the abdomen nearly direct, and diminished the length of the canal, if it can now be called so, to merely the thickness of the abdominal parietes in this situation. In the first of these instances, when the hernia takes an oblique course, the division of the tendon of the external oblique to a small extent may permit the return of the protruded parts; it may be necessary, however, to cut deeper, and divide the lower margins of the internal oblique and transversalis muscles, or the conjoined tendons, or perhaps the neck of the sac, with a portion of the fascia transversalis; and in the instance where the upper extremity of the canal has come down opposite the lower, the whole of these structures will, in all likelihood, assist more or less in forming the stricture — at all events in cutting it, a small portion of each of them will probably be divided. At this step of the operation the bistoury should be nearly in a parallel direction with the linea alba, and the upper margin of the opening should be the seat of division. The epigastric artery will be either on the inner side of the neck of the sac or on the outer, as the case happens to be an oblique hernia or a direct one; but as the surgeon can seldom be certain as to the nature of the case, it will be better on all occasions to follow the above directions, as this vessel will thus be less endangered than if the incision were carried outwards or inwards, under the supposition of the hernia being oblique or direct, as to which points the operator might find himself mistaken. In dividing the stricture, the point of the knife should be raised from the finger, or it may be gently pushed upwards and forwards by the latter until about one eighth or one fourth of an inch of the textures has been cut, when an attempt may be made to reduce the contents of the sac; a little pressure should be applied on a part of the bowel nearest the neck of the sac, and if it recedes, the remaining portion will be readily made to follow; if part of the contents of the bowel—even a small quantity of air—can be squeezed into the canal within, the reduction will be much facilitated. If any portion of the omentum be down, it must next be returned, by pushing in that part first which is nearest the abdomen.

If there are extensive adhesions it may be found impossible to reduce the protruded viscera, and in such a case all that the surgeon can do is to divide the stricture freely; if, on the other hand, the adhesions be slight, they may with propriety be destroyed, when reduction may be accomplished. In some instances it is proper practice to remove a portion of the omentum when it has become much altered in shape, and perhaps irreducible: in such a case a ligature should be applied above the part about to be divided, one end of which should be left hanging out of the wound, after the upper portion of the omentum has been reduced: in other cases it may be advisable to leave the

intestine unreduced, after having cut the stricture, in consequence of sloughing, or a disposition towards it.

If, unfortunately, the intestine is wounded during the operation, which occasionally happens, chiefly through the rashness and carelessness of the operator, then there is no better course of procedure than leaving the aperture at the mouth of the sac, and retaining it there by means of a stitch through the bowel and the latter part—care being taken to keep the orifice in such a position that the contents of the gut will have free egress through the wound, without passing into the peritoneal cavity of the abdomen. Should the patient survive, and if there is an artificial anus, there will be plenty of time afterwards to consider what is best to be done, and whether Dupuytren's mode of practice may be resorted to.

It has not been my design in this work to dwell at great length on any individual operation; and though I have been more particular in describing that for hernia, with its difficulties and dangers, than with most others of which I have treated, the reader must not suppose that the subject has been exhausted; on the contrary, I have confined my remarks to the leading characteristics of the disease and the operation, as they have presented themselves to me in a considerable series of cases, occurring both in my own practice and that of others. It is well known amongst practical surgeons, that in different instances of hernia, when the knife is required, appearances will present themselves which no former experience could have anticipated, and it is in such examples that the real difficulties are encountered: even allowing that these are productive of no embarrassment to the experienced surgeon, it must be admitted by all who have frequently performed this operation, that no language can sufficiently explain the different appearances which may from time to time be the cause of serious impediment. These remarks will be sufficiently appreciated by any one who has already had experience in such proceedings, and I shall add nothing more on the present occasion regarding this subject, than merely refer to the difference in the description of the anatomy of the inguinal canal and of the operation: in the first, various textures have been spoken of under different names, whilst in the latter I have given a general direction to cut through every texture (without specifying each fascia) between the skin and the sac or its contents: the one style answers the purposes of the anatomist, the other, viz., that of considering all the textures or fasciæ, as one layer, is, or ought to be, the view which the surgeon should take of the operation: this layer may be thick or thin, and may be divided with a few strokes of the knife, or require its repeated application, as has been clearly pointed out in the preceding pages.

If a femoral protrusion be small and of recent date, the textures covering it will resemble the natural condition;—there will be a considerable quantity of fat and cellular tissue to divide ere the sac is exposed; and, on the other hand, if it be large and of considerable

standing the skin and other tissues may all be found remarkably thin. In some instances of old date, when the tumour has never attained a great size, the sac is found a quarter or even half an inch in thickness; but in general it differs little in this respect from the usual condition of the peritoneum.

Before resorting to the knife the taxis must be tried, and in applying pressure with the fingers backwards, and slightly upwards, too much attention cannot be paid to the position of the thigh, which should be bent upwards on the pelvis, whilst the patient is in a horizontal position, with the chest a little elevated on a pillow. The muscular parietes of the abdomen, as well as Poupart's ligament, are thoroughly relaxed in the above position, and if the fingers be judiciously applied, every fair chance is thus given to this method of procedure. It often happens, however, that the surgeon does not deem himself warranted in applying much pressure with his fingers; indeed, in many instances, from previous experience, he can form a tolerably accurate idea as to the likelihood of his efforts being successful or otherwise as soon as he places his fingers on the protrusion, and he proceeds at once to divide the stricture with the knife. A single incision about three inches in length, as exhibited by the dotted line in the accompanying drawing (fig. 225) will, in general,

Fig. 225.

permit of all the requisite steps to be performed with facility. If the tumour be of considerable size it may be made longer; but in such a

case an incision of this kind , of this , or of this , (I generally prefer the last,) will be better: two or three flaps can thus be raised, and the parts can then be more clearly distinguished. After the integuments have been dissected from the tumour, it is not necessary to clear away each succeeding layer in the same manner,—a single line of division being all that is required. The dissection must be conducted much in the same manner as is described in the operation for inguinal hernia: whatever is the thickness of the coverings, they must all be divided: and when the sac is opened, the finger must be pushed up towards the seat of stricture; a probe-pointed bistoury must then be passed a little higher than this part, and its edge being turned against the stricture, an incision about one-fourth of an inch will in general suffice to permit the reduction to be accomplished.

With regard to the seat of stricture in this kind of hernia, it will almost invariably be found in the crural ring itself. It is customary for some surgeons to speak of Gimbernat's ligament as being the seat of stricture; but, in my opinion, it is not more so than any other part of the ring; and the idea is quite erroneous, that because this structure happens to be cut to permit the protrusion to be reduced, it has been the sole cause of the stricture. I think there can be little doubt as to the propriety of dividing this ligament to the extent already mentioned, and the reasons may be stated in a few words: the knife cannot be carried outwards without endangering the common femoral vein, and it cannot be conveniently passed behind the protrusion, so as to open the back part of the ring, nor if it were so could any texture be divided likely to relieve the tightness; if it be carried in front, Poupart's ligament may be cut with facility; but the parts will be thus rendered so weak that a protrusion may afterwards happen in the cicatrix; there is thus then only another side of the ring left, and that is formed by Gimbernat's ligament, which seems to me by far the most eligible part for the enlargement. When the aperture is thus cut its diameter is increased, and the stricture is consequently removed.

In some instances the stricture may be relieved by dividing the upper horn of the crescentic margin of the fascia lata where it is attached to Poupart's ligament; it does not follow, however, that this part has consequently been the cause of constriction, for the effect of the incision has been to enlarge the ring, and thus to relax the real seat of stricture; nor do I suppose that the plan would answer in any instance where the latter is very tight: on some occasions, after hav-

ing cut this part, I have not been able to push the bowel up, and have therefore passed the instrument a little deeper, and divided Gimbernat's ligament with the desired effect. It is undoubtedly easier to get at Poupart's ligament in this operation than at Gimbernat's; but the objection I have already stated to the division of this texture seems to me a good one; the edges of the ligament will never come close again, and there must be a certain relaxation of the parts afterwards; for however firm the cicatrix may be supposed to make them, it is certainly no unusual thing to see instances of protrusions occurring after the wound has completely closed. I do not conceive that there is any serious danger of injuring the spermatic cord in cutting Poupart's ligament, as the knife ought never to be carried so high.

The slight additional difficulty of reaching Gimbernat's ligament ought not to deter the operator from dividing it in preference to the mode last referred to, and the only objection to this proceeding that I can perceive is, the risk of dividing the obturator artery, should it happen to originate from the epigastric, and run downwards to the obturator foramen along the inner side of the neck of the sac, parallel with the margin of the ligament. This risk has, I am inclined to think, been very much exaggerated, for although the irregularity is of common occurrence, as proved by the statistics of the dissecting-room, no average has been yet given of its presence simultaneously with hernia, nor would such a calculation be of any great practical value. In such a calculation it would be necessary to ascertain how often the artery runs on the inside of the neck of the sac, and how often on the outside; for it is by no means to be supposed that when the irregularity is present, and a hernia occurs, it must of necessity pass in such a way as to leave the artery on the inner side of the neck of the sac so as to be endangered in the division of the margin of Gimbernat's ligament. Even supposing that the vessel is present in this unusual position, I believe that this texture may be cut to the requisite extent without at the same time dividing the artery; and with this object the point of the bistoury should alone be passed beyond the margin of the ligament; indeed, there is no advantage in passing the instrument deeper than is sufficient to allow its cutting edge to come in contact with the part to be divided, and if this be attended to, the obturator artery will in all probability escape, although it may even be in close contact with the neck of the sac and ligament of Gimbernat. At the worst, the accidental division of the vessel does not appear to be fatal in all instances, as one case, at least (occurring in Dupuytren's hands) proves, where the vessel was wounded, and the occurrence was not even suspected until the death of the patient three weeks afterwards, from disease in the bowels, when a clot of blood in the site of the wound led to the detection of the injury.

After the operation for crural hernia the edges of the wound should be brought into contact by stitches, and a pad should be retained over the parts by a bandage, as in the case of the inguinal protrusion.

Fig. 226.

In relieving the stricture in either crural or inguinal hernia, the utmost care should be taken to avoid injuring the contents of the sac. I have known the point of the bistoury thrust into the bowel in attempting to pass it within the stricture, and in the crural protrusion there is considerable danger of committing this error, unless great caution be used. If the tumour is large, or if the stricture is deeply seated, the bowels are apt to turn up over the finger when the bistoury is on its anterior surface preparatory to dividing the stricture, and if the extent of cutting edge be great there is a risk of the intestine being wounded:—to avoid this, an instrument, such as the one here represented (fig. 226), where the cutting edge is of small extent, may be advantageously used. Some have even recommended a bistoury with a sliding shield, by which the sharp margin may be diminished to the smallest possible extent. The bleeding from the external wounds in these operations (from the superficial epigastric, perhaps, or the external pudendal branches) seldom causes any annoyance, and ligatures are rarely necessary.

In the operations above described, the ordinary method of opening the sac has been recommended; but in large protrusions it would unquestionably be highly desirable to return the contents without thus exposing the peritoneal surface. In the majority of such cases, the stricture may be divided without penetrating the sac; but in some instances, even after this has been done, the protrusion cannot be returned in consequence of adhesions. If there were reason to suppose that these were of old standing—as, for example,—in an instance of long continued irreducible hernia,—it might be a question whether the contents should be exposed, but if it were probable, that the adhesions were slight and of recent date, and, further, if it were supposed possible to succeed in dividing them, and then returning the viscera, the sac should be opened, but by a wound not larger than may be absolutely necessary to effect the objects in view. Even in small herniæ, it has been proposed to relieve the stricture without opening the sac. The practice was resorted to by Petit and Monro, and in more modern times has received the sanction of

Sir Astley Cooper, Mr. Key, Mr. Lawrence, and other surgeons of distinction. I am not aware, however, of any practitioner of the present day having had such experience in this mode of procedure as Mr. Luke, of the London Hospital. In a conversation which I lately had on the subject with that gentleman, he informed me that his operations had been very unsatisfactory in their results until he adopted the plan in question, when he found that instead of losing every third patient, or about that average, he had only lost two out of nearly forty on whom he had operated without opening the sac. Experience such as this ought assuredly to have great weight, and should, along with Mr. Key's excellent Memoir, go far to attract still greater attention to the practice. I have myself adopted it in several instances; but need not dwell further upon it than to express my conviction, that the practice is worthy of far more consideration than it at present meets from the generality of practitioners. The dressing of the wound and after-treatment should be the same whether the sac has been opened or not, and in all instances the patients, when again able to move about, must be enjoined to wear a truss as carefully as if an operation had not been performed. The cicatrix in these individuals gives no security against a second protrusion.

For further valuable information, which every practical surgeon should possess, I must again refer to the works of Cooper and Lawrence, both regarding the kinds of hernia particularly alluded to above, as also the umbilical and other rarer forms of the disease.

The modern proposals, by Gerdy, Guerin, and others, of causing the obliteration of the sac or its neck, have as yet met with few advocates in this country. The subcutaneous incisions of the latter gentleman have not, in so far as I am aware, been put into execution by any of our surgeons; and the ingenious practice of Gerdy of turning in the sac of a large inguinal hernia, as we might the finger of a glove, and using stitches to keep the part in this position, has, to my knowledge, been only once done in England. Mr. Bransby Cooper succeeded in this way in partially relieving a person, who was disabled from active occupation in consequence of a large hernial protrusion through the inguinal canal, which could not be retained within the abdomen by any of the usual means. Under ordinary circumstances it is doubtful in how far the surgeon would be justified in adopting such a procedure.

CHAPTER V.

OPERATIONS ON THE RECTUM.

VARIOUS operations are demanded on and near the lower end of the rectum. An aperture may be required in the perineum in case of imperforate anus, and here the proceedings may be simple or complicated according to circumstances.

A few days ago I saw an instance in a new-born infant, where the opening at the lower part of the rectum was so small that the meconium could be discharged only by drops: a large collection above had taken place, and the protrusion in the perineum was considerable. A probe-pointed bistoury was introduced, and four notches were made, which permitted a most copious evacuation.

If, as often happens, the rectum is closed below by a thin portion of skin only, its projecting extremity, as the meconium collects, will soon become so distinct that there can be no hesitation in passing the point of a knife through the obstruction, and thus giving vent to the matter. In such an instance a crucial incision will be advisable, and it will be proper also to watch the healing of the wounds, lest the opening become too small.

In examples when the anus alone is imperforate, and where the gut immediately above is fully developed, the sphincter and levator muscles are, in all probability, entire, and the parts shortly after operation will appear as if nothing had ever been wrong.

But the bowel may be much deeper, and a freer use of the knife may be required. Here the wound must be made in the usual site of the anus, and carried sufficiently deep to reach the end of the gut. This, however, cannot be accomplished in all instances, for the termination of the intestinal canal may be so high that it does not reach the cavity of the pelvis at all, or if it does, the surgeon is reluctant to carry the instrument so deep in case of wounding the bladder, peritoneum, or iliac arteries. The latter vessels must be closer to the wound than might be imagined, for in such a young subject, when the finger is passed deep, the sides of the pelvis can be readily felt — indeed, it is in close contact with them.

Occasionally the gut opens into the bladder or urethra, when, if its lower end cannot be reached, an incision must be made into one or other of these parts. A case of the kind once came under my own care, the particulars of which were published in the 36th volume of The Edinburgh Medical and Surgical Journal. An opening was made into the neck of the bladder as was supposed, and the operation was, in as far as circumstances would admit, perfectly successful. The boy lived and throve till he was six years old, when he died of disease of the lungs. Although it may be doubtful if there was a sphincter or levator here originally, he had the command over the aper-

ture and the urinary apparatus that children usually possess. Occasionally when his bowels were loose, a few drops of fæces would come by the urethra, and he was wont also to discharge part of the urine by the artificial opening. On several occasions small hard urinary deposits were discharged from the anus, and I had to extract one about the size of a hazel-nut. Often his mother had to remove small seeds and barley-pickles from the orifice of the urethra, and once she extracted a small portion of bone which he had swallowed in his food. On inspecting the parts after death I found that the bowel terminated in the membranous portion of the urethra, by an aperture about the size of a lancet puncture, and not in the upper end of the bladder as was at first imagined.

