1863

A manual of military surgery - Chapter V: On resections

Let us know how access to this document benefits you
Follow this and additional works at: http://jdc.jefferson.edu/milsurgcsa

Recommended Citation
http://jdc.jefferson.edu/milsurgcsa/7

This Article is brought to you free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's Center for Teaching and Learning (CTL). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in A manual of military surgery, [Confederate States Army], 1863 by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: JeffersonDigitalCommons@jefferson.edu.
CHAPTER V.

ON RESECTIONS.

Malgaigne, in his work on Operative Surgery, says: "We comprise under this title the removal of the articular extremities of bones, the resection of long bones in their continuity, and, lastly, the extirpation of certain bones without amputation of the soft parts."

Excepting a slight alteration in the position of words, the same definition is given by Mr. Pirrie, F. R. S. E., professor of surgery in the University of Aberdeen; surgeon to the Royal Infirmary, &c, &c. 2d ed., London, 1860.

Accepting Malgaigne's comprehensive appreciation of the term, we shall proceed to give a brief history of the operation in general, and then describe the operative procedure as applicable to special cases ordinarily falling under care of the surgeon.

The first operation of the kind on record was performed, as it is reported, by Filkin, of Liverpool, who excised the knee-joint in 1762. After this, Vigaroux and David removed the head of the humerus, but no publication of their operations was made until after the upper part of the same bone had been removed by White, of Manchester, 1768. Mr. Park, of Liverpool, was the first to propose, but the celebrated Morcau was the first who performed excision at the elbow-joint.

The foregoing is almost a verbatim extract from Mr. Pirrie's "Principles and Practice of Surgery."

Resections may be performed at either one of three distinct periods, viz:

1. Upon the field. 2. In hospital, to which, immediately after action, the patient has been removed, in consequence of want of time, or appliances upon the field; or 3. At a more remote period the result of such injuries, inflicted during transportation to hospital, as to direct the surgeon's care en-

tirely to that constitutional restitution which would enable recovery after resection.

Without undertaking to decide, we simply ask, if, in moving armies upon such a continent as this, it be not better, in order to save life, to amputate immediately upon the field, rather than leave the patient the chance of having his limb preserved by the removal to a distant hospital? When we reflect that the present is a war of immense distances, over huge mountains and along rugged roads, and in which transportation of even the best character is attended with pain, annoyance, sleeplessness, hunger and thirst to the wounded soldier, should not such an operation as will most probably save life, rather than one which preserving limb for a few days, and finally ending in death from either pyæmia, erysipelas or nervous exhaustion, be performed?

In cases hereinafter to be reported, we will find that amputation is best suited to transportation, and resection to absolute rest and care.

The reasons, as justly inferred for this last remark, are based upon the facts that—

1. Resections are of slow performance.
2. They should be well rested after operation.
3. Careful attendance and watchfulness should be for a long time kept over them.
4. Transportation destroys proper adjustment.
5. Long and continued jailing creates suppuration.
6. This, added to want of nervous and muscular power, creates that state of constitution that finally,
7. Ends in death by the causes above enumerated.

RESECTIONS OF THE CRANIUM.

Under the title resections, removal of bone from the head will be first considered and described. The removal of bone from the cranium or the trepanning operation must of course be performed under the circumstances immediately calling for it, whether on field or elsewhere.

TREPPANNING.—The circumstances necessitating trepanning are wounds of the cranium, attended with depression of the internal plate, or such diseases of bones of the cranium as give rise to enlarged growth, infringing upon the superficial of the cerebrum itself. The methods of operating, not vary-
ing to any considerable extent, may be stated in a general way, to be the election of such place for applying the trephine as not to injure the important blood-vessels coursing within the cranial cavity, and to avoid entering the sinuses. In military surgery but little discretion can be left to the surgeon—the wounds occurring at the will of the fickle course of balls and shells, or inflicted by the uncertain wield of sabres, the bayonet's puncture, or the sudden fall upon some sharp projecting body. As these causes give rise to different characters of wound, we may here state that the immediate necessity for surgical interference may not occur to all minds alike, and hence, while the comminuted fracture would, under the symptoms attending it, at once suggest an operation, the punctured wound on the contrary might pass by unnoticed until such manifestations occurred as to render the application of the trephine useless. The anatomical difference in structure of the two plates of the cranium is such, that while the outer one may be punctured, the extent of injury corresponds entirely with that of the body inflicting it. The reverse, however, prevails in case of wound occurring to the inner or vitreous plate. Here stellation is the result, and hence great apprehension of fatal end by depressed and detached spiculae, though the effect is not so readily exhibited. Wounds, therefore, of this latter variety should be cautiously examined, and the surgeon at once proceed to remove the portions of bone resting upon the brain.

Figure 1, plate I. gives an idea of distribution of the arteries and sinuses, and suggests what place is preferable for the application of the trephine. When possible, such precaution should be taken as to avoid the evil results consequent upon internal hemorrhage.

Figure 2, plate I. exhibits the patient under the trephine. The flaps have been made and dissected up—the scalpel has cut close to the bone, and so much only of the peri-cranium has been removed as was necessary to give purchase to the bit and circular saw of the instrument.