When the infant cannot be relieved by an opening in the perineum, the sigmoid flexure of the colon may be cut into through an opening made in front, (as was originally proposed by Littre,) or any other portion of the large intestine which might happen to be prominent. The descending colon, as was recommended by Callisen, perhaps even the sigmoid flexure, may be reached behind where not covered by the peritoneum, and thus that membrane may be avoided; but such proceedings have been attended with indifferent success, and considering the condition in which the patient is afterwards left, with an artificial anus in the side, constantly permitting the escape of the contents of the bowels, such results are scarcely to be regretted.

In the adult the lower part of the intestine in some individuals becomes completely obstructed, by the contraction of a stricture, or in the progress of scirrhus and cancer of the rectum. Amussat in such a case, has strongly recommended the formation of an artificial anus higher up, and has succeeded in relieving several patients in this way. Mr. Teale of Leeds, Mr. Alfred Jukes of Birmingham, and others have performed such operations. The latter gentleman has published some drawings of the parts, in an instance where he opened the descending colon behind the peritoneum in the lower part of the lumbar region: his patient died on the sixteenth day, and one upon whom Mr. Teale operated in March 1842, died on the seventh day after.

Operations are frequently required in cases of hemorrhoids. During the inflamed condition of these tumours, such treatment is seldom advisable. The ordinary means of subduing that disease — such as leeches, fomentations — especially those which are termed anodyne, rest, the horizontal position, and laxatives, form the only reasonable method of practice in such instances, although sometimes when one or more of the inflamed projections are very hard and prominent, a lancet may be advantageously thrust in, or if the base be not extensive, the scissors may be used to snip away the greater part of the disease. But in general, such interference cannot, in my opinion, be deemed good practice. I believe, however, that in the chronic condition of such tumours much more may be done by active surgical interference than is commonly supposed. Here I

allude principally to that relaxed and vascular condition of the mucous membrane of the gut which is far from being unusual in the adult, and which is the cause of so much distress whilst at stool, both from the copious discharges of blood and matter, as also from the eversion or prolapsus which occurs at the time. I may also include those examples where one or more hard tumours are connected with the inner part of the verge of the anus, which protrude on these occasions, or sometimes escape through the sphincter whilst the person walks, and for a time become, in a manner, strangulated.

In either of these instances, supposing that the ordinary treatment by means of astringent lotions and applications in the form of decoctions and ointments, and a due regard to the state of the bowels, exercise, and so forth, produces no benefit, I should strongly advise the removal of the offending parts by means of ligatures, as being preferable to the knife or scissors. Such a proceeding as the following may be resorted to: The patient having had the gut cleared by an enema of warm water, should be desired to lean upon a bed, present his breech to the surgeon, and strain so as to cause the lower part of the mucous lining to protrude: then the surgeon should, with a curved needle in a handle, (p. 30,) introduce a very stout thread or thin whipcord through the base of the part intended to be removed; next the instrument should be thrust across at right angles to the course which it first took, and another ligature being thus inserted, each should be divided into two, and by drawing a firm noose on all four, the part will be completely strangled; and, provided the threads have been drawn sufficiently tight, will drop off in the course of five or six days; after which the sores will speedily heal, and the annoying state of the rectum will be permanently cured.

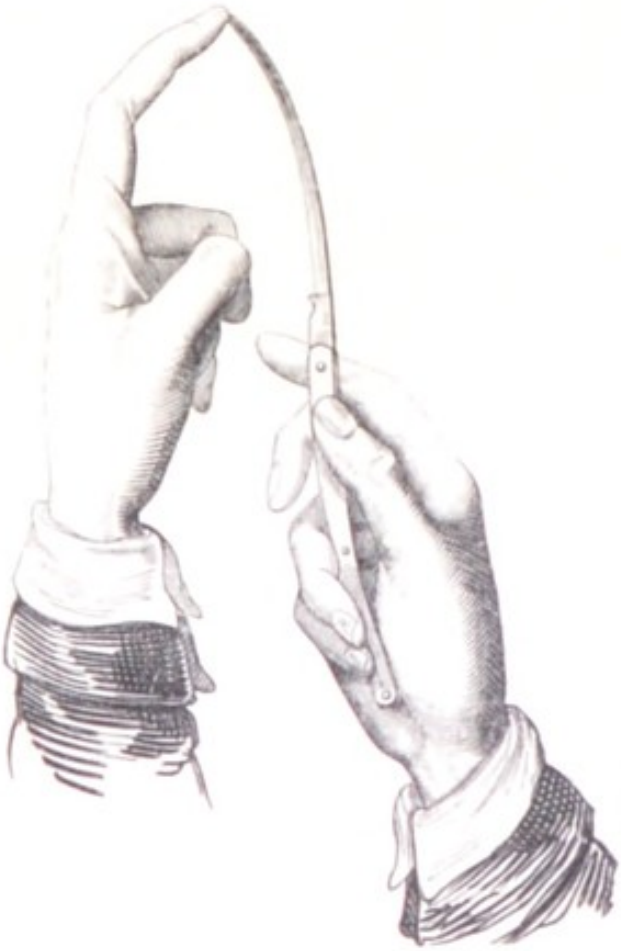
If the relaxed and vascular mucous membrane, or the tumour, be removed with cutting instruments, the hemorrhage may be very troublesome; and, besides, larger open wounds will be left, which will heal slowly, and possibly the interior of the gut may after all remain of a more capacious size than may be desirable. By the proceeding above recommended it will be observed that, besides avoiding all bleeding,—not more than a few drops of blood will be lost,—the interior is contracted in diameter at once; for, supposing the punctures to be about an inch separate, when the threads are drawn tight the part included in the different loops will be compressed into a size so small, that when the slough separates the open sore will not be larger than may be covered with the tip of a finger. Judging from my own experience of this practice, I have no hesitation in stating, that it seems to me so superior to the other modes alluded to, that it should always be preferred. In such a proceeding, as in many other operations in this region, the patient may for several days after have difficulty in voiding urine; indeed there may be complete retention. The catheter, however, will seldom be required, as a little camphor and hyoscyamus, or such like remedies, with the hip-bath, will seldom fail to put all to rights.

Suppuration in the vicinity of the anus may be treated according to those general principles contained in the chapter on abscess in the first part of this volume. This is one of those instances where the practitioner should make an opening at an earlier period than he might possibly deem necessary in many other parts; for if an external incision be not soon made, the matter may perhaps burst into the rectum, and thus the case may become more complicated. Under almost any circumstances, the sac of the abscess is likely to pass into that condition termed sinus, when the treatment may be such as is recommended in the chapter on this subject. It will rarely happen that the sinus (here technically termed fistula in ano) does not require to be laid open. Occasionally such cavities close spontaneously, but it much more frequently happens that the aperture remains patent, and continues to discharge a thin matter, which keeps the patient's linen constantly in a filthy condition, unless he wears some covering upon the part. Sometimes the end of the sinus closes for a time, and the patient fancies himself cured; but ere long an uneasy sensation, perhaps throbbing, is felt in the vicinity, and at last the cicatrix bursts, and the discharge becomes as copious as before. The opening may be single, double, or more; it may be on the skin or mucous membrane; or possibly the sinus may open both on the skin and gut. Sometimes two openings will run into one sinus, and in other instances several fistulæ may exist around the anus. The external end of the sinus may be close to this aperture,—an inch off, or even two or three,—it may be towards the scrotum or in the direction of the sacrum, but is most frequently at one side, and usually about midway between the anus and tuber ischii. The opening in the mucous surface may be close on the verge, or it may be high within the rectum. Some authors have asserted that the inner opening is never beyond an inch from the anus—it rarely is; but I have myself laid open a sinus as high up as the blade of a bistoury would reach, and have often treated cases at intermediate distances. In one instance, then, as may be perceived, the length and thickness of parts between the fistula and the gut will be considerable, whilst in another the partition will be short and thin,—perhaps not more than the thickness of the gut itself,—nay, even the mucous lining; for occasionally matter will so burrow between the muscular fibres and the latter membrane as to establish a fistula, and one which is more apt to be overlooked than those of a conspicuous kind.

The operation for fistula may be performed thus:—The patient should lean over the margin of a bed, table, or back of a stout chair, and the surgeon should seat himself sufficiently low to get a clear view of the perineum: he should then introduce the end of a probe-pointed bistoury (p. 67) through the external opening, and push it slowly along the sinus until it reaches its upper extremity; then the point of the fore-finger of the left hand, smeared with oil, should be passed into the anus, and if the instrument has not yet penetrated the gut, he should cause it to do so, either through the

opening in this situation,—supposing that one is present,—or he should thrust it through partly by pushing with his right hand, and partly by scratching with the nail of the left over the point of the blade; and as soon as this is accomplished the bistoury and finger must be drawn downwards, much in the attitude here represented, (fig. 227,) so that all the textures between the sinus and the rectum are divided, and thus the two are as it were thrown into one chasm. In some instances it may be found most convenient to hook the apex of the finger behind the point of the blade, and thus in a manner to force the cutting edge through the parts which must to be divided. It is scarcely requisite to point out, that if the opening in the skin has been some way from the anus, the sphincter muscle must be divided in the incision; indeed, with few exceptions, the success of the operation seems to depend

Fig. 227.



chiefly on this circumstance. When the sinus is thus laid open, it is well to push the finger into the track to ascertain that there has been no off-set from it. Frequently a space may be discovered under the skin, and the knife should be so used as to expose it fully. A slip of lint moistened with oil should then be passed to the bottom of the wound, and the patient be kept in bed until the

cavity heals by granulation. Doubtless in such cases much depends on the manner in which the operation is performed, but much also may be attributed to the care in dressing; for unless the lint (usually, after the first occasion, covered with a little spermaceti ointment) be kept in the bottom of the granulating surface, the external part of the wound may close, and a sinus still remain. This, however, but rarely happens; whilst, on the other hand, with every attention, after a well-executed operation, ulceration or abscess may come on, new sinuses may form, and the proceedings may all require to be repeated. In such a case, as indeed in all instances of fistula in ano, it may be well to ascertain the condition of the patient's lungs; for the coincidence of fistula with disease of these organs is often remarkable. I need scarcely state that a surgeon would seldom be justified in interfering with a sinus under such circumstances. But fistula in ano will sometimes show itself when there is no suspicion of disease in the chest. Some time ago I had occasion to lay open a sinus on the verge of the anus in a man about fifty years of age, whose appearance did not in any way betoken even a disposition to chest affections: at first the wound went on favourably enough, but in three weeks, when it should have been nearly healed, its condition was much the same as within a few days of the operation, only that there seemed less action on the surface: it continued thus for nearly two months, notwithstanding every variety of treatment which could be feasibly resorted to, both as regarded local and constitutional means, when more decided change of air was recommended. During all this time there was no complaint of any pain within the chest,—no circumstance to lead to suspicion even that something was wrong,—yet in the course of three months this person died of rapid consumption, the wound keeping open all along.

If two or more sinuses are present, they should be exposed in the same way, at the same time, and treated in a similar manner. On one individual I have laid open five deep sinuses at the same period, and after he had been repeatedly operated on before by another practitioner. By great care on the part of my assistant, Dr. George Williamson, now of the Hospital Staff, Fort Pitt, all these wounds healed kindly from the bottom, and the patient was ultimately enabled to resume his duties as assistant-surgeon in the Navy. Here there was complete loss of power over the sphincter for a considerable time; but ultimately this unfortunate condition wore off.

Unless the wound be very deep, there is seldom any bleeding likely to do harm. Should it be more copious than may be desired, the wound should be firmly stuffed with lint, and a pad should be retained

over it by a bandage.

If the sinus is on the left side of the perineum, the surgeon may

find it most convenient, when the patient stands as above directed, to use the bistoury in the left hand; or if he has not sufficient ambidexterity for this, he may have the patient placed on his back, with his knees in the air, as for lithotomy. In any position a couple of stout assistants will be of service to keep the patient steady; for if he is at all unruly, as often happens, the proceedings will be rendered somewhat annoying, and possibly the blade of the bistoury may be broken during the struggles, and remain in the wound. I have seen this happen in the hands of a most dexterous operator; and at all times whatever force may be used with this instrument, care should be taken that the blade does not wheel round, so as to be strained sidewise, for it is then very apt to snap. The cutlers often erroneously make a kind of notch near the heel of this instrument, which causes it to be very deficient in this situation; and it is here where it usually breaks. The flat surface of the blade should slope gradually from the handle to the point.

The division of other sinuses in the perineum, such as those constituting urinary fistulæ, require no especial notice here, neither does it seem necessary to refer particularly to the manner of introducing instruments into the rectum, although cases requiring such manipulations are of frequent occurrence in the practice of surgery. Here, as in other parts of the body, the young surgeon should accustom his finger to the examination of the interior of the gut, whether for the sake of ascertaining the condition of the tube itself or the contiguous parts, such as the bones, prostate gland, and neck of the bladder, (as already adverted to at p. 504,) or for detecting the presence of foreign substances. In the latter instance it is occasionally requisite to introduce instruments, perhaps lithotomy or midwifery forceps, to extract large substances, such as pieces of wood and stones, which have been introduced by the persons themselves. In the Medical Gazette for 19th August, 1842, Mr. Russel, of Aberdeen, gives the history of an individual who seemingly has a remarkable propensity for introducing stones within the anus; he (the patient) himself had extracted, after the surgeons had failed, one weighing thirty-two ounces, and another had been removed with midwifery forceps by Dr. Moir, six months previously, weighing twenty-nine ounces. In the same journal, for 18th February, 1842, there is a case related where Mr. B. Phillips extracted, after the patient's death, a portion of a walking-stick; and several examples of a similar nature are referred to. In some instances the fingers will suffice to extract a small object, such as a bone which may have been swallowed and been arrested in its course downwards in this part of the canal; and on some occasions the finger may be most advantageously used in severing and extracting portions of hardened feculent matter on which ordinary enemata produce no effect.

The removal of the anus and a portion of the rectum for malignant disease, such as scirrhus and open cancer, as recommended and followed by Lisfranc, seems to have few advocates in this country. My

old colleague Mr. Lizars used occasionally to perform the operation, and I have seen one of his cases where, in a man of middle age, he had, some years before, removed several inches of the tube. The parts appeared as if no such proceeding had been resorted to, and the patient had complete power over the lower end of the remaining portion of the bowel. Mr. Lizars was in the habit of removing the verge of the anus in that condition wherein I have recommended the use of ligatures, and operated thus:—The breech being properly presented, he seized the swollen and protruded parts with a volsellum (p. 440), with which he pulled them still further down; next with a bistoury he effected their separation, by incisions made in the line of the circumference of the gut, and then he stuffed a large hard compress, previously prepared for the purpose, into the wound, which he retained firmly by means of a bandage, and thereby suppressed all bleeding. A similar process was followed, when larger portions of the gut were removed, the operations being similar in most respects to those done by Lisfranc. I have not in my own experience met with an instance where I deemed such a proceeding advisable.

CHAPTER VI.

OPERATIONS ON THE SCROTUM, TESTICLE, PREPUCE, AND PENIS.

On the scrotum a variety of operations are required, but few can be done on the dead subject, so as to give an idea of what they may resemble on the living. The treatment of hydrocele forms, perhaps, the largest proportion of the ordinary surgeon's duties in this situation. Here a variety of methods must from time to time be resorted to, notwithstanding the very general application of that by injecting port wine and water. First, after it has been ascertained that the ordinary means of promoting absorption, such as are alluded to in the chapters on inflammation and its consequences, in the early part of this volume, have been found to be of no avail, as will usually be the case, the fluid must be withdrawn from the tunica vaginalis,—a proceeding which may be accomplished in a variety of ways, the most common being by means of a trochar and canula. The manœuvre may be effected thus: The scrotum should be seized in the left hand, gently raised, and squeezed so as to render the skin very tense in front; then the point of the trochar held in the right hand, with the apex of the forefinger almost close upon it, should be thrust into the front of the swelling, about midway between its upper and lower end,

at any interval between the vessels in the scrotum. As soon as the instrument has entered, which will be readily known by the cessation of resistance, the finger must be raised; and, as the trochar is withdrawn, the canula should be thrust somewhat deeper, where it must be allowed to remain until the fluid has run off, when it may be removed.

If the part above referred to be selected, and if the puncture be made nearly at right angles with the surface, there will be little risk of injury to the testicle, as this gland is almost invariably at the back of the swelling. It is injured sometimes when the trochar is thrust too deep, more especially when the hydrocele is small; and on all occasions it is well to ascertain the position of the organ beforehand, as in some instances it lies so much in front as to be in considerable danger. If the want of transparency does not indicate its situation, pressure with the fingers will usually do so.