The improvement made by Mr. Galt, of Virginia, upon the old trephine, renders its employment much less dangerous, and prevents wounding the membranes by a too rapid motion or incautious pressure. An author thus describes it:

"It consists of a truncated cone, with spiral peripheral teeth and oblique crown-teeth. When applied, the peripheral
teeth act as wedges, so long as counteracting pressure exists on the crown; upon removal of that pressure of the cranial walls, its tendency is to act on the principle of a screw; but owing to its conical form, and the spiral direction of its peripheral teeth, its action ceases. In repeated trials the membranes of the brain have not been injured."

Such conveniences then being within the surgeon's reach, and no danger existing of wounding the cerebral membranes, the remarks of Malgaigne may be here inserted. He says, in his Operative Surgery, (Brittan's translation, 1851, page 179;) "We may trepan on all the accessible points of the cranium. The sutures, the frontal sinuses, or the presence of the temporal muscle, are no longer obstacles with the modern practitioner. But we must avoid touching the confluence of these sinuses opposite the occipital protuberance, and in general go as far as possible from the thickest points of the cranium, from the course of the venous sinuses and the middle meningeal artery.

"Some have said that it is easy to recognize, when we have perforated the diploe by the redness of the groove, caused by the saw; and again, when we have reached the internal table, by the whiteness and dryness of the bone dust. This distinction holds good on the subject, but on the living patient the blood continues to flow from the diploe, and prevents our drawing any inference. The more rapid progress of the saw in the diploe has also been vainly given as an indication. But, to judge of the distance we are from the dura mater, we have no other resource, than frequently measuring the depth of the groove with the end of a pen, and especially examining whether the bone is perforated in any one part of the circle before the other. The disc of bone having been removed, and the edges levelled with a lenticular knife, the operation may be continued according to the end proposed. If we want to raise bits of depressed bone, slip an elevator between the cranium and dura mater, without dividing that membrane. If an effusion exists beneath, divide it longitudinally, or crucially, very carefully, carrying the point of the bistoury perpendicularly on it.

"Dupuytren did not fear, in an urgent case, to plunge his bistoury even into the cerebral substance, to more than an inch in depth.

"The mode of dressing varies. If the external wound must
be left open on account of some effusion, carry into the sac a very thin band of linen, cover the wound with a bit of linen riddled with holes, in the same way as an ordinary wound, taking care not to pass this linen between the bone and dura mater, as some advise. Some lint over that, with compresses and a moderately tightened bandage, completes the dressing,

“If there is no effusion, re-unite the flaps by first intention by means of adhesive plaster.”

In applying the trephine, the surgeon should pay strict attention to the anatomical peculiarities which exist at the different regions of the skull. The author above quoted gives the following valuable rules to guide us in the operation:

“1. When we trepan on the temporal fossa, Sabatier advises making a V-shaped incision, the base upwards, in order to respect the fibres of the temporalis muscle. Velpeau very properly remarks, that by so doing we cut, just the same, all the fibres comprised in the base of flap. To respect these fibres as much as possible, we would advise making two incisions in the direction of the muscular fibres, and re-uniting them inferiourly by a transverse incision, so as to form a V incision, reversed and cut off at the top; on the one hand, the division of these fibres, and the cicatrix that results, are less extensive; and on the other, the transverse incision, affecting more or less the deep aponeurosis on which most of its fibres terminate, we should divide really less muscular fibre.

“2. When we have to traverse the frontal sinus, the internal table of the bone not being on the same plane as the external, in performing the operation as usual, the dura mater would be torn at one point before the second table was cut through at the opposite. To cut the second table, then, a smaller crown should be used than that employed in sawing the first.

“3. When we trepan on the sagittal suture, or opposite the venous sinusses, we run a great chance of opening them; the hemorrhage generally stops of itself, or yields to a little plugging.

“4. Lesion of the middle meningeal artery is more serious, on which account it has long been forbidden to trepan at the anterior angle of the parietal bone, under which the artery lies. If hemorrhage occurs, it may be compressed with a bit of lint placed inside the cranium, and retained by a thread
outside (Physick); or with a plate of lead bent so as to embrace both surfaces of the bone; or it may be plugged with a bit of wax, if it is shut in a complete bony canal; or touched with a steel probe, heated to whiteness (Larrey); or even tied, in which Dorsey once succeeded.”

**Operation.**—The patient being placed in the recumbent or semi-recumbent position, the hair having been closely and neatly removed, an incision having a semi-circular form or that of a V, T, A or X is made down to the bone; this being well scraped, the operator seizes the handle of the trephine with his right hand, and fixing the perforator by its screw, so that it protrudes slightly beyond the teeth, he places the same in the centre of the disc of bone to be removed; the instrument is now worked in a rotary manner, alternately backwards and forwards, until the teeth have cut a groove sufficiently deep to receive them; the perforator is then loosened and slid up in the shaft and fixed, to avoid wounding the membranes; great care should be taken to maintain the instrument in a position perpendicular to the part operated upon, in order to avoid its penetrating more deeply on one side than the other, and thus suddenly and unawares wounding the cerebral membranes. (See rule No. 2 of Malgaigne, previously laid down.) It is important to examine the depth of the groove frequently with a quill, cut in form of a toothpick, to ascertain how nearly the instrument has completed the section of bone; the teeth of the trephine should be cleaned frequently with a small brush or wet sponge, to avoid clogging with bone dust, which impedes easy action of the instrument, and might create unfortunate pressure. The disc of bone should be raised with the elevator, and the edges remaining smoothed with the lenticular knife, usually found at the other end of it.

In fractures with depression there are frequently projecting points of bone which it is desirable to remove; this may be done with the bone nippers (rongeur) or with Hey's saw.

**RESECTIONS OF THE FACE.**

**Resections and Removal of Superior Maxilla.** (Plate I., figures 3 and 4.)—Many surgeons have attempted, more or less, extensive resection of this bone; but the rules for the operation must entirely depend on the disease.
Anatomy.—In attentively examining the face of a skeleton, we see that the superior maxillary bone is attached to the others in but three principal points. First, by its ascending process and articulations with the os unguis and ethmoid; second, by the orbital border of the malar, as far as the sphenoo-maxillary fissure; third, by the articulation of the two maxillary bones and palate bone with each other. There is a fourth point of contact behind, with the pterygoid process and palate bone, which yields easily by simple depression of the maxillary bone into the interior of the mouth. In detaching these different points, no large vessel is injured; the trunk of the internal maxillary artery may be avoided, or in any case easily ligated after the removal of bone. Should unforeseen hemorrhage occur during the operation, we have a resource in compression of the carotid against the transverse process of the seventh cervical vertebra. As for the nerves, only one important trunk need be divided—the superior maxillary, which may be easily cut before the bone is removed.

Operation.—The patient is either seated on a chair of moderate height, or placed in a semi-erect position upon an operating table—his head thrown a little backwards and leaning on the breast of an assistant. According to Gensoul's method, a vertical incision is first made, extending from the inner angle of the eye to the upper lip, which is divided on a level with the canine tooth.

Another incision, dividing the first, is made from nearly the base of the nose and prolonged to within half an inch anterior to the lobe of the ear; a third extends from half an inch outside the external angle of the eye to the point of termination of the second. The result is a quadrilateral flap, which is turned back upon the forehead.

The bone being thus laid bare, begin with a chisel and mallet the section of the external orbital arch near the suture that unites the malar with the external orbital process of the frontal bone; then cut the zygomatic process of the malar. Next attack its upper and internal attachments, apply a chisel below the internal angle of the eye, and cut through the inferior part of the os unguis and the orbital surface of the ethmoid. The ascending process is, in like manner, separated from the corresponding nasal bone; then detach, with a knife, all the soft parts that unite the ala of the nose to the superior maxilla; extract the first incisor tooth of the side operated.
on and slip a chisel between the two bones directly from before backwards, but by the mouth, working it from side to side; lastly, to separate the articulations and adhesions to the pterygoid process, and, above all, to cut the superior maxillary nerve, pass a chisel flatly between the soft parts and floor of the orbit, from above downwards and from before backwards, so as to cut the nerve well back and at the same time to get a good purchase on the bone to depress it into the mouth. It only now remains to divide, with the curved scissors or knife, all the soft parts that still hold the bone, and especially the attachments of the velum palati to the palate bone, so as to leave the soft portion of this velum extended between the pterygoid process and the other side of the mouth.

The cavity resulting from the operation is formed on the inside by the septum nasii; outside, by the cellular tissue, which is found in so great abundance under the buccinator muscle; above, by the depressor oculi and the adipose tissue of the orbit; behind, you see the back of the throat; above, the velum palati. Leave the wound open for a half hour or an hour, employ sutures and adhesive strips and cold-water applications. Union takes place very rapidly, and the restored symmetry soon forms a singular contrast with the hideous chasm immediately resulting from the operation.

Velpeau makes but one incision, which commences at the labial commissure, and, being extended outwards and upwards, terminates at the temporal fossa of the side affected. The operation is reported by some surgeons to be attended with less subsequent deformity and equal celerity of performance.

Another modification is suggested by M. Nelaton. This surgeon, whose success has been eminent and whose skill equals his success, a man thoroughly versed in anatomy and its application to removal of structure with as much preservation of important parts as possible to the patient, prefers the multiple to the simple incision of Velpeau and others. The simple incision begins at the labial commissure and terminates at the union of the malar bone with the zygomatic process or thereabouts, depending entirely upon whether the operator designs the removal of the entire malar bone or not. In this incision, the filaments of the facial and tri-facial nerves are cut. From this may result a facial neuralgia (tri-facial injury), and there always does result a facial paralysis (injury of facial nerve) to a greater or less degree, so that the side operated
upon always contrasts badly with the sound side. The muscles lose their tension; there is ptosis of the inferior palpebra; the side looks dull and dead. Besides this the duct of Steno incised and the cut surfaces not uniting exactly, a salivary fistula may be created.