If a common sewing-needle or a pin be introduced once, twice, or thrice,—once will often suffice,—a similar effect will be produced, though in a different way: the fluid escapes through the aperture in the tunica vaginalis, gets effused into the cellular tissue of the scrotum, and is rapidly absorbed, so that in eight-and-forty hours the swelling will have entirely disappeared. This may not happen in all instances, yet it will in by far the greater number, provided the scrotum is otherwise in a healthy condition, and the fluid does not exceed four or six ounces in quantity. Some years ago this method of treatment attracted a good deal of attention; but so far as I can perceive, it has undeservedly passed out of notice again,—perhaps in consequence of the over-sanguine statements of those who advocated the plan, that it would effect the cure of the disease; but this it is no more likely to do than tapping is to cure ascites, or than the trochar when it is used in hydrocele. It is well known that, after the use of the latter instrument, either in the abdomen or scrotum, the respective diseases are occasionally cured; and the same will sometimes follow the use of the needle, as above recommended; but it is equally certain that such happy results rarely ensue.

If the hydrocele forms again, one or other of these processes may be repeated as often as may be desired; but it is customary after the second or third time to resort to some method of altering the action of the serous surface,—a proceeding which is usually brought about by inducing inflammation. This may be done in a variety of methods; but among the present race of surgeons that by injection has been most frequently resorted to. The proceeding is accomplished thus: The serum being drawn off in the manner already directed, a small syringe, provided with a moveable stop-cock nozzle, is applied to the end of the canula and the tunica vaginalis is again distended nearly to its full extent by a fluid of a different quality from that which has previously been present. A mixture of port wine and water (two thirds of the former to one of the latter) has been generally used since it was so strongly recommended by Sir James Earle; but the wine

will do by itself, and also the water, although the former would perhaps be too stimulating for the generality of cases, and the latter too little so. Solutions of salts, acids, and of tinctures, have also been used for the same purpose; in short, any change of fluid seems, in most examples, to be sufficient to produce the desired effect. Whatever fluid is selected, it is allowed to remain in the cavity for the space of four, six, or ten minutes, or until the patient feels some pain in the testicle, extending, perhaps, up the cord and into the loins, when it is allowed to pass away by withdrawing the stop-cock nozzle; then the canula itself is removed, and so the operation is completed. The patient should keep his couch for a few days, as in all probability considerable inflammation will ensue. The action on the surface will afterwards be so far changed, that the fluid will not again collect. It can scarcely be doubted that in the generality of instances adhesion takes place between the tunica vaginalis and that portion of it named reflexa, although doubtless in some the cavity remains much as before, though the action on its surface is changed for the better, either by diminished secreting, or increased absorbing powers. Sometimes, however, a sufficiently severe inflammation, or at all events the necessary change of action, cannot be produced in this way, even after repeated trials, and as the patient may be anxious to have the disease cured, it may be accomplished in other ways: a seton may be passed through the cavity, it may be cut into, or a portion of it may be removed entirely; and in any of these methods it is evident that a more severe inflammation is certain to be excited. The seton, as I have seen, may produce alarming inflammatory swelling. With incision, or if it be combined with excision, the wound must be stuffed with lint, so as to induce granulation on the serous surfaces, which ultimately unite by adhesion and obliteration of the cavity. The latter process, I imagine, is also usually the result of the seton.

Occasionally I have found the following method answer very well. After using the acupuncture needle, and finding that the whole of the fluid had not been absorbed, or that a new collection was forming, I have with an ordinary sewing-needle passed a piece of common linen thread into the cavity, in the form of a small seton, such as has already been referred to in the chapter on aneurism by anastomosis. This has traversed the scrotum and cavity for about an inch, and has been allowed to remain for one, two, or three days, according to the apparent extent of inflammation. As soon as the patient has complained of pain, and the parts have begun to swell, the thread has been withdrawn, and a radical cure has generally been the result. The puncture and the presence of the thread have usually permitted the fluid to escape into the cellular tissue, and, as the thread has come into contact with the testicle, the desired and requisite amount of inflammation has been more certainly produced.

One or other of the above plans must insure the obliteration of the cavity, and it is easy to perceive that some of them may be modified in various ways, as, for instance, with the needle the surface of the

testicle may be scratched in such a manner as to induce inflammation on the surface, while at the same time vent is given to the fluid. A fine trochar and canula may also be used, the point of either being caused to graze the testicle. But the plan most likely to supersede all others, is that which has lately been brought under the notice of the profession in this country, by my friend, Mr. Martin, of Grosvenor Street, formerly surgeon to the Native Hospital in Calcutta. Instead of throwing in several ounces of port wine, this gentleman, by means of an ordinary urethra syringe, passes through a narrow canula, which has already been used in tapping, a small quantity of solution of iodine, which he allows to remain in the cavity—withdrawing the canula as soon as it has been introduced. The requisite amount of inflammation is thereby produced; and, as Mr. Martin has pointedly stated, without any risk having been incurred of the port wine being infiltrated in the cellular tissue of the scrotum—an event which, in the ordinary operation, is probably not so rare as some suppose. I have myself known four instances of this unhappy mistake, and have little doubt that others of greater experience must have seen many more. Velpeau has resorted to a similar practice; but the amount of experience acquired by Mr. Martin among the natives of the East, who seem peculiarly liable to this disease, puts all that can be stated by a European practitioner into a small compass; for whilst a surgeon, possessing even tolerable opportunities here, can speak only of his dozens of cases, or hundreds at most, Mr. Martin can adduce thousands! I have lately learnt from others who have practised in India, that the method has answered equally well in their trials of it, and now it remains to be seen whether it will prove beneficial in equal proportion in other parts of the world.

The above plans modified by circumstances will be also applicable to that form of hydrocele which is occasionally seen in the spermatic cord.

Hematocele and Cirsocele require no particular notice here, unless it be that in the latter affection the method of obliterating the veins with needles, as described at p. 319, might possibly be of service in those instances where active interference is deemed requisite. The introduction of threads among the veins, of heated wires, the application of pressure by means of forceps, as recommended by Breschet, may each be resorted to without much danger. But the instances are rare wherein a judicious surgeon would interfere, for cold bathing night and morning, a suspensory bandage, refraining from violent exertions, with due attention to the bowels, usually constitute the routine of such practice as may be necessary in these cases. In one instance, where the patient urged me to perform castration, I used a heated awl instead, thrust it into the varicose plexus, and thus produced such a degree of inflammation as to obliterate the veins, and occasion a complete cure, while the testicle remained entire. The needle and thread, however, I should infinitely prefer, as a safer, and equally efficacious means of cure.

Occasionally large sarcomatus tumours of the scrotum (sarcocele,

elephantiasis) require the use of the knife, although such swellings are of rare occurrence in the natives of Great Britain. The largest case of the kind successfully treated in this country (weighing 44 pounds) occurred to Mr. Liston, in the early years of his practice in Edinburgh. When such tumours are only a few pounds in weight, undoubtedly the incisions should be made in such a way as to preserve both testicles and penis, for in such instances these are invariably in a sound condition; but when the growths are large—say, forty, sixty, or one hundred pounds in weight, as the immediate safety of the patient is implicated, I imagine that the surgeon does wrong in attempting to save them by any protracted dissections. When once the knife is applied in such examples, the operation should be done not so much with a view of clearing and preserving these organs, as that of saving the patient from the dangers of exhaustion, which, in my opinion, is likely to be of more serious import than any shock resulting from the speedy accomplishment of the proceedings. Possibly had Mr. Key, in his bold and admirably executed operation on Hoo Loo, removed the enormous mass (56 pounds) with less regard for the genitals, the fatal shock might not have occurred; and, contrasting the proceeding (which occupied one hour and 44 minutes) with the more rapid one by Mr. Liston, who, perceiving the emergency, swept all away at once in the course of a few minutes, it appears to me not unreasonable to suppose, that if the patient had been kept a shorter period on the operating table, the result might have been different.

No set rules can be given for the performance of such operations different from those which guide the surgeon in the removal of tumours on other parts, neither does it appear necessary here to refer particularly to those dissections which are occasionally required for the separation of those warty excrescences or cancerous ulcers, which constitute the disease termed Chimney-sweeper's Cancer. The general rules applicable in all instances of malignant diseases are peculiarly so in these cases, for unless the affection be removed at an early period, and also with free incisions in the surrounding healthy textures, there will be little benefit in resorting to an operation at all.

The testicle itself is the seat of various kinds of swellings. That particular form of tumour termed hernia humoralis requires some separate notice. Here the enlargement is entirely the result of inflammation of the organ, and should in general, in my opinion, be treated in accordance with the usual surgical means of subduing severe and acute local inflammation. Rest, leeches, anodyne fomentations, laxatives, and low diet, are such as I should recommend; and here, too, the young practitioner should never lose sight of the value of good position. If he is careless in this respect the enlarged organ by its increased weight drops between the thighs, and the swelling is thus apt to become more troublesome, as has already been explained at p. 57 in the chapter on effusion. A suspender is of great value in such cases; indeed, it is well to recommend one in any instance

where there may be reason to apprehend swelled testicle coming on,—as in puncturing the scrotum for hydrocele,—in the acute stages of gonorrhœa. Even in the after-treatment of lithotomy I have known suspension of the testicles of service, for in some individuals the inflammation following the wound in the neck of the bladder (doubtless from its proximity to the seminal ducts and vasa deferentia) appears to induce a similar action within the gland.

My own experience of the method of compression by means of straps of adhesive plaster, as recommended by Fricke, Ricord, and others, has not been such as to entitle me to give a very decided opinion upon the practice. The same reasons that would induce me to object to the application of pressure in erysipelatous and other swellings during the acute stages of inflammation, would actuate my course of treatment in hernia humoralis; but towards the latter stages, when the swelling assumes a chronic condition, I should deem the method of great value, and here the plaster or the straps may be of the ordinary adhesive kind, or such as may produce a greater excitement on the surface,—as the camphorated mercurial plaster which, in other parts of the body is so beneficial in promoting absorption of indolent swellings. I have tried the method occasionally, and the reader will find in Mr. Acton's work on Venereal Diseases a drawing illustrative of the mode in which the scrotum may be enveloped by such straps.

It is seldom that the inflammation in these cases runs on to suppuration: occasionally, however, it does, or sometimes abscesses form in the substance of the testicle without the whole organ being affected with inflammatory action. These abscesses must be treated like similar diseases in other parts of the body. It will often be found, however, that they heal up slowly, and that sinuses are apt to be formed. These latter may, in some instances, be closed by the judicious use of injections, ointments, and pressure; but sometimes they resist such treatment, and then the knife may probably be required. I need scarcely caution the young surgeon against cutting freely in this organ; but that is rarely, if ever, required; for in such instances the most that may be necessary will be a free external wound in the scrotum, to permit the proper dressings to be applied to the bottom of the sinus.

In some instances hernia humoralis ends in chronic enlargement of the testicle, which may resist all the usual modes of inducing absorption: sometimes it seems the commencement of new action in the organ, whereby it is converted into a mass, to which the term "tumour" is more strictly applicable. At last it becomes evident that the natural structure cannot be saved or restored, and that the removal of the disease becomes advisable or absolutely necessary. The operation may be done thus:—The patient should be laid on his back, and the surgeon should grasp the organ in his left hand—supposing it to be about the size of a large pear or a pine-apple, and by means of the thumb and fingers should render the skin in front tense: with a bistoury he should then make a slight lunated incision from the upper end of the testicle to

within a little of its lower extremity; then he should form another of the same length so as to make an ellipsis (p. 38): still squeezing with his left hand, and applying the point of the knife to the loose cellular tissue between the skin and the tumour, the latter will in a manner start from its place, when by dividing some loose textures behind, and cutting across the spermatic cord, the removal is completed. Before severing the latter part it is customary to desire an assistant to grasp it so that it may not retract within the inguinal canal. In general, I believe, that this is a useless precaution: the cremaster is invariably excited to action thereby, and it often happens that the cord is forcibly pulled from between the fingers, which at this time, from the slippery state of the part, have no great power to hold fast. This has occurred repeatedly in my own practice, but I have never had the least trouble in securing the spermatic arteries—for in this situation there are generally two branches. I can imagine some instances, however, when from these vessels having passed within the canal, some difficulty might be experienced in laying hold of them, — indeed, I know, of one instance of the kind. The operator had to pursue them into the canal; and whether it was from this additional injury in the proximity of the peritoneum, or from other causes, inflammation within the abdomen ensued, and carried the patient off within three days. Besides the spermatic branches, other small arterial twigs require ligature on these occasions; the scrotal arteries from the perineum and from the femoral should all be carefully secured, for hemorrhage is very likely to occur within the first few hours if they are not; and although it is seldom to such extent as to cause alarm from loss of blood, it may nevertheless occasion the separation of the surfaces, and retard the cure. I need scarcely add that, in accordance with what may be called a characteristic feature of British Surgery, as also from deeming it the best method of dressing, I should recommend, that the surfaces should be laid together, so as to encourage union by the first intention, and that the wound should be in other respects treated according to the principles laid down in the early part of this volume.

If the tumour is of considerable size, the left hand can scarcely be used with full effect in the manner above recommended. An assistant may hold the testicle while the surgeon seizes the lips of the wound with his fingers or forceps, or the assistant may perform the latter duty. Then, instead of dividing the cord as the last step, some do so at an earlier stage;—but all these matters may be left to the discretion of the operator.

The narrow condition of the orifice of the prepuce, constituting what is generally termed phymosis, and often also occasioning paraphymosis, demands more attention from the surgeon than is usually bestowed upon it. In early age, in middle life, and in advanced years, it may be, and frequently is, the cause of much annoyance and distress. In some children where the prepuce is very long, the urine does not always escape freely, and either from this circumstance, or other less apparent sources of irritation, inflammation and suppuration

ensue, and the boy suffers acute pain when voiding his urine. Under such circumstances the disease may be checked and cured by injections under the foreskin, first of tepid, and latterly of cold water; but it may happen, as the result of such an inflammation, that the foreskin becomes adherent to a large portion of the glans. From time to time the child may suffer in this way. Perhaps as he grows up, the foreskin may be drawn back over the corona, and cannot readily be pushed forward again, and thus paraphymosis is established. Then, possibly, in advanced years, without this latter condition having ever been present, a venereal affection,—gonorrhœa, chancres,—even simple excoriations, may induce great swelling of the prepuce, additional tightness of the orifice, and may thus obstruct the efficient use of lotions and dressings. Even without any such causes as those alluded to, the natural discharges, from being pent up, act as irritants; warts often form within the prepuce in such cases, and occasionally a foul discharge ensues, the part becomes swollen, and when an examination is made of the narrow orifice, the interior is found to be covered with such a crop of warts, as to appear like so much cauliflower. These excrescences are more frequently seen in those with the prepuce in this state than when the orifice is of sufficient size to permit free ablutions.

The most efficient relief for all these evils is to enlarge the orifice, or remove the prepuce entirely. If the latter be inflamed, unless there is reason to suspect mischief underneath, it is best to treat the inflammation merely, and to leave any such proceeding until the parts have in a manner resumed their original condition. If paraphymosis be present, an attempt must be made by compressing the glans—which in some such cases is remarkably turgid—to bring the skin forward. If inflammation has fairly set in, however, this can scarcely be accomplished, and in some of these instances the retracted prepuce often becomes so œdematous that punctures will be advisable to permit the escape of serum, and it may also be necessary to carry the knife deep behind the corona, so as to divide, and thus enlarge in some degree, the orifice which is displaced in this situation.

Fig. 228.

In gonorrhœa, or when chancres are present, and when the prepuce is swollen, it is a common custom with some to slit it open, but in general I should dissuade from such practice, which in no wise expedites the cure, but causes additional pain at the time, and often increases the amount of inflammation, inducing the effusion of lymph, and that condition usually termed solid œdema.