The multiple incision is made from the root of the nose a little externally to the median line towards the affected side. The flap is dissected upwards, close to the bone, (carrying with it one ala nasi) until a further dissection is prevented by want of room caused by the superior end of the incision being too confined. This is remedied by letting fall another incision (perpendicular or oblique) proceeding from near the inner angle of the eye to the superior end of the first.—Though there results more than one cicatrix in this case, the deformity is not so great as in the others in consequence of less injury being inflicted upon the nerves. The flap having been dissected back to the limits desired, the subsequent steps are the same as in Velpeau's operation. The operation as above described, was performed by M. Nelaton in his amphitheatre at the Clinique de la Faculté in Paris, in 1853; and two years afterwards it required close observation to reveal an ablation of the superior maxilla. In this case the incisor teeth were left by sawing the bone obliquely above them in a line extending from the interspace between the second incisor and the canine teeth upwards towards the septum. The teeth were at first loose, but afterwards became firmly fixed in their sockets. Neither the voice nor articulation was impaired, nor was the patient at all incommoded by food getting into the cavity left after the operation.

In this operation, in order to preserve as much symmetry as possible, it is always desirable to leave that portion of the ascending process of the superior maxilla which extends upwards from a line drawn from the inferior border of the nasal to the same border of the os unguis and terminates in union with the frontal bone. Hence, in giving the anatomy of the bone, this portion was omitted, inasmuch as it should be retained if possible.

Description of Figures.—Figure 4 represents an operation described by Guerin, but answers very well in describing Gensoul's method, as given by Malgaigne. Guerin's first incision (slightly convex) commenced at the ala of the nose, its convexity looking backwards, and terminated at the cor-
responding commissure of the lip following the naso-labial fold or furrow. He then dissected up the two flaps formed by the incision, until the nostril, on the one hand, and the malar process on the other, were well exposed; this process was then divided from above downwards and a little from within outwards, with a small saw held in the right hand. The soft palate was next detached from the posterior border of the palatine bone by a transverse incision departing from the posterior border of the last molar and terminating at the median line of the roof of the mouth. An incisor tooth was then drawn, and the horizontal portion of the maxilla divided from before backwards, with Liston's forceps, the branches being placed one in the mouth, the other in the nose. A final section of bone is now made transversely by the forceps in a line corresponding with the point of insertion of its lower branch and the divided malar bone, (as represented in figure) the bone is then firmly seized and removed.

Figure 3 is noticed out of order because it merely represents the points at which the chain saw is introduced and its lines of action after the instruments described in Guerin's operation have been, to a greater or less degree, employed in Velpeau's modification, of which this figure is a representation.

Syme, Liston and others have their modifications also, but they are not described in this chapter because, for all practical purposes, those already mentioned are deemed sufficient for the military surgeon, who, in many cases, must adapt his own election to the immediate exigencies surrounding him—in other words, must modify for himself.

Resection or Ablation of Both Superior Maxillae.—The remarks upon resection of one superior maxilla already made, if rightly comprehended by means of the text and figures, will readily suggest to the surgeon a proper method for the removal of both.

In Cooper's Surgical Dictionary the operations of Heyfelder and Dieffenbach are described. The patient occupying the same posture as in the foregoing operation, Heyfelder made an incision from the outer angle of each eye to the libial commissure of each side respectively, and closely dissected up all the softer parts to the inner angles of the eyes and the nasal bones. The flap was then turned over the forehead and the orbital margin clearly exposed along its inferior ridge.
By means of a chain saw introduced through the inferior orbital fissure, he separated the maxillae from the malar bones. By a similar procedure, the maxillae were separated from the nasal bones. A bone forceps was next employed to disentangle the upper maxillary from its further bony connections, and the soft palate was then dissected from its union with bone. Pressure from above downwards then being practised, the two maxillae were entirely loosened, and a little further dissection completed the operation. The subsequent dressings were the same as used in a less extensive operation.

Dieffenbach made an incision from the root of the nose through the centre of the upper lip; if required, other incisions extend upwards on either side of the nose to the angles of the eyes; two flaps are thus formed, which are reflected and the bones exposed.

Resections of the Inferior Maxilla.—This bone may be entirely ablated or only resected in part.

Resection of the Body or Central Portion.—The muscular attachments to this portion of the bone on either side of its symphysis are those of the levator menti, depressor labii inferioris, depressor anguli oris, and platysma myoides, all of which are osseo-cutaneous muscles. Besides these, we have other attachments existing between the hyoid bone and inferior maxillary, viz: those of the genio-hyoglossus and the genio-hyoideus on either side. In performing the above operation these attachments must, necessarily, be severed, but the deformity which inexperience might cause to be inferred is practically very slight; in fact, all of these operations, whether for partial or total removal of the lower jaw-bone, are attended with great rapidity of reunion and restoration of symmetry.

Operation.—Figure 5, plate I, represents the method adopted by Dupuytren, and is thus described by Bernard and Huette: The patient is placed in a chair sufficiently elevated to prevent his feet from touching the floor and getting a purchase thereon.* An assistant placed at the back holds the patient's

*This position applies only in those cases in which chloroform is not administered. The semi-recumbent posture is best suited to the employment of anaesthetics. The writer has seen them employed in various instances of removal of the body, or one entire half of the lower jaw-bone, and in no case have they proved detri-
head closely and firmly against the breast, and at the same time makes pressure upon each facial artery at the point where it crosses the lower maxilla. The operator, standing in front, seizes one of the angles of the lower lip with his left hand and an assistant draws the other angle from the bone, thus putting the whole lip on the stretch. A vertical incision is at once made which divides all the soft tissues down to the bone, in a line corresponding with its symphysis, and is then extended as far as the hyoid bone. The two flaps, a b, are next dissected back and the knife kept as close as possible to the bone c. This last having been sufficiently exposed and the points at which it is to be sawn through decided upon, an incision is made through the periosteum and a tooth corresponding with each of these points is extracted. When dividing the bone Dupuytren stood behind the patient and used a small Hey's saw, as represented in the figure. Should the chain-saw be preferred the surgeon's position will be in front of the patient. The bone being divided on both sides an assistant pushes back the tongue with a spatula, to protect it from the knife, and the operator holding the detached piece with his left hand, introduces a probe-pointed bistoury, held perpendicularly, and, keeping as closely as possible to bone-surface, divides all the tissues attached to its concavity. After this division the tongue will sometimes fall backwards and suffocation be threatened. This, however, is easily remedied by holding the head forwards, which position throws the tongue in the same direction and prevents its backward tendency.

If, in consequence of the extent of disease, the first incision does not suffice, make another along the base of the bone joining the first at right angles. When only a small portion of bone is removed, the saw may be used perpendicularly; but when resection of a large piece is demanded, in order to bring the fragments better together, it would be well for the section to be more or less oblique, according to the thickness of the bone structure. In this case begin to trace the groove for the saw by four or five perpendicular strokes, and afterwards incline it so as to have the required obliquity; in all cases a mental. The tongue was grasped with a volcellum or forceps, or retained in proper position by means of a strong ligature passed through its tip.
firm support may be obtained by applying the inferior against
the superior maxilla, at least in the beginning of the section.

Modifications.—If the portion requiring exsection be so
large as to demand removal with it of integument, Dupuytren
recommends two incisions to be made—one on each side of
the raphe of the lip—and meet at an acute angle formed at
the upper border of the hyoid bone, in the shape of the letter
V, so that the cut surfaces when approximated for sutures may
form a line corresponding with the median.

This is termed the ordinary operation to be performed in
such cases as the foregoing, and Gensoul objects to it be-
cause the cicatrix is in the median line. He remarks that
when the bones no longer support the skin of the chin, there
results a line of inodular fibrous tissue extending from the
lip to the hyoid bone, whose tendency is always to retract, to
draw the lip downwards and flatten the new-formed chin.
Hence, Gensoul makes his first incision—as is ordinarily
done—median; having completed his resection, if he finds
that too much integument is left, he removes as much of it
as he deems proper, but from one side only of his mesial in-
cision, so that the resulting cicatrix inclines laterally and
leaves the chin free from the evil results attending, in his
opinion, the ordinary operation. The cicatricial line may
then be said to lie between the second point of section of one
half of the lip and the terminal end of the first, viz: os
hyoides, and the operation be termed the half-V or V-opera-
tion. Malgaigne, not objecting to Gensoul's method, asks if
it may not be proper, in such cases, always to make the first
incision lateral, so that the benefit of such a line of union as
above described, may be secured to the patient whether sub-
sequent removal of integument becomes necessary or not?

The removal of the bone having been completed, the me-
tallic or silk suture may be used—always the latter, should
the hare lip suture be preferred.

Whether the fragments should be brought in contact or
not, must depend upon the amount of bone removed. If the
surgeon, having removed but a moderate portion on each side
of the symphysis, deems it best to approximate the sawn
surfaces, he can do so by either employing a metallic thread
through the bony fragments themselves, or, by using the
same around the teeth corresponding on each side. Mal-
gaigne says that, in general, neither is necessary.
In order to create as little deformity as possible, and leave the dental surfaces of the fragments in their natural relations with those of the superior maxilla, it behooves the surgeon to pay the strictest attention to their proper adjustment. This is best done by using a non-corrosive metallic plate, or one made of vulcanized India-rubber, and adjusting it in such manner to the corresponding teeth of either side so that the interspace caused by removal of bone may be exactly preserved, while adventitious tissue is forming and filling it up. This latter having arrived at a sufficient degree of maturity, substitutes the artificial means employed and which may now be removed.

As a substitute for all the foregoing operations, in which the subsequent cicatrix and its results seem to be the points of difference among authors, it has been proposed to make but one incision along the inferior border of the bone corresponding with the extent of injury, and dissect the two flaps, (one up, the other back), until sufficient room for the chain saw is procured. The remaining portion of the procedure is then accomplished as heretofore described. This leaves a concealed horizontal cicatrix, and adds much to the symmetry of the lip and chin. By many surgeons of high note it is deemed the best mode of operating, and we concur in their belief.

The preceding rules given for removal of the body of the inferior maxilla, or only the central portion of it, are considered sufficiently explicit as to do away with a detailed account of the mode of operating in case one-half of the horizontal portion should require resection. The muscular attachments to be severed, the vessels and nerves to be divided, the deformity resulting, the manual procedure, and the subsequent treatment are, with a few variations, the same as already mentioned, and the operator will readily recognize them.