Supposing little or no inflammation present, and that the parts are as represented in the last cut (fig. 228), which was sketched from a patient of mine, on whom I was about to enlarge the orifice, and at the same time remove an indolent ulcer—an excoriation on the margin—the following proceeding will effectually put matters right:—The extremity of the foreskin should be seized between the forefinger and thumb of the left hand, and half an inch of it removed with a single stroke of a sharp bistoury—care being taken not to injure the point of the glans: the skin will now retract suddenly over half the latter part, a large wound will appear; but as yet the surface of the glans will be as completely covered as ever: now, the blunt-pointed blade of the surgical scissors (p. 30) should be inserted between the glans and what covers it, which is in fact the lining membrane of the prepuce, and a slit should be made half an inch, or a little more, directly upwards, and in the mesial line, when the membrane will curl over in a manner, and follow the course of the skin, whereby the glans will be completely exposed: next the skin and mucous membrane should be tacked together by a few stitches of interrupted suture,—no heed being taken of the sharp corners of the mucous tissues, excepting to keep them as far from each other as possible: the narrow circular line of wound will close by the first intention; and thus in the course of six or eight days the parts will be as if no operation had ever been performed, or rather, as if they had been naturally well formed at first.

A proceeding such as this may be so conducted as to effect a partial removal of the foreskin, and still leave sufficient behind to bear a resemblance to one originally well formed, or a complete circumcision may be effected. Perhaps the latter course should in general be resorted to, as when inflammation occurs in the prepuce—as it must after these wounds—a troublesome swelling is apt to continue in the remaining part for a long time afterwards.

The above proceeding may be modified in various ways: with the exception of the stitches, it resembles, I believe, the Jewish rite. In the infant the stitches are of no consequence, but in the adult I deem them an essential appendage of good surgery. Erections are of frequent occurrence during the nights immediately succeeding such an operation, and if the two membranes of the prepuce are not thus held together, a large open granulating surface will be established, which will be slow in healing, and may, moreover, by its contractions in a circular direction, cause, for a long period afterwards, a degree of inconvenient tightness on the end of the corpus cavernosum. Usually, when I mean to perform complete circumcision I pass a director between the front of the glans and the foreskin as high as possible, then run a narrow, straight, sharp-pointed bistoury upon the groove, transfix the root of the prepuce by cutting towards myself, and next by carrying the blade in a circular direction, right and left, separate the part.

In certain cases the prepuce is of a natural length and appearance in every respect, saving that the orifice is painfully tight and liable to

slight cracks and lacerations. The latter condition is often completely remedied by warm lotions and abstaining from any cause of irritation; but often in these instances the surgeon may confer great benefit by enlarging the opening. Here it has been recommended to cut at various parts of its circumference; many good authorities advising a slit on one side of the frænum; but after trying them all repeatedly, I give a decided preference to the following: The point of a director should be pushed in front, between the glans and prepuce, about half an inch up, and then a bistoury, such as that described for the last operation, should be thrust through, from within outwards, and carried downwards, by which means a wound half an inch in length will be made in the skin (fig. 228): that in the mucous membrane will scarcely appear so long—it should be lengthened with the scissors, and then two, three, and even four stitches should be introduced with a fine needle, and when union is complete the orifice will be sufficient to permit the foreskin to move over the glans, as in a natural condition. Here I consider the stitches even more necessary than in circumcision: if, for instance, the wound is left to itself, a considerable granulating surface is established, and as it contracts it diminishes on all sides, and the orifice becomes nearly as tight as if nothing had been done, nay, it is positively in a more troublesome state, for the cicatrix is, perhaps, less extensible than the natural orifice, and the patient is left in a condition similar to that of one who has had a large chancre on the part; whereas, by using the needle and thread the two sides are laid together, a transverse line of union of an inch in length is thus accomplished, and the aperture of the foreskin is increased in a proportion similar to that of the circumference of a circle to its radius.

Those who do not use stitches, instead of cutting a small wound and managing it in the manner described, occasionally, to make sure that the orifice will never contract improperly again, divide the skin and mucous membrane as high as the corona glandis; a most gratuitous use of the knife, and in my opinion totally unnecessary. It is in such a case that the annoying results of the operation for phymosis are most conspicuous. The extent of the wound induces considerable inflammation, solid œdema of the two flaps, or wings as they may be called, often ensues, and whether or not, the condition eventually causes so much trouble as to induce the patient to submit to their removal. When the foreskin is thus extensively slit up, as may be required in instances of deep-seated chancre — it should invariably be separated at the time by circumcision.

Bleeding is seldom troublesome in these operations — occasionally one or two ligatures may be required; but when stitches are used the others are seldom needed.

I have had to operate both on the child and adult for adhesion between the foreskin and glans, and have generally, in such examples, removed the former entirely. Sometimes a dissection has been necessary to separate them; but in other instances the adhesions have been torn up by stripping the skin backwards. Lately, in operating

on a patient about seven years old. I found, on coming to separate the two with the knife, that a slight force enabled me to effect this with far less pain than by the instrument. Circumcision was afterwards performed, stitches were used, and in less than a week the parts appeared almost as if nothing had been done. The condition was supposed to have obtained for some considerable time, and during erections, with which he was much troubled at night time, the pain from an overtight frænum was sufficient to deprive the boy of his natural rest.

In many cases of the kind above alluded to I deem it the duty of a surgeon to recommend an operation at an early and favourable opportunity, as the patient may be thus saved from much after distress. Most practitioners must have seen extensive ulceration and sloughing in some such instances, during venereal inflammations. In one instance the glans appears through a slough at the root and upper part of the foreskin, whose natural orifice is thus carried below the penis; in another example, one half or more of the glans suffers (ulcerates — sloughs) ere the mischief is suspected, and it is a current doctrine, that, independent of venereal affections, the extremity of the organ, from never being thoroughly cleansed, is in some degree predisposed to scirrhous or cancerous action. I have myself seen one instance where the end of the penis was amputated in consequence of a malignant looking tumour having its origin evidently from this condition of the foreskin.

Amputation of the end of the penis may be done in the following manner:—The part to be removed should be grasped in the left hand, when the surgeon, with a stout bistoury or small catlin, should effect the separation with one stroke of the blade. An assistant may have hold of the root of the organ, and can restrain the hemorrhage by pressure, until ligatures are placed upon the dorsal arteries, those in the corpus cavernosum, and such others as may require them. The wound will heal by granulation, and towards the latter part of the treatment some attention may be necessary, by the introduction of bougies, to keep the orifice of the urethra open, as it has a great tendency to contract. There is no occasion to preserve the skin by drawing it upwards before the incision is made: even when it is drawn towards the diseased part, as is sometimes done, there is always a sufficiency to cover the cut surface, for the corpus cavernosum retracts greatly as soon as it is divided. I have now seen this operation performed six times in the manner above described, having operated on two of these occasions myself.

CHAPTER VII.

OPERATIONS FOR RETENTION OF URINE.—INTRODUCTION OF INSTRUMENTS INTO THE URETHRA AND BLADDER.

In cases of retention of urine, when it is found that the ordinary diuretics and antispasmodics, warm baths, &c., prove of no avail, and when moreover it is impossible to introduce a catheter into the bladder in the ordinary manner, it may become necessary to evacuate the urine through some artificial opening into the viscus. The bladder may be punctured in a variety of ways and places. For example, if the obstruction is near the neck of the organ, the catheter may be forced along in the course of the original urethra, or as near to it as possible. Perhaps in this manœuvre it will pass through the substance of the prostate; but this should not constitute an objection to the plan, for the new passage may in every respect be as efficient as one formed by puncture or incision in any other way. Here I beg it to be understood, that it is not meant by the above recommendation to countenance the formation of what is commonly termed a "false passage," —a phrase which is generally used to imply, that the instrument has not been carried along the natural course, which might have been accomplished with greater care or greater skill. That this blunder is often committed there can be no doubt; but the above mode of procedure is advised under the supposition that the urethra has become in a manner impervious, either from stricture, or alteration in the size and shape of the prostate.

If this method is not selected, the bladder may be opened above the pubes in the following manner:—The patient being laid on a table, with his shoulders and knees slightly raised, an incision about three inches long should be made above the symphysis through the skin and linea alba, when the cellular tissue in front of the bladder will be exposed, and the viscus may be opened with the point of the knife, or what will be better, with a trochar and canula. The latter may be left in the wound for some days afterwards, or, in preference, a flexible gum catheter should be introduced and retained. When such a proceeding is required the bladder will perhaps be greatly distended, and will consequently be prominent in the hypogastric region; its upper end will therefore be so far above the pubes as to have carried the peritoneum beyond much risk: such a danger, however, should not be overlooked, and every care should be taken that this membrane is really above that part where the puncture is about to be made. There must be danger from the proximity of the serous surface in case of the escape of urine into the cavity, or of inflammation; but there may be equal danger perhaps in making the puncture too close to the pubes; for as the bladder contracts, the orifice may sink so much into the pelvis that infiltration may ensue.

The bladder may be evacuated through a wound in the perineum similar to that for lithotomy, afterwards described, or the incision may be conducted between the bulb of the urethra and anterior verge of the anus, or it may be thus:—A curved trochar or canula, about seven inches long, should be introduced into the rectum on the concavity of the fore-finger of the right hand, the point of which should be placed on the triangular space, already referred to, behind the prostate gland; then the point of the trochar, which will probably have been concealed (withdrawn) in the canula, should be forced through the tunics of the rectum and bladder, and the end of the canula being continued in the same course, the former may be withdrawn, when the urine will flow through the tube. The latter must then be removed, and the fluid allowed to find its own way in future, or perhaps a small flexible catheter may be carried into the bladder through the interior of the canula as it is taken away. The catheter may, however, afterwards be found inconvenient in the anus.

If the bladder be at all dilatable, the triangular space will be consiberably larger than in the natural condition of the organ, — the vasa deferentia will be further apart,—the peritoneum higher; nevertheless the proximity of these structures should be remembered, and, to avoid them, the point of the trochar should be kept about the middle of the space. If the prostate is large, as it usually is in such examples, the puncture should be made close behind,—nay, it had better be made through it, than that the peritoneum should be endangered; for although the seminal ducts, or a vesicula, might thus be injured, that is of little consequence in comparison with puncture of the peritoneum, which would in all probability occasion the death of the patient.

It will be observed that, in any of the last three modes referred to, the urethra is left in the same condition as that which has given rise to the necessity for puncture. Possibly it may still continue impervious, and the urine will therefore continue to drain away through the artificial aperture. Under such an anticipation the operation above the pubes has been preferred by some, on the score that the discharge of urine may be in some measure regulated by the flexible catheter; but it really seems doubtful whether this condition, or that in which the urine collects in the lower part of the rectum and is discharged *per anum*, is the least troublesome.

Puncture by the rectum seems to have been most generally performed; but, for my own part, I should prefer the mode of forcing a passage as nearly in the original course (if not altogether so) as I could possibly manage. Doubtless with much patience, caution, and skill, one surgeon will introduce a catheter where another has failed, and often he himself will at last succeed when he has probably been in despair: in some instances the natural tube will have been opened, but the instrument will very often have been thrust in a devious course, — sometimes only below the mucous membrane, at others through the prostate,—even through the tunics of the bladder beyond the limits of this gland. I have seen five different passages in

the prostatic portion of the urethra or bladder, each capable of admitting a full-sized catheter, and which was the original (if it existed at all) it was impossible to say. Here, during life, an instrument had been frequently used, and, as was supposed, with great skill and dexterity; and certainly, in so far as the injuries went, the patient was none the worse, although assuredly there was no occasion for so many canals, for one would have sufficed; and the surgeon, supposing that he had been conscious of having forced a passage at first, and that with a large catheter, should have gone through the artificial course on all future occasions. If I may venture to criticise the catheterism of such surgeons as have claimed superior dexterity in this operation, I should say that occasionally they have effected this manœuvre, and led others to suppose that the instrument has been carried along the natural course. In my opinion the practice is the best that can be adopted; but, in giving it recommendation, I hope it will not be supposed that I sanction carelessness as to the danger of thus wounding the neck of the bladder. The formation of a false passage is justifiable only in extreme cases, and when all other reasonable means have failed,—and then, in my opinion, it had better be made with the catheter in the manner referred to. Neither should it be supposed that this is the easiest mode of puncturing the bladder; — on the contrary, more tact with the instrument and a nicer knowledge of anatomy is required to succeed in this way than in the others referred to. Very little force will thrust the point of a catheter through the membranous portion of the urethra, and cause it to pass on one or other side of the prostate; but something more is necessary to guide it in the proper course; for, even when the surgeon has all the advantage of a wound in the perineum to assist him to guide the point of a catheter into the bladder, he often finds it not such an easy task as he may probably have imagined.

Supposing that the bladder is emptied in this manner, the catheter should be allowed to remain for four, six, or eight days, when it should be withdrawn, cleaned, introduced again, and,—the same movements being repeated at proper intervals,—retained until a callous passage is formed.

Sometimes in cases of impassable stricture, in a part of the urethra anterior to that in which the proceedings above referred to are required, it may be advisable to divide the obstruction with a knife, and thus permit the evacuation of the bladder and the introduction of an instrument at the same time. In certain instances, especially if the stricture were supposed to be very short, Mr. Stafford's lancet-catheter (afterwards referred to) might be used, but in others it will be necessary to make an incision in the perineum. I have seen several instances in young boys who had been severely wounded in the perineum by an earthenware *pot* breaking under them:—the urethra had been opened, and its anterior part had closed in the cicatrix. In other instances in youth, the obstruction has been spontaneous; but such examples are most frequently seen in the adult. Sometimes the imper-

vious condition of the passage is accompanied with fistulous openings in the perineum; in others the surface is entire; and occasionally there may actually be infiltration of urine in the cellular tissue between the skin and the neck of the bladder. In certain examples the distended urethra can be felt behind the stricture, and here there can be little difficulty in doing what is required; for, first the bladder can at once be evacuated by cutting into the tube, and then the latter being so capacious, there can be no great trouble in getting the point of a catheter along, when once it has been got through the contracted part. The proceedings may be conducted in this manner: — The patient should be tied and placed in a similar position as for lithotomy; then the surgeon, seated as if about to perform that operation, should cut in the raphè in the line of the bulb of the urethra, and having made an incision about an inch or somewhat more in length, should feel for the end of the catheter, which should now be carried along the anterior part of the canal, or which may have been introduced before the incision was made: next, partly by using the knife and partly by force, the point of the catheter should be brought into the wound, and afterwards, by cutting and forcing, carried along the posterior extremity of the urethra into the bladder: sometimes a few applications of the knife will suffice, and the instrument will slip along at once; but on other occasions the most difficult step of the operation is to get it into the back part of the canal. Perhaps the latter may not have been sufficiently opened,—if, indeed, it has been cut at all,—and possibly there may be stricture so far along, that the difficulty may still be as great as if an attempt were being made to force the passage without any wound in the perineum. A director or a straight staff passed into the aperture may probably be of some advantage, and supposing that the catheter is at last introduced, it must be kept in the bladder (changing it from time to time) until the wound in the perineum has closed.

In this operation, as well as in that previously described, a catheter about the medium size (No. 6 or 8) and length should be used. Occasionally, if the pelvis is large, the patient stout, and the prostate enlarged, an instrument, an inch or two longer than common must be used, and it should always be sufficiently stout not to yield to any reasonable amount of force. It may bend, as I have witnessed in several cases, or it might actually break. A silver instrument is generally used on these occasions, but after the canal has once been, forced, a flexible catheter may be advantageously substituted in some instances. Either may be kept in the bladder by means of tapes attached to the rings and fastened in front and behind to a band round the loins. Narrow slips of oiled silk will perhaps answer better than common tape; and instead of fastening them directly to the instrument, it is the custom of some first to attach a ring of wood to them, by means of a couple of tapes, and then this being slid upon the penis to connect the body tapes with it, whereby they are less apt to be disturbed.

Such proceedings as those above referred to should, in my opinion,

be seldom resorted to when an instrument can, with tact and reasonable force, be pushed onwards without any external incision; perhaps the most legitimate cases are those where, besides the obstructed condition of the urethra, infiltration is present (a no unusual complication), or where there are fistulous openings connected with the urethra. Recently I have deemed it right, with two of my patients, to resort to this practice. In one, healthy and middle-aged, there were total retention, old fistulæ, and slight effusion of urine: a catheter could not be introduced: the circumstances not appearing favourable for forcing a passage, I accordingly cut in the perineum, carried the catheter onwards, and the patient made an excellent recovery. The other was a man advanced in years, who had long suffered from stricture and urinary fistulæ; the scrotum and skin of the penis were greatly swelled, and in that condition termed "solid œdema"; a catheter was introduced here also, by aid of a wound in the perineum, but the injury inflicted was followed by fatal inflammation in and around the neck of the bladder.