**RESECTION OF ONE-HALF OF THE LOWER MAXILLA.**—
This operation, as usually described, applies to those cases which are the result of chronic bone disease. In military surgery the necessity requiring surgical interference is, we may say, immediate, in comparison with the length of time during which bony tumors are developed. Hence, the various modifications and operations described by different authors do not need mention here. The operation being demanded by a traumatic injury, must, of course, be adapted
to the cause inflicting the lesion. When practicable, it may
be performed in two ways, viz: by flap or by a single inci-
sion, not involving the labial comissure. As the latter bet-
ter assures symmetry, it is preferred whenever it can be
practised.

Figure 6, plate II. taken from the work of Bernard and
Huette, represents the operation as follows: A horizontal in-
cision is made along the inferior border of the bone extending
from the symphysis to the angle; to the extremities of this
incision two others are let fall vertically, one internal, dividing
the lower lip on the median line, the other external, begin-
ing at the zygomatic arch and passing behind the ramus.
This gives a quadrilateral flap, which is dissected up and
turned inwards. The saw is next applied upon the median
line, the bone divided, and the soft parts detached from its
posterior surface with a bistoury closely grazing it from sym-
physis to angle; reaching the articulation, a probe-pointed
bistoury is inserted behind the coronoid process below the
zygomatic arch, and the tendon of the temporal muscle is di-
vided, while traction upon the bone is made downwards in
order to disengage the condylloid process from the glenoid
cavity. The pterygoid muscle is next detached, and while
drawing the bone firmly towards him, the surgeon severs the
ligamentous connexions. This latter precaution is recom-
mented for the purpose of avoiding the vessels neighboring
the ramus of the bone and the internal maxillary artery.

When circumstances permit, it is always advisable to leave
the coronoid and condylloid processes, and to saw the bone
below its ligamentous attachments, thus avoiding the facial
paralysis resulting necessarily from entire ablation of one-
half.

Explanation of Figure 6, Plate II.—F, b, a, represent the
flap; d, the median line; c, the bone.

Resections of the Superior Extremity.

Resection of the Clavicle, (Figure 7, plate II.)—This
bone may be resected in whole or part. Travers, Davie,
Mott and Syme have published cases of successful result. It
has been operated upon by many others, and with equal suc-
cess; but these operations were demanded in consequence of
chronic disease of bone, and this not appertaining to the pur-
pose of the chapter devoted to immediate resections, or those made necessary by gun-shot injury, renders their description useless, as the mode of procedure must always be modified according to the extent and relations of the part to be removed. The incision may be curved, linear or crucial. Velpeau, in removing the scapular extremity, adopted the last, and describes it as follows: First, make a crucial incision, each limb of which should extend about two inches from the centre; dissect up and turn back the flaps, and keep them well separated; next divide the acromio-clavicular ligaments, and as much of the attachments of the deltoïd and trapezius muscles as may be necessary; then, by means of a wooden lever, introduced into the articulation, raise the bone and detach the healthy tissues; carry the chain saw from below upwards; divide the bone and remove the diseased portion. Velpeau suggests another operation which he deems preferable to the first. It is performed by making an incision parallel with the clavicle, and a few lines below it, which terminates at the acromion process; another and shorter cut is carried backwards from the outer extremity of the first, at right angles, making a triangular flap. The ordinary or chain saw may be used, and the danger of the operation is proportionate to the point at which section is practised. The nearer we approach the middle of the bone, the closer we get to the axillary vessels; hence, the chain saw is more desirable.

The operation for removal of the sternal extremity varies but little from the foregoing, and the following mode of procedure explains the ordinary operation: Make an incision, corresponding with the long axis of the clavicle, two or three inches in extent; divide the ligamentous attachments with a bistoury or narrow bladed knife, taking care to follow well the line of articulation; slip a piece of sole-leather under the bone, and with a small strait saw, or the chain saw, divide it at the point selected. In military surgery, the bone being fractured, a section of the inner extremity of the portion left, if scapular, should be made. If the sternal portion be preserved, then its outer end should be smoothly sawn off. The further attachments must now be severed, and the knife kept closely to the bone on its superior and posterior surface; the sterno-cleido-mastoid and sterno-hyoid muscles are detached from the bone to be removed; a section of some of the fibres of the pectoralis major will be rendered necessary on its ante-
RESECTIONS OF THE SUPERIOR EXTREMIT Y. 273

rior aspect. The important parts thus avoided, and which are
in near relation with the clavicle posteriorly, are the pleura,
internal mammary artery, sub-clavian vessels, and transverse
cervical artery. On the right side the innominata, and on the
left the thoracic duct, merit the surgeon's consideration.
The entire clavicle may be removed. The operation has
been successfully performed, and is thus briefly described:
A curvilinear incision, with an inferior convexity, is made
from one articular extremity to the other; another is made
upwards, extending from the acromion process to the outer
border of the external jugular vein, the platysma myoides
and a portion of the trapezius are cut through; a grooved
sound is passed under the bone near the acromion, and serves
as a guide to conduct the chain saw, which accomplishes the
section externally.

In order to facilitate this operation, it has been recom-
mended by Velpeau and Malgaigne to make three incisions,
giving a quadrilateral flap with a superior base, which being
cautiously dissected, is turned upwards, and the resection con-
tinued as above described.

The preceding methods were suggested by the existence of
a large tumor of long growth, which had altered to a great
degree, the relations of parts, and particularly those of the
articular extremities. In very recent injuries, there being no
enlargement of bone, and no abnormal adhesions contracted,
the military surgeon may proceed to act under more favor-
able circumstances; and in such cases, provided the soft tis-
sues have not been injured or carried away to any consider-
able extent, the operation is very much simplified by making
use of the horizontal linear incision, or some slight modifica-
tion of it.

The after treatment should be, as much as the cause will
admit of, that of fractured clavicle, complicated with external
injury.

RESECTION OF THE SCAPO-LUMERAL ARTICULATION,
(Figures 9, 10, 11, plates II. and III.)—That portion of the
humerus enclosed within the capsule, when disconnected from
the shaft, becomes a foreign body, and, if left within its en-
velope, gives rise to great inflammation, which subsequently
involves all the bones neighboring the joint. Unlike the head
of the femur, when fracture occurs within the coxo-femoral
articulation, that of the humerus has no source of nutrition

12*
through a ligamentum teres, and hence is left to die within its cavity. No chance for ligamentous re-union of fragments existing, the superior one becomes a foreign body, and, if not removed in time, will do such mischief to the surrounding parts as will ultimately demand an operation of more dangerous result.

Articular diseases, requiring surgical interference, are the results of inflammation, chronic affections, or injuries of some kind, whether of recent or remote date, such as fractures or lodgment of foreign bodies. The object which the surgeon hopes to attain is conservation to the patient of a partially useful limb, which the above-mentioned accidents have rendered useless at the joint involved. In many instances, mobility has been restored, and in many also a surgical ankylosis, produced in a line of direction different from that of the accidental ankylosis, has rendered useful a limb which before was an incumbrance. It may be laid down, as a general rule, that restoration of articular motion may be expected in most cases where, after operation, extensor, flexor and ligamentous attachments are, in whole or in part, preserved. In all others, ankylosis must result.

In the operation now under consideration, it would be prudent not to resect below the inferior attachment of the deltoid muscle. Various procedures by which it may be accomplished have been proposed, but they may all be reduced to two principal modes, viz: by a simple and vertical incision or by forming a flap.

The latter method may be performed in several different ways. Moreau preferred making the flap quadrilateral, with its base downwards. Mauné, the same, with base upwards. Sabatier made it triangular, with superior base, and, moreover, he excised it. Morel practised a semi-lunar incision, with base upwards. Syme operated by making, first, a longitudinal incision, of four inches, corresponding with the middle line of the deltoid, and next another, extending from the inferior extremity of the first and passing backwards as far as the posterior border of the axilla. Baudens incised over the anterior border of the deltoid in a vertical line, commencing a little below the coracoid process; at each extremity of this incision he made a transverse cut, dividing the fibres of the deltoid, but not involving the skin; the object being to have a wider opening through which to incise the capsule and
expose the head of the bone. Malgaigne vaunts highly the method proposed by Lisfranc and says it is incontestibly superior to all others. It is the same as that practised by him in amputating at the scapulo-humeral articulation. He terms the operation of Baudens a *multiple operation*, and hence excludes it from the method by *simple incision*.

If any rule can be suggested in regard to a choice between the two methods, it may be briefly stated, that the simple linear incision will suffice when the head of the bone is crushed or comminuted; but, in most cases, where the operation is performed for the removal of diseased bone, the flap method will be found to be preferable. Should the latter be practised, the following description will serve as a guide to the operator: Make a vertical incision from the apex of the acromion, along the middle of the deltoid, to near its insertion, and, from the lower extremity of this incision, make another upwards and backwards, cutting in a semi-lunar direction, towards the posterior border of the axilla; raise up the flap, which will comprehend the external portion of the deltoid; open the joint; detach the muscles which are inserted into the tuberosities; open the bicipital groove and avoid the tendon of the biceps; thrust out the head of bone and carefully employ the saw. It is reported that, in fourteen cases in which this operation was performed, only one proved fatal.

The subsequent treatment should be entire rest, flexure of forearm, and close approximation of arm to thorax by long adhesive strips.

*Explanation.*—Figure 9, plate II. represents the straight or simple incision. Figure 10, plate III. represents the V-shaped incision of Sabatier. Figure 11, plate III. represents the U-shaped incision recommended by Erichsen.

If considered necessary, the glenoid cavity may be removed together with the humeral head, and the same operative procedure be employed. In all cases it should be the surgeon's care to keep the knife as close as possible to the bone in executing the last *manoeuvre*, viz: that of ablation of the cardiac fragment. The distal end (if severance of bone demands the operation) must be neatly sawn through, while due care is paid to the axillary vessels and nerves.

The lower extremity of the humerus may be excised or resected, or a portion of its shaft can be removed. The first is best done by the method for removal of the elbow-joint,
and the second by an external linear incision, care being taken, if the upper portion is removed, to avoid the circumflex artery and nerve, and, if the lower, to cut along the outer border of the brachialis anticus and not involve the external cutaneous nerve.