When the urethra has been burst by external violence, or has given way behind an obstruction, and infiltration is present, there should be no hesitation about making free incisions; they will afford the patient the only chance of life, in all probability; for although in good constitutions recovery does take place in some, although the urine has made its own way to the surface, such examples are few in proportion to the numerous instances where death is the result of this condition, even when free openings for the escape of urine have actually been made. Urinary infiltration is most frequently seen in those advanced in years, and perhaps also with otherwise debilitated constitutions; hence probably the frequent fatal results; but even in the young the danger is imminent. The most remarkable case of recovery from this state, which I have ever witnessed, occurred in a boy about nine years old, who had impervious stricture (resulting from an injury of the perineum), in whom the urethra gave way behind the obstruction. The perineum and scrotum were much distended, and the urine had passed in front of the pubes into the cellular tissue under the skin of the hypogastric region; a deep wound was made on the left side of the perineum, as if for lithotomy, up to the prostate gland, without, however, entering its substance; the urine escaped freely, and although incisions were also required for suppuration in each groin, above Poupart's ligament, the boy survived, and ultimately, by attention to the urethra, a good cure was effected.

Occasionally in some of these cases the whole scrotum sloughs and the testicles (each, however, covered by the tunica vaginalis) are laid bare. Such a condition is sometimes seen to follow the operation for hydrocele, where the port wine injection has been thrown into the cellular tissue instead of the serous cavity. If the patient survives until sloughing is established, although the result may remain long doubtful, recovery usually takes place.

The introduction of instruments into the bladder being so frequently required on the living body, should be carefully studied on the subject; and in the dissecting-room many valuable opportunities are lost of acquiring both knowledge and dexterity in such proceedings. A catheter, bougie, and sound, should invariably be used in the dissection of the male pelvis. One or other, or all three successively, should be introduced previous to dissection; and when the lateral view of the pelvis, as described at p. 505, is under notice, each instrument should again be passed, and its progress through every portion of the urethra carefully observed. Besides those of the usual curve (afterwards noticed), a straight instrument should be introduced, when, with a little management in depressing the handle, the point will be seen to glide along almost as readily as that of one with a curve. It seems sufficiently strange that the possibility of introducing a straight instrument into the bladder should not have been perceived until the fact was demonstrated by Gruithuisen about thirty years ago. The idea appears always to have prevailed that, as the urethra is naturally flexuous, a bent instrument was absolutely necessary to permit its point to pass along, while the flexible nature of the materials composing the tube was overlooked, as also that when the curve was fairly within the bladder the tube was actually on the straight part of the instrument. The student, with the urethra before him—either in the pelvis, and therefore attached to the bones and almost in its natural condition, or separated, as described in the dissection of these parts,—should, by introducing straight instruments and others with different degrees of curvature, satisfy himself of the fact that it may be made to assume almost any shape from a right angle to a straight line. These remarks are only applied to the healthy passage, however, for it does happen in disease that the canal assumes certain curves which even a solid rod of steel will not alter; as for example, in persons advanced in life, the prostate gland occasionally becomes so much enlarged, and that portion of the urethra within it is so greatly increased in length, and bent at the same time, that the bend is such as cannot be made straight excepting with considerable force, which is usually accompanied with great pain.

Notwithstanding these circumstances, in using inflexible catheters or bougies such instruments should always, in my opinion, be curved at the point, as they thus more resemble the ordinary natural curve of the urethra near its vesical extremity, and therefore glide more readily along, until the point is in the bladder, when the straight part can be freely carried along the most fixed and least flexible portion of the tube. If a catheter is to be used, such a bend as that here exhibited (fig. 229) will generally be found most useful. The instrument for ordinary purposes should be made of silver, sufficiently stout to resist a moderate force, about the diameter of a goose-quill, nine inches long, and having apertures on the sides such as are exhibited in the drawing. Some prefer the small holes, others the large one, and a third party combine the two. The small openings

are said to clog up, the large one to permit its margins to injure the mucous membrane, — both of which objections have attracted more notice, perhaps, than they really deserve. The point of the instru-

Fig. 229.

ment should be slightly conical—the makers generally have it too abrupt—and the rings at the other end are intended for the purposes already alluded to at p. 548.

Supposing catheterism to be required on the living body, the proceeding may be accomplished thus :—The patient being laid on a low bed, couch, or on the floor, with his shoulders and knees slightly raised, the surgeon, standing on his left side, should seize the glans with the forefinger and thumb of the left hand, and squeeze it gently from before backwards, so as to cause the orifice of the urethra to gape ; then with his right hand he should introduce the point of the catheter (previously warmed and dipped in oil) and carry it onwards with a gentle pressure, taking care to stretch the penis sufficiently to prevent the moveable part of the urethra from remaining bent or being thrown into folds, until it has reached the angle of the pubes, where the urethra perforates the triangular ligament: the surgeon's right hand may have been held nearly over the anterior part of the crest of the ilium ; now, however, the hold with the left hand being given up, the right should be moved into the mesial line ; in other words, the instrument should be brought parallel with the linea alba ; next it should be raised, and made to describe a portion of a circle, of which the catheter is as it were the radius, and then a force little more than the weight of the instrument will cause the point to glide into the bladder. In all instances, whether of a simple nature or attended with difficulty, it is a good general rule to cause the point to move along the upper surface of the urethra ; *i. e.* that nearest the penis. When the introduction is effected, the straight part of the catheter, and the penis, are nearly parallel with the thighs. Just when the introduction is accomplished, the thumb of the right hand should be placed on the open extremity, and kept there until a proper utensil is placed under it to receive the urine. The same manœuvre should be attended to when it is about to be withdrawn, and thus the fluid within the tube will be prevented from escaping until its end can be put over the pot.

If the urethra and other parts are healthy, all these proceedings can

be accomplished with the utmost facility; but there may be many difficulties to overcome, most of which demand particular notice here. In corpulent persons, with the pelvis naturally large, and the prostate much increased in size, the interior of the bladder is further from the orifice of the urethra than under ordinary circumstances: sometimes, even when the prostate is in a natural condition, the neck of the bladder is higher up during great distention of the viscus, and in either of these cases a longer catheter is required than that in common use: it may be advantageous also to have the curve somewhat larger. Sometimes when the urethra is of its full calibre, the point of the instrument is apt to hitch on that part where it passes the triangular ligament; indeed, in ordinary cases, when it does not slip readily along, this is the seat of obstruction: the operator may probably be urging it onwards a little too high, or somewhat too low, and in either instance, if only a fold of the mucous lining be in the way, it will be sufficient to foil the attempt. The occurrence is more likely with a small-sized catheter than with one above the average diameter: and in instances of paralysis of the bladder, resulting from fever, injury of the spine or pelvis, and such like cases, where the urethra is known to be free from stricture and otherwise healthy, it is well to bear this in mind. At other times, when the prostate is not greatly increased in its entire bulk, the middle lobe may be of such a size as to project right in the course of the point of the instrument; and again, the most common and most troublesome of all obstacles is stricture in the urethra, more especially if previous futile attempts have been made, causing laceration, bleeding, and subsequent inflammation and infiltration,—the latter being either the result of the inflammatory action, or possibly being combined with that of blood and urine.

In elongation of the urethra, whether from enlarged prostate or retention, or in examples of paralysis with healthy urethra, there is seldom any great difficulty; a little gentle movement of the instrument will generally suffice to put its point in the right way, although in the prostatic affection this is not always readily done. Here perhaps the point has to be elevated over the projecting middle lobe, or made to glide along by one side or the other. In the instance of stricture it is not reasonable to suppose that the full-sized instrument above recommended can be carried along the contracted passage, and therefore one of smaller diameter must be selected. Catheters vary in the latter respect from that of an ordinary silver probe to about three lines, and such a size must be chosen as will pass the narrow course: the larger it is, the better, for the point of a small one is exceedingly apt to get out of the proper line, and thus for future attempts the difficulties are increased, by the formation of a false passage which has not penetrated into the bladder. When such an instrument is used, only the smallest imaginable force must be applied to carry it onwards; it should rather be insinuated than forced along, and should the latter be deemed necessary, an instrument of larger calibre should in general be selected.

In all instances of difficulty, from whatever cause it may arise, if it be in the perineal portion of the urethra, more especially about the membranous part, the forefinger of the left hand passed into the rectum will greatly facilitate the operation. In this way the point can usually be felt, and guided in the proper course, but there are other proceedings which may be followed in cases of this kind with great advantage. Thus in some examples the instrument seems to pass on more freely when the patient stands ; indeed, some surgeons on all occasions prefer this attitude to the recumbent. In cases of extreme difficulty, however, and supposing the patient to be suffering under the distress of long-continued retention, the erect posture cannot be easily maintained ; and there are many instances where it is not practicable. Clysters of warm water, the hip-bath, blood-letting by lancet, leeching, or cupping, opiates, and antispasmodics, may perhaps save the necessity for persevering with the catheter ; the bladder may be in part or entirely relieved ; even yet, however, it may be needful to go on, and possibly, if the patient is now placed in a warm bath, the efforts may succeed. If not, and the urgency is great, the bladder may then be entered in any of the ways already described. Unless, however, there is reason to suppose that the bladder or urethra behind the obstruction will burst ere long, the last resource of puncturing should not at once be adopted. Even in the worst cases of retention, when the bladder arrives at a certain point of distention the urine begins to dribble away ; thus further accumulation is prevented, for at this time it often happens that the secretion of the fluid goes on less rapidly than before, and although this is a condition which cannot long continue, and should not long be permitted, some favourable change may yet take place, and the patient be thereby saved from the very equivocal advantages of the method by puncturing.

I use and recommend the silver catheter, as preferable to all others, and cannot say that I have ever seen an instance where a flexible gum instrument could be introduced when the other had failed ; nevertheless many excellent surgeons choose the gum catheters, which at the time of the operation can be made to alter in bend by means of the iron wire with which each is usually provided. When introduced and the wire is withdrawn, it certainly, by bending to the course of the urethra, must be less likely to cause irritation than the hard and inflexible metallic instrument ; and therefore in cases where there is a necessity for keeping a catheter constantly in the bladder, it must be preferred. Some patients are in a condition to walk about, although from disease of the urethra, bladder, or elsewhere, it is necessary to retain a catheter, and here the advantage of a flexible material must be sufficiently obvious.

Sometimes, in very corpulent individuals, it is most convenient to introduce the point of the catheter with the right hand nearly between the patient's thighs and the convexity towards the abdomen ; it is then, after being pushed along as far as the triangular ligament, turned into the same position as when the other mode is pursued, and thus

carried into the bladder. This manœuvre has been termed the "tour de maître," and used at one time to be more practised than it seems to be at present. It is seldom, indeed, that patients have such a protuberant belly as to render this attitude absolutely necessary, and while it is impossible to point out any peculiar advantage which the method possesses, it is not difficult to perceive many objections against it. The latest fashion in catheterism is that of introducing the instrument with one hand only: the point is passed into the orifice of the urethra, and then, by hooking the penis into a position similar to that when it is held between the fingers, partly by pushing the catheter onwards, and partly by, in a manner, shaking the organ on to the instrument, its point reaches the triangular membrane, when it can be slid along as in the common method. This proceeding can readily be accomplished under ordinary circumstances, but it probably requires a little more dexterity than the usual one, over which, when properly performed, I am not aware of any real advantage which it possesses.

The catheter is by many surgeons used as a bougie in the treatment of stricture, instead of the solid iron rod which is commonly resorted to for the purpose of dilating such contractions. The mode of introducing the latter instrument is in most respects similar to that for the former. Whichever is used for stricture (and in my opinion the choice may be left to the surgeon or patient), a size is selected which will pass the obstruction by gentle pressure; then in the course of two, four, or six days, a larger size is carried along, and so the process is repeated until the urethra is brought to its proper diameter. But a stricture is not always so readily overcome as these remarks might seem to imply, and this will depend on a variety of circumstances,—as its position, its length, its diameter and firmness, the irritability of the canal, the sympathetic effect of each introduction on the bladder and system generally; these, and many others, which need not be particularly alluded to here, may all retard or render the cure a process both of considerable skill and difficulty.

A stricture in the perineal portion of the urethra, especially behind the triangular ligament, is almost invariably more troublesome to deal with than in any other site; one of half an inch, an inch, or of greater length, usually is more obstinate to deal with than when the obstruction is more limited: a narrow one, particularly if it be firm, as is most commonly the case, must require a more frequent use of the dilators, and in some individuals the application of an instrument to the urethra produces so much pain and irritability both at the time and afterwards, that in such parties the final cure may be much retarded.

There are greater varieties in bougies than in catheters. The curve of the steel bougie is seldom so great (so acute) as in the latter, and occasionally, if the anterior end of the urethra be alone the seat of disease, a short straight rod is all that may be necessary. The point is usually (and always should be in my opinion) a little more conical. Sometimes the steel is plated with silver, which is an excellent method

for preventing rust. Instead of steel, some prefer a more flexible material, such as the ductile metallic composition for the purpose of bougies, — the wax bougies, or those now formed in a variety of ways by the aid of caoutchouc. The silver wire with a round knob at the point, as recommended by Sir Charles Bell, in so far as I know, is never resorted to now-a-days.

The practice of dilating strictures by means of bougies seems that by far the most generally resorted to. The method, by means of caustic, as practised by Hunter and Home seems to have gone almost out of date, although from my own limited experience with it, I should say that it is, perhaps, too much neglected in the present day. I have not had an opportunity of seeing the ingenious instruments of Mr. Stafford put into use, although I believe they might be most advantageously applied in many cases. A catheter, straight or crooked, with a concealed lancet at the point, which can be thrust onwards into the stricture, by means of a stilet, constitutes the peculiar characters of these instruments; and, in so far as I can perceive, they are more simple than those of Amussat, and likely to be equally efficacious. Various contrivances have been devised for the purpose of enlarging the urethra, differing in simplicity from that of the ancient Egyptian,—who used the gut of a small animal, which, while it was in the canal was distended with air,—to the complicated apparatus of the gentleman last named; and some cleverly constructed apparatus is to be seen in the shops for applying caustic; but most of them are of service only when they are carried beyond the seat of stricture, and therefore can come into play only when the main difficulty with a stricture has been overcome, viz., the passing of an instrument at all; for when once this is accomplished, the case is, as it were, within the command of a bougie.

From the above remarks it may be readily perceived, that I give preference to the inflexible bougie as a general means of treating stricture. In ordinary cases, where there is no immediate urgency for passing a catheter into the bladder, unless the instrument glides readily along with a moderate force, it is better, in my opinion, to make the entry after repeated trials on different occasions, than to force it at once. Unless the circumstances are very peculiar, success in this particular must at length be attained, and, from the first attempt until the cure is complete, the surgeon must be guided as to the period of repeating his operations by the apparent effect of each: the urethra in one individual may be so callous that in eight and forty hours, or even less, an instrument may be again introduced, whilst in another, four, six, or eight days must be allowed to elapse. On each new occasion a larger size must be used, though from time to time, in getting from number one in the scale up to nine or twelve, it may be well to rest satisfied with one size until the urethra becomes, in a degree, callous, when a larger may next be had recourse to. Patients usually dread the appearance of blood on these occasions, but there is seldom any real cause for apprehension,—in fact, I have often thought that those stric-

tures which bleed most are more susceptible of a rapid cure than others. An old, hard, tight, and callous stricture seldom bleeds on the application of any moderate force; but when the converse obtains the weight of the hand alone on the instrument will cause hemorrhage, and in such a case, provided the bougie or catheter be properly used, the obstruction is commonly overcome with comparative facility, and when an instrument of tolerable size (number six or seven) can be introduced, the operation is usually accomplished without further trouble from bleeding. In thus treating of hemorrhage more lightly than some may deem correct, I beg it to be understood, that I by no means sanction any unnecessary rudeness; there is a certain amount of force and energy which may legitimately be resorted to on these occasions by one well acquainted with the course of the canal, and well practised in the use of instruments; but the young surgeon can commit no greater error in the treatment of these cases than to suppose that a heavy, stiff hand and violent force will compensate for that skill and tact which can only be acquired in the course of years by experience in the dissecting-room and on the living subject.

CHAPTER VIII.

STONE IN THE BLADDER. TREATMENT. SOLUTION. LITHOTRITY. LITHOTOMY.

THE symptons of stone in the bladder are usually very unequivocal: frequent calls to make water, sudden stoppage of the stream, pain after evacuation, in the neck of the viscus and at the glans penis, irritation in the region of the bladder, in the perineum, anus, and rectum, occasional discharge of ropy mucus, blood, lymph, or pus, all afford the strongest presumptive evidence as to the presence of a calculus; yet most or all of these may be more or less conspicuous and none be present, while in other instances the symptoms may never have been such as to excite suspicion. The only certain test of this disease is afforded by the sound—an instrument which in most respects resembles the ordinary steel bougie, and which may be used in the following manner:—The patient being laid as in the proceeding for catheterism, the sound must be introduced in much the same manner, and when it has entered the bladder its point must be gently moved about in all directions until it strikes the concretion, when the sensation on the part of the surgeon will be such, that he can scarcely err, and in addition, in most instances, the sound of the concussion is sufficiently distinct to be heard by those in the immediate vicinity. If the stone is not touched at once, a change in the patient's attitude may alter its position: thus, if he turns slightly to one side

or the other, raises the pelvis above the level of the shoulders, or stands erect, the search may be more successful. In one instance, a common catheter will be as efficient as any other instrument; when, however, there may be doubt as to the metal having touched a stone or merely a hard surface within the bladder, the solid steel should be preferred. Of late years it has been a prevailing custom to use a sound similar in shape, near the point, to the lithotrite exhibited in one of the future figures, under the supposition that the short part beyond the curve can be turned down behind the prostate gland, and that the interior of the bladder can thus be more thoroughly examined: with this shape, or with a large curve, it will sometimes be of advantage to raise the lower part of the bladder by introducing the forefinger into the rectum. In one example the stone can be touched most readily when the bladder is moderately distended with urine; in another, when it is almost empty: on one occasion, in the same individual the object may be most palpable, at another time, the utmost tact cannot detect it—and the latter will be observed, too, in instances where there is afterwards every proof that the stone has not in the interval passed into any pouch connected with the bladder: indeed, this condition is exceedingly rare—I mean that of a large pouch sufficient to conceal a calculus of ordinary dimensions. On all occasions a small stone, as might be anticipated, is more difficult to detect than a large one, and in general, when one of moderate diameter (eight or twelve lines) is present, it is felt almost as soon as the instrument enters the bladder; for although a calculus may for a time lodge in any part of the organ, its most frequent seat is so immediately in contact with the orifice of the urethra, that it is often struck ere the curve of the sound has passed the prostate. It need scarcely be added, that all the movements with the sound must be made in the gentlest manner possible: on one occasion a slight rotatory motion with the hand will suffice, on another the whole instrument must be carried inwards so as to tap the stone, and again, it may probably be necessary to draw it backwards in such a manner as to cause the concavity between the curve and point to touch the neck of the bladder on all sides of the urethral orifice.

Although it has been recommended that the sound should be introduced as for catheterism, it will be found inconvenient to use the right hand when the outer end of the instrument is between the patient's thighs: the left may therefore be used at this time; but as few possess the same delicacy of touch with the latter organ, the surgeon may, after having reached the bladder, place himself between the patient's thighs or stand upon his right side. For my own part, I generally introduce the sound with my left hand, while standing by the patient's right side, and then, when any minute search is required, I seize the instrument with my right hand.

In the event of a stone being detected, the treatment may next be taken into consideration. Supposing that all those internal, or, as they may be called, constitutional means, which a knowledge of the

practice of medicine will enable the surgeon to exhibit, have been tried and found of no avail, (which in all probability will be the result,) there are various mechanical proceedings which he may resort to, and which demand especial notice in such a work as this. The proposal to dissolve stone in the bladder by passing medicated fluids into that viscus is of old date. Towards the beginning of the last century the ingenious Dr. Hales used to show the possibility of passing a stream through the cavity by means of a double-tube catheter. His experiments were, however, performed on some of the lower animals, although he believed in the possibility of thus effecting the cure of stone on the human subject by solutions of the carbonate of soda. Since then, to the present day, but little progress has been made in this mode of treatment; for although, from time to time the practice seems to have been successfully tried, (as evinced by the cases occurring to Dr. Rutherford, Sir Benjamin Brodie, Drs. Ritter, Jurine, Petit, and others,) it has attracted a small share of attention from the practical surgeon. Various solvents have been used on these occasions, from simple water to nitric acid — the latter being so weakened as not to injure the mucous lining of the bladder. Hales was aware of the power of a solution of carbonate or subcarbonate of soda over certain kinds of calculi, and the efficacy of the Vichy water, whether as an internal or as a local remedy, depends, in a great measure, on the bicarbonate of soda which it holds in solution. Dr. Rutherford used lime water; Dr. Ritter, caustic potash; Sir Benjamin Brodie, nitric acid — all, of course, in a diluted state. Dr. Hoskins, of Guernsey, affirms that he has discovered (by an elaborate process, if I understand him aright,) an effectual and safe solvent for phosphatic calculi, and only awaits the result of some trials now making with it, to give the formula publicity. Gruithuisen, although seemingly impressed with the virtues of simple water, entertained the idea that the strength of its current might have no inconsiderable influence, and so (perhaps with more mechanical ingenuity than surgical discretion) proposed to carry a stream through his double catheter by a tube communicating with a reservoir on the top of a two-story house! Professor Jurine, of Geneva, was of opinion that injections of water had caused such a change on a large calculus in one of his female patients, that it broke down into many fragments.

This method of treating stone may now be more favourably resorted to than in former years; for, instead of the periphery alone being attacked, the object may be previously broken into fragments, whereby a vast extent of additional surface may be exposed to the dissolving and disintegrating influence of the menstruum.

The fluid may be carried into the bladder by means of a catheter and syringe,—the latter such as is used for hydrocele,—or one made longer on purpose, or a caoutchouc bag with a proper nozzle may answer. A double tube—so constructed as to resemble externally a common catheter—had better be used, whereby, if it is desired, a continued stream may be kept up. For this purpose Hales, Gruithuisen

and others, used the instrument like a syphon, — a dish with a communicating tube being kept above, another below. A Read's syringe may be applied for the purpose, and such an apparatus I have had by me for many years. A flexible caoutchouc catheter may be used on these occasions; silver, however, is generally preferred; and when Sir Benjamin Brodie injected nitric acid, the catheter was made of gold. Mr. Weiss has lately constructed some instruments in the form of those which I have used, and had them gilt so that they will resist the action of any ordinary solvent.

Instead of a single stone there may be several, or there may be numerous small concretions, varying in size from a mustard-seed to a garden-pea. In such examples the practice above alluded to may be equally applicable, although there may often be every reason to suppose that some, if not all, of the little bodies are originally formed in the kidneys, and drop down the ureters into the bladder. Here it is evident that local measures alone will not suffice; but even while constitutional remedies are being exhibited some may advantageously be tried. Besides attempting to dissolve these objects, or possibly without trying such a plan at all, some method more strictly mechanical may be resorted to: the urethra may be dilated to the fullest possible extent by means of bougies or otherwise, and thus there will be a greater probability of the gravel passing away in the natural stream; or a large catheter, provided with one or two large eyes, may be introduced, and the cavity being distended with fluid, the small stones may pass along the tube, or possibly, in withdrawing it slowly, while the fluid is still in the viscus, a few may follow its point. Such plans have been known to suceed, as evinced in the practice of Ledran, Boyer, Sir Benjamin Brodie, and the late Mr. George Bell of Edinburgh,—who was thus fortunate in ridding a patient of one hundred and fifty concretions,—and in other instances the calculi have been seized with instruments made for the purpose, and extracted at once. The instance where Sir Astley Cooper was so successful as to cure his patient by extracting upwards of eighty small stones in this way, is the most celebrated of the kind. Mr. Weiss, who constructed

Fig. 230.

the original instrument used for this case, has lately made it in some respects more perfect. This drawing (fig. 230) exhibits its shape and appearance: at the point it consists of two blades hollowed out within,

which can be caused to open by means of a stilet, connected with a kind of trigger near the handle. When in the bladder the blades are opened, and allowed to shut again, which they do by their own elasticity, provided the trigger is not meddled with ; and, more perhaps by chance than by dexterity or precision of movement, one, two, or more of the concretions are probably caught within the hollow chops. By a repetition of such proceedings from day to day, as circumstances may permit, the malady may thus be removed. The method, however, is of older date than Sir Astley's operation, although the instruments do not seem to have been so perfect. Sir William Blizzard was occasionally in the habit of resorting to it, and the proposal is at least two centuries old. But cases where such practice may be deemed advisable, or may actually prove of service, are truly of rare occurrence, and in by far the greater number of cases of stone some more effectual means must be resorted to.

In modern times the methods of drilling, percussing, and crushing the stone into sand, or into such small fragments as to pass away spontaneously, or to be removed by appropriate instruments, have been devised, proposed, and carried into execution, with the excellent motive of saving the necessity for resorting to a cutting operation, which until within these twenty years was deemed the only certain method of cure,—although one attended with so much difficulty and hazard as to make it in every respect a last resource.

It is compatible neither with the limits nor with the arrangement of this volume, that I should enter upon the particular history and progress of the subject of lithotrity, which now occupies so large a share of modern surgical literature. The celebrated cases of General Martin and the monk of Citeaux seem invariably to be put at the top of the list of all lithotritic proceedings. The former relieved himself by frittering the stone into sand by means of a steel bougie made rough like a file on its convexity : the latter, by means of a kind of chisel introduced through a canula, and made to act on the stone by percussion with a hammer. The General's bladder is said, however, to have held a stone within it when he died, and the relief which he experienced may probably, after all, be attributed to some of those accidental alterations as to position of the stone and otherwise, which are occasionally met with in practice where no mechanical means have been adopted, and which are well ascertained to have occurred in some instances during the exhibition of the nostrum of Madame Stephens. Although Gruithuisen of Munich proposed, in 1813, to seize and then perforate a stone in the bladder by the process of drilling, and though Dr. James Arnott, in 1821, proposed applying a small circular saw, introduced through a canula, to rasp off a portion of the concretion (the latter for the purpose of chemical examination,—the former to permit of the more advantageous contact of solvents,) though Elderton, in 1819, first proposed a curved lithotritic instrument, and though Amussat, Leroy, and Civiale were busily engaged on the project of destroying stone in the bladder by mechanical means, the first operation on the living sub-

ject, at all resembling the modern proceedings, was not performed till 1824, when the last-named gentleman succeeded in freeing a patient of his complaint by the application of the instruments on only two different occasions,—sittings, as they have been technically named. Since this date the operation has been very frequently performed both by those who have devoted their sole attention to the subject,—among the most distinguished of whom may be named Civiale himself, Heurteloup, and Costello,—and by the regular surgeons of the day. The names of Amussat, Leroy, and Ségalas occupy distinguished positions in the interesting history, and it were needless to name the various surgeons of our own country who have practised this operation.

Like many other novelties, lithotrity has undoubtedly been too much vaunted by its professed advocates and performers; but it is equally clear that in many instances it forms an admirable substitute for lithotomy. Notwithstanding the reputed success of Civiale, it seems to me that in the present stage of its history we have not sufficiently authentic data by which to determine the comparative safety of lithotrity to that of lithotomy; but regarding the applicability of the former, and even its superiority in many instances, there need be no doubt. Years must yet elapse, and the operation must be tested in our public hospitals by the same class of surgeons as those on whose proceedings the statistics of lithotomy have been founded, before an unbiassed professional judgment can be given on the subject.

There are certain circumstances adverse to the success of lithotrity, which should always be inquired into, ere it is determined to resort to this operation. The diameter of the urethra before the age of puberty is most unfavourable, both on account of the smallness of the instrument which must of necessity be used, as also that the fragments cannot pass away in such large portions. Besides, in early years the urethra and bladder are more irritable—less callous to the contact of the needful apparatus. At any period of life a small urethra is objectionable on the above grounds, whether there be stricture or a natural want of development. Any obstruction to the free passage of instruments or of urine, must be a great hindrance, and in advanced years the natural enlargement of the prostate, and what may be termed the diseased enlargement, present impediments which the utmost skill may not be able to surmount. Should the bladder be sacculated—a condition which can scarcely be ascertained on the living subject—the chances of success will be further diminished; for, supposing the stone to be broken into various fragments, the probability of some of these lodging in such pouches, must always render the results of the proceeding uncertain. But from my own experience I should say, that the most formidable objection to lithotrity is the apparent irritability of the urinary organs: if the patient does more than wince while being sounded; if the application of the steel to the urethra seems to occasion pain—I mean more than that sensation which patients usually have on such occasions—if the mucous surface of the bladder is so tender as to cause the contact of the instrument to

be borne with difficulty; and if the muscular fibres are excited to such violent contraction as to occasion the evacuation of the fluid contents along the side of the instrument, or to excite an irresistible desire to micturate, then assuredly the circumstances are peculiarly unfavourable to the proceeding. A stricture may be cured; the natural calibre of the urethra may be increased by dilatation; even in certain cases the objectionable state of the prostate may be in some measure overcome by means of large catheters, scoops, and proper position whilst voiding urine; but the irritability—excitability, I may call it—and tendency to inflammation, which are almost certain accompaniments, cannot so readily be coped with. It is very certain that in some instances the organs become more and more callous after the application of instruments; but it is equally certain that the conditions above referred to often rather increase than otherwise, after the first, second, or third sitting; and, in addition, that in certain cases, where the conditions have not been by any means conspicuous before the operation, they have become so developed as to retard the whole proceedings, making each succeeding attempt more painful than the preceding one, so that the cure (if cure it can be called) is ultimately completed amidst the most miserable sufferings—miserable to the patient, and disheartening to the surgeon,—when, from time to time, as a favourable opportunity presents, he has again to resume his attacks upon the original cause of the suffering—the stone—which may at this time be already comminuted into a variety of fragments.

While I do not hesitate to assert that the above picture is by no means overdrawn, it must be admitted that the effects are very different in the majority of cases in which lithotrity is properly applicable: and here be it remarked, there is a vast difference between such examples and those in which, unfortunately, it is attempted; for when the circumstances are favourable, viz., when there is a large and callous urethra, a capacious and apathetic bladder (if I may so call it), with good muscular power, a healthy prostate, and a small or moderately-sized stone, the operation may be done once, twice, or as often as may be required, with as little annoyance to the patient as if he were only undergoing the treatment for stricture.

Supposing lithotrity to be the mode of treatment, the method of crushing the stone into fragments is that which is now in general use, having almost entirely superseded the percussing force of Heurteloup, and also the process of drilling by means of a straight instrument, which was at one time so extensively used by Civiale, but which, we learn from Mr. Edwin Lee, in his Dissertation on the subject, for which he was awarded the Jacksonian Prize for 1838, is at present scarcely ever employed by that distinguished lithotritist. The curved instrument originally devised by Mr. Weiss, in 1823, formed the type of those which have since been so much improved—it may be said perfected—by himself and M. Charriere. The lithotrite of the present day consists of a male and female blade, which, while they are so adapted to each other as to resemble a common short-curved sound,

can, by a sliding motion, be so opened at the extremity within the bladder as to leave a space of sufficient size to enclose the stone, when they can again be closed, and with such a force, as to divide the object into two or more fragments, which can then be treated in a mode similar to that by which the original stone has been broken down. This force was, as Mr. Weiss originally proposed it should be, applied by means of a screw: Heurteloup, however, who first used the instrument, preferred a hammer wherewith to close the blades; but the screw has been again adopted, and it is scarcely possible to refer to any *useful* piece of mechanism for surgical purposes more perfect than the instruments now constructed by Mr. Weiss.

In 1834 I described, in The Lancet and in The Edinburgh Medical and Surgical Journal, a modification by means of a rack and pinion, which I was induced to prefer after having witnessed some operations with the apparatus of Heurteloup. The necessity for a vice in which to fix the instrument, as used by this gentleman—the complicated, though ingenious table, and the various processes of fixing and unfixing the different screws and pins, all seemed to me to be unnecessary complications. The vice, capable of being fixed at any proper height on the margin of the table, was at first deemed a most valuable means of preventing the percussion from acting injuriously upon the urethra or bladder—it certainly was admirably adapted for that purpose; but it was entirely overlooked that, while the lithotrite was in the viscus and thus fixed, there was nothing which could prevent the patient so moving and writhing his body as to bring the bladder against the instrument, and thus unconsciously inflict greater injury than might have been occasioned without the vice. I have nowhere seen this circumstance so clearly pointed out as in Mr. Lee's Essay, already referred to. A hand-vice has been substituted by some; but it may well be doubted if there be further use for the hammer, as the screw above referred to affords as much destructive force as the limited size of the instrument will bear.

Of late years I have in some respects simplified my own instrument, and generally give it the preference to the screw force. It is such as may be understood by the drawing below (fig. 231), and may be used in the following manner:—The patient being laid on the mar-

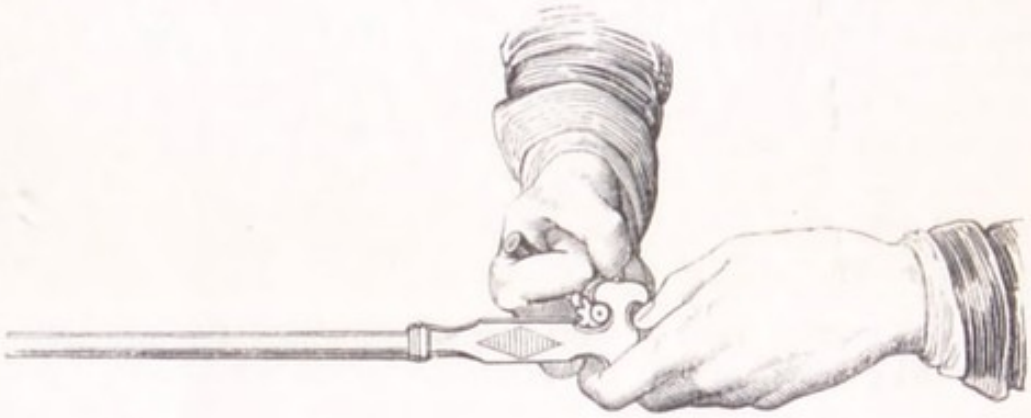
Fig. 231.

gin of a bed, or a couch, with the shoulders and knees slightly raised, the surgeon, standing between the latter, should introduce the instrument with the blades closed, and smeared with oil or lard, in a slow, steady, and cautious manner, so as to cause the smallest possible ex-

citement: next, when the curved point is fairly within the cavity, he should cautiously feel for the stone, as in the process of sounding already described: then having touched it, he opens the blades by drawing the inner one towards him, and pushing the outer a little onwards, until he supposes the gap sufficient to include the calculus, when he turns their points, and dips the whole end of the instrument in the supposed direction of the stone, then pushes them towards each other, and thus grasps the object: this being done, he should move the instrument slightly by way of making sure that he has not included part of the mucous membrane, and being satisfied on this score, he should apply the handle (fig. 232), and by turning it in the manner indicated by the accompanying drawing (fig. 233), should force the inner blade onwards, either by a continued turn of the hand, or by sudden and short jerks, so as to imitate slight percussions, until the object is shattered, when he may repeat the proceedings on one or more of the fragments, according to

Fig. 232.

Fig. 233.



circumstances. Perhaps one proceeding may suffice if the stone is small; but more frequently the different portions have to be touched, and the repetitions must be resorted to at intervals of two days, or more, according to the condition of the bladder above referred to. Previous to the performance of each operation, the patient should be desired to retain his water for a couple of hours or more, or else some tepid fluid must be thrown in immediately before. When the cavity is tolerably distended, the instrument moves about with more facility and less pain to the patient,—besides the stone is more isolated, as it were, and the blades can be placed on each side of it with less risk to the tunics. Usually towards the end of each proceeding, the bladder

becomes comparatively empty, from the escape of urine through the chinks and alongside of the instrument, and then as the blades are more likely to inflict injury, they should be closed and withdrawn. It will seldom happen that there is not some slight effusion of blood, the urine being generally tinged red for some time after, and clots occasionally pass away, either by themselves, or mingled with sand and small fragments. For the purpose of clearing the bladder as rapidly as possible, Heurteloup used an instrument of steel resembling a common catheter, through which, when introduced after the operation of breaking the stone, he injected tepid water until it was forcibly expelled, when clots, sand, and small fragments occasionally escaped at the same time through the eyes, which were purposely made very open. In case of any large fragment sticking in these apertures, a most ingenious stilet, constructed towards the point like a watch-chain, was introduced so as to cut them off, and allow the instrument to be withdrawn without injury to the urethra from any portion projecting through one or other of these openings. The double-current catheter, with Read's syringe, already referred to (p. 559), I have used with similar objects, and an elastic piece of steel has acted as a stilet.

The subsequent treatment must be conducted on ordinary surgical principles. Usually when the stone has been divided, a smaller instrument than that which has originally been used will suffice for the fragments, which are on some occasions so very friable that the mere squeezing of the blades together with the fingers will suffice to crush them. The teeth may vary considerably in shape from those represented in fig. 231: the two blades may be so made that the one encloses the other, or they may be opposed, as is represented in this cut (fig. 234). The instrument now most generally in use is open on the convexity of that part between the turn and the point, so that the fragments cannot collect and clog up the blades in such a manner as to prevent them from being readily shut; but sometimes a kind of scoop is used—one blade having a large excavation,

Fig. 234.

Fig. 235.

the other forming a sort of lid for it. Some of these are so constructed as to suit for catheters at the same time. In one instance such a curve as that represented in the sketches referred to may be found to answer best, in another the angle may be more or less oblique. In some instruments the point beyond the curve is longer, in others shorter, as here exhibited (fig. 235);—but the minute details of these matters would carry me far beyond my present limits.

Occasionally both patient and surgeon experience more annoyance from a fragment lodging in the urethra than from any other circum-

Fig. 236.

stance, and much ingenuity and manipulative skill may be necessary to expedite its passage. Various instruments have been constructed to enable the surgeon to extract these objects. One of this figure (236) may sometimes answer: the two blades are intended to grasp the fragment, and the screw or file in the centre is designed to fritter it down. In one instance a bent piece of wire will suit, in another the scoop end of a common director; and again, a long slender forceps, similar in construction to those used for extracting polypi from the nostrils, (p. 456,) will serve the object in view. But I need not dwell on such topics, nor after all that has been previously stated in this volume need I give special notice to such matters as the ordinary principles of practice should dictate,—as regards the necessity of using every instrument with the most gentle and delicate movements,—the value of opiates, especially when exhibited by the rectum,—the advantages of diluents, hip-baths, and, generally, all such means as shall allay pain, promote the passage of fragments, and avert or subdue inflammatory action.

Although lithotrity may be performed on children, it may well be doubted if such a proceeding should ever be attempted upon them; for it would be difficult to name any single operation of magnitude which has been more successful on young subjects than that of lithotomy. Out of one hundred and five cases operated on by the latter method in the Norwich Hospital—the patients being under ten years of age—only three died, thus giving an average of one in thirty-five; and although other tables do not show altogether such favourable results, there are good reasons for supposing, that the average deaths in young persons who are subjected to lithotomy is little more than one in twenty-eight or thirty. Until it can be shown, then, that lithotrity surpasses this success, and is in almost every other respect to be preferred, it is only a fair conclusion to draw at the present time, that lithotomy is decidedly preferable in such subjects; and when, moreover, the comparative frequency of the disease in children is taken into account, it will at once appear that a large proportion of all cases of stone must yet be set aside for the lithotomist. Above the age of puberty, however, the average alters very materially, and as already stated, the propriety of resorting to lithotrity ought to have due consideration.

The circumstances which are unfavourable for lithotrity can be considered as giving only a negative advantage to lithotomy: if the magnitude of a stone precludes the selection of the former, it renders the latter a dangerous alternative; but of two evils the surgeon's judgment has to determine which can be deemed the least; and it seems certain that the latter method must still, in many examples, be the only means of attempting a cure by operation.

I propose here, in accordance with the arrangements in other parts of this work, to limit my notice of lithotomy to an exposition of the practice which I myself should follow, and of which I can speak from personal experience. Cutting on the gripe is not practised by any surgeon of the present day; the operation with the apparatus major is equally obsolete; the high operation is but little followed unless by the distinguished Souberbielle, or in instances where other modes are not deemed eligible; the recto-vesical method has few if any advocates; the bilateral proceeding is but rarely pursued, and has never, to my knowledge, been performed in this country with the double lithotome; the cutting gorget, from all I can perceive, is getting more and more into disuse; and the lateral operation, as practised by Jaques in his latter years, by Rau and by Cheselden, seems, with few exceptions, to be that in most common use among the modern surgeons of this country. The whole proceedings as practised by some in the present day so nearly resemble those of the last-named most distinguished of all British lithotomists, that the custom prevails more than ever of calling the operation Cheselden's. With some slight modifications, the following is a description of the proceeding, and such as I should recommend:—Every care being taken, as in all other operations, whether capital or not, that the patient is in as favourable a condition as circumstances will permit, the perineum should be shaved, a clyster of warm water should be administered about an hour before, and he should be desired to retain his urine until the operation. Before the appointed time the surgeon, particularly in the early part of his practice, should ascertain that there is a good stout table in the apartment, and also a chair, each of a proper height in proportion to his own taste and size; and here too, as in all other operations of great magnitude, he should see that all his apparatus is in perfect order, as has been especially noticed in some of the early chapters in this volume. Everything being prepared, the first step is to introduce the staff, which should be as large as the urethra will admit with ease, and of such a shape as that here represented (fig. 237), having the groove

Fig. 237.

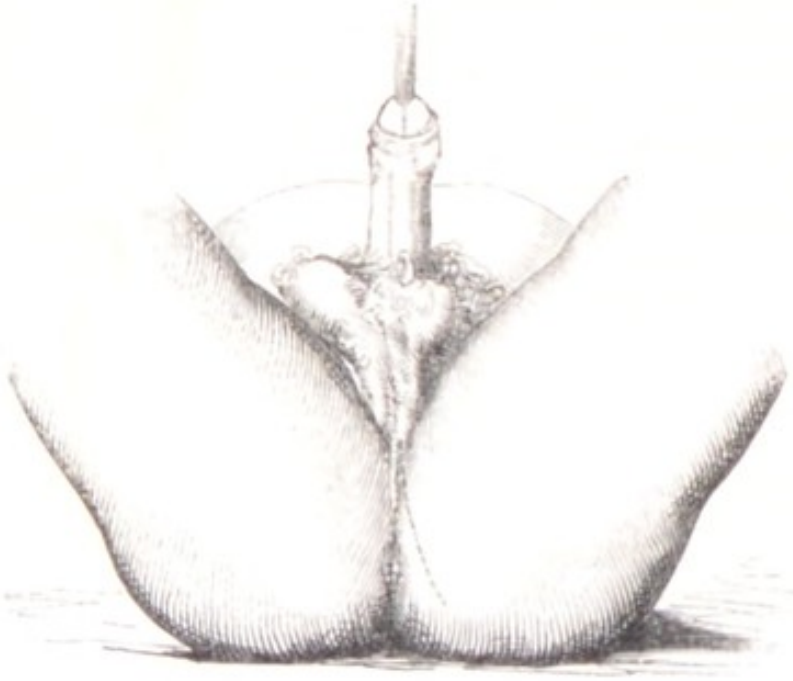
presented a little to the left side of the urethra. This being slowly and cautiously done, as with the catheter, in the manner already described, the instrument should be made to strike the stone, and should then be given in charge of an assistant. Next the patient should be secured thus:—A piece of broad worsted tape about three yards long should be doubled, and formed into a loop in this fashion (fig. 238), which should then be fastened on one of the patient's wrists; and next, he being desired to grasp the outer margin of the foot, the two ends should be so twisted round each hand and foot as to bind them firmly together. A similar manœuvre should be executed at the same time on the other side, and thus the patient will be securely bound, hand and foot, although two assistants will be required, one at each knee, to hold the thighs properly apart, and others may also be of service to keep him steady. The breech should now be brought to the margin of the table and the assistant, who has charge of the staff, should be desired to hold that instrument in his left hand, nearly perpendicular, with the concavity of the curve resting on the upper part of the triangular ligament, and to draw the scrotum slightly upwards, and a little to the right side, with his right hand, while he stands on the patient's right side. Then the surgeon should seat himself in front of the perineum, having previously arranged with an assistant about having the instruments handed to him, or having already arranged them properly on a chair at his side; now it may be well to pass the forefinger of the left hand, well oiled, into the rectum, to ascertain the size of the prostate (if that has not been done previously), and also the depth of this organ from the surface; next, having withdrawn his finger, he should trace the course of the rami of the pubes and ischium on the left side, ascertain the position of the tuberosity of the latter bone on each side, and having scanned the whole surface, he should proceed to use the knife (fig. 239), which he should hold much in the manner of

Fig. 238.

Fig. 239.

a common bistoury (p. 5). The point should be entered about one inch and three fourths in front of the anus, about a line's breadth left of the raphè, pushed through the skin, and carried by a kind of sawing motion down to the left side of the perineum, about an inch beyond the anus, the middle of the incision being at equal distances from the latter part and the tuberosity, as indicated by the line on the accompanying drawing (fig. 240); next, the blade should be run

Fig. 240.



along the surface of the exposed cellular tissue, and then the point of the forefinger of the left hand should be thrust into the wound a little in front of the anus, so as to penetrate between the accelerator urinæ muscle and the erector, the knife being applied to any part which offers resistance; now with a little force the finger can be placed upon the membranous portion of the urethra, and the groove in the staff, and the blade, with the flat surfaces nearly horizontal, should be carried along above the finger, made to perforate the urethra about three lines in front of the prostate, and then be slid along the groove until it has entered the bladder, having slit open the side of the urethra and notched the margin of the prostate in its course. In withdrawing the knife, if the stone is supposed to be of considerable magnitude, the blade should be kept a little out of the groove, so as to increase the incision of the prostate. The forefinger of the left hand should next be slipped slowly into the bladder along the staff, and in such a manner as to cause dilation of the surrounding textures, and its point should be moved about in search of the stone, which being found, should be retained in a position near the neck of the viscus; then the assistant should be desired to remove the staff, and the surgeon should

introduce the forceps (fig. 241) along the upper surface of the finger, slowly withdrawing the latter as the former make progress: their entrance will be denoted by a gush of urine, at which instant the blades should be expanded, and now, in all probability, may be closed upon the stone; extraction should then be effected by a slow zigzag movement; and this being done, the operation is completed. It may be well, however, to examine the interior of the bladder, in case of other concretions being present, and this may be done with the point of the finger, with a common sound, or with such an instrument as is represented below (fig. 242), which is technically called a searcher; if others are present, they must also be extracted; then the patient being unbound, should be carried to bed, desired to lie principally on his back, occasionally permitted to rest on his right side, and the future treatment must be conducted according to circumstances. Sometimes, if there has been much laceration, a tube (fig. 243) is passed into the wound, and retained for the next forty-eight hours by means of tapes or slips of oiled silk attached above to a cord round the loins.

Fig. 241.

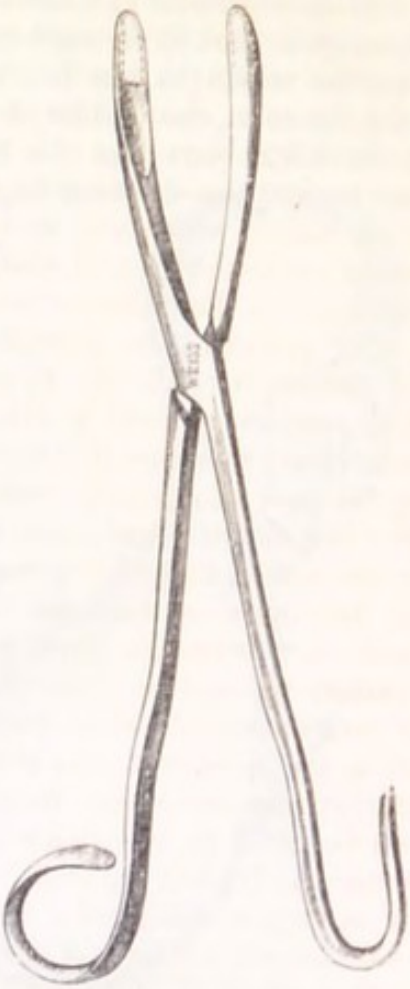


Fig. 242.

Each stage of the operation and each instrument require some separate consideration. It is recommended that the staff should be introduced as the first step,—chiefly because it can be more easily passed before the patient is bound, and also because it is satisfactory to touch the stone before going further. Unless the calculus be large and palpable, and this has been well ascertained before, the surgeon should never cut into the bladder until he feels the concretion when the pa-

Fig. 243.

tient is on the operating table. The staff usually permits him to do so; but as it is not of a convenient shape for making a minute survey of the bladder, should that be required, it will be necessary to withdraw it, and pass a common short curved sound, which will probably be most conveniently used when the patient lies in the ordinary position for this process. In general the staff suffices for all the sounding which may be required at this particular time; therefore it is unnecessary to pass the regular sound at first; but as the former may possibly not suffice, and as it is possible also that the stone may not be detected even with the most careful examination, and as consequently the surgeon would not be justified in proceeding further, it is always best in my opinion to pass the staff before tying up the patient. This latter circumstance may to some appear of less consequence than I seem to attach to it,—indeed, in my own practice I have not always attended to it; but the staff is not in every instance introduced so readily as may be imagined; and in case of difficulty, as it might be supposed that the attitude of the patient when his hands and feet are tied together might be unfavourable,—as I believe it is in some,—the surgeon might regret having him thus bound;—besides, there is nothing more likely to ruffle the temper of a young operator than meeting unexpectedly a difficulty in this the beginning, and perhaps most simple step in the proceeding, and therefore he should avoid throwing annoyance in his own way, however petty it may appear to those familiar with such matters.

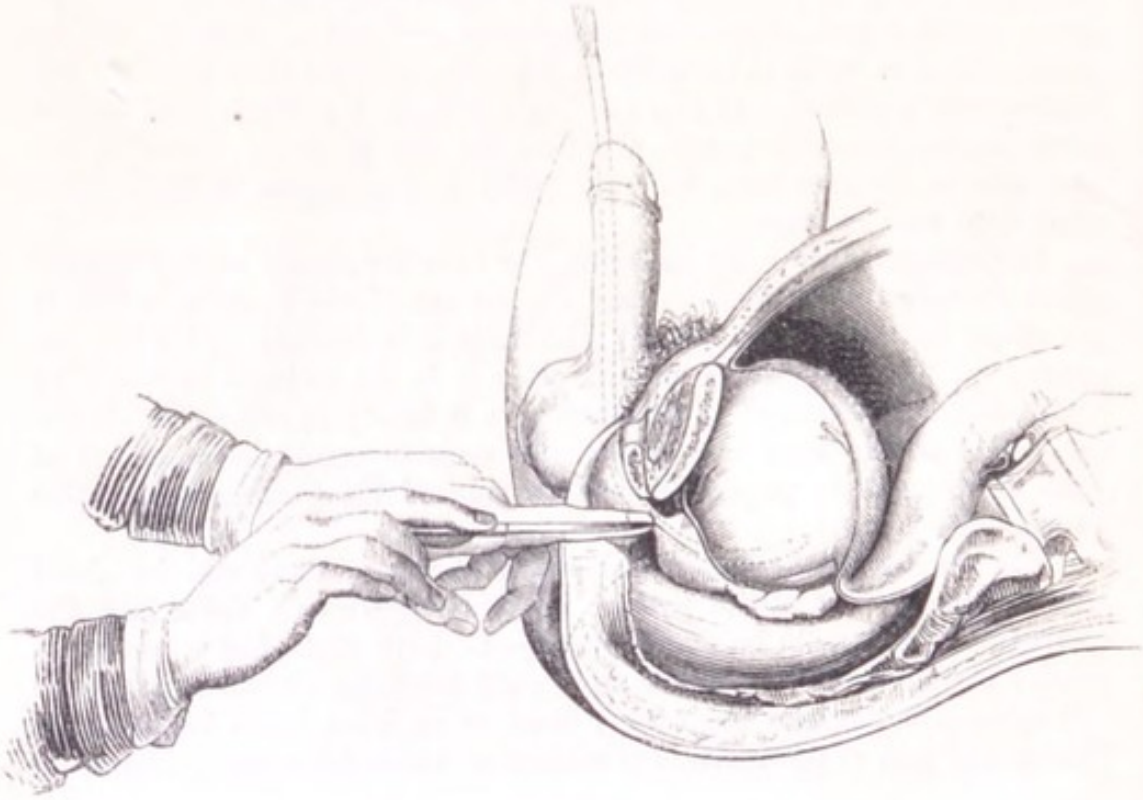
Before commencing the incisions, the operator should satisfy himself that the point of the staff has not slipped out of the bladder, which it is apt to do unless the assistant who holds it is careful; and when assured on this subject, he should place it in the attitude in which he wishes it held afterwards, and then give it finally in charge to the assistant. It has been the custom with some to cause the convexity of the instrument to project in the left side of the perineum, but this seems unnecessary.

The length of the external incision in the adult should be about three inches; but if the patient is fat, the perineum deep, and the stone large, it should be made longer,—at both ends, but more especially in front. It has been a customary recommendation to have the external wound as far behind the anus as in front, but I believe that the lower part of the incision is seldom of much advantage, unless, in-

deed, the stone be very large; but even in such an instance it will be found that the skin towards the scrotum is more put on the stretch than that behind: besides, an incision which is begun an inch and three quarters or two inches in front of the anus, when the scrotum is held up in the manner recommended, will not appear so great after the parts are allowed to resume a more natural position. The skin alone should be divided in front, and between the tuberosity and the anus the blade may be carried deeper, although there is less occasion for this in general than some have supposed. The young surgeon is often told to cut freely here, because there is no important texture,—nothing but cellular tissue; but where the stone is not above an average size, there is actually no need of a wide gap in this situation.

A free division of the skin, then, I consider a most important feature in the operation; but beyond this the application of the knife should, in my opinion, be extremely limited. The point of the finger may, in general, be thrust without much force into the space between the muscles above named, provided the superficial fascia has been cut; it will probably be arrested by the lower part of the triangular ligament, and some of the fibres of the levator ani; but I believe the groove may be felt through these parts, — they may in a manner be squeezed up against it, and the puncture with the knife as it is carried onwards will usually suffice to admit the point of the finger, which, being accomplished, gives the operator the power of enlarging the wound to any extent he may think necessary. The dotted line in the accompanying drawing (fig. 244) will give an idea of the

Fig. 244.



extent of the wound as far as the membranous portion of the urethra: the left forefinger is placed as above recommended: the point of the knife is represented as being about to be carried onwards, and the dotted line on the prostate shows the extent of incision through the left lobe of that organ. It will be observed that a considerable portion of the gland remains uncut, and that the line of incision is nearly parallel with, and a little below the attachment of the pelvic fascia, as referred to at page 506. In all probability the transversus perinei muscle will tear under the finger, as will also such of the fibres of the levator ani, and of Wilson's, as may be interfered with: if, however, these or any other parts seem to resist the entrance of the finger, the edge of the blade should be turned against them; but as the amount of resistance cannot be well appreciated until the wound has been made into the bladder, and as it might be both troublesome and dangerous to use a sharp-pointed instrument any longer, a probe-

Fig. 245.

pointed bistoury may be selected for the purpose, and one such as this (fig. 245), which it will be perceived resembles that laid aside in all respects excepting the point, will be found to answer well. In some instances where the stone is large it may be desirable to make a freer opening in the prostate than the line in the drawing indicates; but as it will be unsafe to use the sharp-pointed bistoury for the purpose, the blade exhibited in the last drawing will answer. It may be used before the stone is grasped by the forceps, or after, as may be thought proper: if before, it may be carried further along the left lobe, or be laid on the right one so as to divide it to a similar extent; if the stone is between the forceps, the blade may still be put against one or other of these parts of the prostate; but it may now be more difficult to reach the right lobe, and, in so far as I can perceive, there should be no hesitation in cutting any part of the gland which seems to offer great resistance, with the exception perhaps of its under surface, where the position of the seminal ducts and other circumstances should deter the surgeon from using a cutting instrument. The blades above recommended may be each set in a stout ebony handle, somewhat longer and thicker than that of the scalpel, or they may be in clasp-handles. It is advisable to have the sharp-pointed one in this setting, as the operator can conveniently keep it in his vest-pocket until he is about to use it, and thus there will be no chance of the point being broken by an awkward assistant or an inquisitive looker-on.

I believe that in a large majority of cases the opening in the deep part of the perineum and neck of the bladder need not at first be

longer than what the forefinger will stop, and as the latter follows the course of the knife as soon as it is withdrawn, there will be as yet only a slight escape of urine ; but when the forceps are used the fluid will gush out at once, at which time, as already stated, the stone may probably be seized.

Perhaps the most difficult part of the operation pertains to the use of the forceps. With such a narrow wound some care is required in slipping them towards the bladder, for otherwise their points might get between the prostate and rectum — indeed, even in using the forefinger there is danger of its passing in this direction. If a large opening be made in the back of the bladder the urine must escape before the forceps are introduced; but if it be small, as has been recommended, the great gush will not take place until the blades enter the viscus, and if they are opened at this time there is every probability of the stone being carried between them by the force of the current, as well as the natural contraction of the bladder which usually throws it towards the neck. If the stone is not grasped at the period referred to, the blades must be closed and moved about until they touch it, when they must again be opened and an attempt made to seize it. Now, however, the bladder, having contracted, will prevent the blades being opened so readily as before. I have often found it of service to give the forceps a kind of shake, which seems not only to make the stone fall between the blades, but also causes it to settle down, as it were, in the most favourable position in the concavity between the chops. In extracting, the movements should be slow, the hand should, if necessary, be carried up and down, and from side to side, and with such a degree of pulling as to cause the textures to yield gradually. Occasionally it may be of service to introduce the point of the left forefinger to force the parts slightly backwards ; and in all instances the prostate, and consequently the neck of the bladder, should be kept as much as possible in their natural position. In the different operations which I have witnessed, when there has been difficulty in extracting a stone of moderate size, or perhaps a little above the average, two circumstances have appeared to me as having had considerable influence in retarding the proceedings; first, the shape of the forceps, and next, the mode of using them. If the blades be short between the hinge and the points, as they often are, their wedge shape, when the stone is grasped, is too abrupt to cause that gradual dilatation which appears to me to be of so much consequence: the blades, besides being more apt to slip, are thus brought against the interior of the neck of the bladder most abruptly, when any force exerted at this time is more likely to bring the prostate against the rami of the pubes than to cause the expansion alluded to: moreover, the stone is now much less likely to come through than ever, as, in addition to the resistance of the gland the interval between the bones is so narrow that it may be physically impossible for it to pass while the parts are thus situated. If, however, the blades be made of a length and shape in proportion to those exhibited at page 570, the above difficulty may, in

some measure, be overcome: but still the extracting force must be applied gradually, and in a direction more towards the floor than the surgeon, and thus the expansion will be chiefly in that direction in which the space between the bones is largest. I believe that it is of some consequence, also, to have the whole forceps of considerable length, (from nine to ten inches for the adult,) as the lever force may be of great importance when the stone is very large; and in all instances it is wise to have at hand a variety of forceps of different sizes, for occasionally a stone proves to be much larger than has been anticipated, and a full-sized instrument may then be of great service. The concavity of the jaws of the forceps is usually made rough, having a variety of little metallic projections; but some prefer those lined with stout linen, which is sewed to them through apertures made on purpose, as may be seen in the drawing on a preceding page. Sometimes it may be advantageous to have the forceps curved near the points, so as to reach the lower part of the bladder more conveniently, or perhaps up behind the pubes, and in certain instances, such as when the stone is flat and difficult to seize, a scoop (fig. 246) may

Fig. 246.

be more serviceable than the forceps. This instrument is used by passing it behind the stone, then fixing the latter against it with the point of the left forefinger, and thus extracting all three at the same time.

The principal dangers in the operation above described are, wound of the rectum or of some large blood-vessel. The former will be best avoided by keeping the knife, when in the deep part of the wound, chiefly above the finger, which may also be used to depress the gut. Under the age of puberty there is seldom any annoyance from hemorrhage, but in the adult there may be both trouble and danger. The superficial perineal artery, or its transverse branch, is occasionally of such size, that, when divided, a ligature may be necessary;—it is usually so near the margin of the wound that it can be secured with great facility. The artery of the bulb will seldom be cut, as the point of the knife should never be carried so high at this part: an anomalous branch (forming the dorsal artery of the penis) occasionally traverses the line of incision in the prostate, but such a circumstance is rarely met with, and when the scalpel is used (for it may be perceived that there is little difference between the blade represented at p. 568 and the last-named instrument, saving that the one for lithotomy is blunt towards the heel), the edge of the knife is not likely to encounter the common pudic. Perhaps the most troublesome hemorrhage may be from the veins around the neck of the bladder, which in

those advanced in years are often of considerable size. If necessary, the opening in the skin might be enlarged, to permit the application of a ligature to a deep-seated artery—it might even be possible to carry a curved needle round the pudic, were this deemed advisable; but in the generality of instances the bleeding ceases as soon as the patient's thighs are placed together; for then the cut surfaces come more closely into apposition: cold over the pubes may be resorted to; but the most efficient means of all—especially when a ligature cannot be applied—is to use the tube delineated at p. 571, which, when introduced into the bladder, can be so surrounded by plugs of lint as to keep up very efficient pressure, and at the same time the urine is allowed to dribble away through the canal. When the tube and plugs are withdrawn, at the end of four-and-twenty or eight-and-forty hours, the effused lymph on the cut surfaces will have closed the divided vessels.

As the urine must escape by the wound for the next ten or fifteen days, a piece of Macintosh cloth must be laid between the patient and the mattress; a folded blanket or sheet should also be placed under his breech, a sponge may be put in front of the wound, to absorb part of the urine, and care should be taken to keep the skin as dry as possible. Usually, from the swelling of the parts in the track of the incision, the urine passes freely by the urethra on the second or third day, but it soon again all escapes by the wound, and then on the eighth, ninth, or tenth, it flows in part by the natural course, and in a few days more is entirely evacuated through this channel. The aperture in the perineum generally closes in about three weeks or a month, sometimes earlier, and occasionally much later, a few drops of urine coming from time to time, for six weeks or more, through a small chink still unclosed.

The treatment after lithotomy, as regards diet, the state of the bowels, and the various evil consequences of the proceeding not particularly referred to above—such as infiltration, wound of the rectum, inflammation of the neck of the bladder or of the peritoneum, &c., &c., should be conducted on the ordinary principles of surgery, which, it is presumed, must be known to any one who would undertake the operation.

Very recently a proposal has been made by Dr. Willis to extract the stone by dilating the neck of the bladder, after making an incision in the perineum and opening the membranous portion of the urethra, in imitation of an operation once performed by Sir Astley Cooper, at the suggestion of the Drs. Arnott, and partly also of the old method of Romanus and Marianus by the apparatus major; but it remains to be proved in how far the operation is to be preferred to the present method. A most intelligent friend, Mr. Thomas Elliot, of Carlisle, has favoured me with an account of a case, in which he has successfully extracted a stone in this manner on a young man of seventeen, but as it is his intention to publish the particulars, and as the reader will do well to peruse Dr. Willis's own remarks on his proposal (Lithectasy he

calls the proceeding) I need not refer more particularly at present to such a practice.

Among the numerous authors on the subject of lithotomy, there is difficulty in selecting those most worthy of notice in such a work as this; and it is not deemed necessary to advert in any particular manner to the modifications which have been or are practised with regard to different steps in the proceedings. Of the method with the cutting gorget I have had little experience; and although I have seen the operation admirably executed with this instrument by Mr. Green at St. Thomas's Hospital, I cannot but express my concurrence with the prevailing feeling of the present day, that the scalpel or bistoury is the safest instrument for making the wound in the neck of the bladder. There is no modern author with whose works I am acquainted, who has so clearly pointed out the deplorable effects of the gorget, as Mr. Crosse, and in so far as I am myself able to form an opinion, the instrument might be altogether dispensed with among modern surgeons.

Through the polite attention of Mr. Key, I have had an opportunity of witnessing with what ease and dexterity he performs the operation on a straight staff in a way peculiar to himself, and of which he has published an account; but partly from custom, and partly because I think that in the present state of our knowledge of the means of extracting a stone from the bladder by lithotomy the proceeding of Cheselden cannot be excelled, whether as regards facility of execution or safety to the patient, I give his method the preference. The highest averages of success (one death in five, in six, seven, and in eight) have been attained in this way, by Cheselden himself, and by many who have imitated his movements, among whom I may enumerate as perhaps the most successful, Mr. Martineau of Norwich, Mr. Chrichton of Dundee, and Mr. Liston, whose operations I often witnessed in former years with admiration.

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