**Resection and Ablation of the Scapula, (Figure 8, plate II.)—**This figure represents Syme's mode of operating in which he makes an incision from the acromion process to the posterior edge of the scapula, ʃ, ɛ, and another extending downwards from the centre of the first to the inferior angle of the bone, ɛ, Ʌ. Having dissected up the flaps and turned them back he separates the attachments of the deltoid and divides the acromio-clavicular connexions. Should the sub-scapular artery be divided, it must be seized and tied immediately. He next enters the scapulo-humeral articulation and rounds the glenoid cavity, then hooks his finger under the coracoid process and makes traction which facilitates the division of the muscular and ligamentous attachments—and this should be done, he says, with rapid sweeps of the knife.

Other methods have been suggested, as exhibited in the figure, viz: a flap formed by the incisions, ʃ, ɓ, and Ʌ, Ʌ, joined at the extremities by ɓ, Ʌ, and Ʌ, Ʌ. Chassaignac advises a single curved incision.

Janson operated upon the infra-spinous portion of the scapula by making two semi-elliptic incisions. Having turned out his flaps he discovered that the articular portion was not diseased and, by means of a saw, removed the diseased part. The patient recovered with use of the shoulder-joint.

The entire removal of the scapula was performed by Mr. Fergusson in King's College Hospital, in February, 1847. The arm had been previously removed at the shoulder-joint and a portion of the glenoid cavity and adjacent bone had been taken away with it. The patient was reported as doing well a month after the operation.*

**Resections at the Humero-Cubital Articulation, (Figures 12, 13, 14, plate III.)** This articulation may be entirely removed, or only a portion of it be resected. The mode of proceeding will depend upon the character of the wound and the extent of time which the disease may have occupied. If an entire removal be demanded, the humerus, as well as the

* Druitt's Modern Surgery.
ulna and radius, must be involved. The figures 12, 13, 14, plate III. are intended to represent the different ways by which these operations may be performed according to the part or parts involved and the circumstances calling for surgical action. In describing the operation, most surgeons lose sight of the fact that ankylosis may have occurred in such way as to put the arm and forearm in one and the same straight line; hence, flexure at the joint would be impossible before section is practised, and hence the recommendation to "place the patient in a prone position, with the elbow semi-flexed," must depend upon circumstances, and cannot be a rule.

Pirrie advises as follows: "The patient having been placed in the prone position, with the elbow semi-flexed on the edge of a table, and presenting its posterior aspect to the surgeon, the joint is conveniently exposed by a wound in form resembling the letter H; and the performance of the operation is exceedingly easy, if that form of incision be adopted. The parallel portions of the wound may be two inches long, and the transverse portion should extend from the very margin of the outer tuberosity of the humerus along the upper part of the olecranon process to as near the inner tuberosity as may be without endangering the ulna nerve. The two square-shaped flaps having been detached from the subjacent parts, the soft parts behind the condyles deflected laterally without injuring the ulnar nerve, and the bones brought into view, the olecranon process should be cut through with the bone-forceps and the lateral ligaments divided. After which, the humerus can easily be made to protrude, and be sawn off through the tuberosities. The head of the radius and portion of the sigmoid cavity of the ulna left after the division of the olecranon process should be removed by the bone-forceps or saw, and bleeding having been arrested, the edges of the wound should be brought together, and the arm secured in a semi-flexed position. A most useful joint, formed by ligamentous union, is the usual result. I have now performed this operation thirty-five times, and, with one exception, all the patients have done well. I have practised every form of incision, and, although the H incision makes the performance of the operation very easy, I now invariably prefer the single longitudinal incision. By this form of incision the soft parts are left in the best possible state for steadying the cut ends of the bones."
Figure 12, plate III. represents the single straight incision which Chassaignac recommends. It is made on the external and posterior part of the elbow, from a to c, and commencing about three inches above the joint, is carried as low as may be necessary. The head of the radius is exposed, its shaft divided with the chain saw and the upper extremity removed. The extremity of the humerus, b, is now exposed and the chain saw applied at the point selected; the fragment of bone is easily made to protrude and disarticulation is effected. At this juncture, the ulnar nerve must be cautiously avoided. The upper extremity of the ulna is now brought within reach and easily sawn through.

Figure 13, plate III. is a modification of the foregoing and is the straight incision made use of in removal of the extremity of the humerus alone. It is practised on the posterior and external part of the arm to an extent which admits a free exposure of bone. The same precautions apply in this case as in total resection, and due regard must be paid to the brachial artery and ulnar nerve.

Figure 14, plate III. is descriptive of Moreau's quadrilateral flap, with base upwards, and shows the action of the saw upon the humeral extremity, while a slip of wood or metal is carried under it to prevent injury to the soft parts on the anterior aspect of the arm.

Other resecting operations may be performed at or near the humero-cubital articulation, and the preceding descriptions are deemed sufficient as a guide to the military surgeon.

The rules and descriptions which have been given above serve for removal of the entire bone or only a portion of its shaft between the articular surfaces. The only modification worthy of note here is that of adding a transverse incision backwards to each extremity of the longitudinal cut, thus giving more room for action by forming a quadrilateral flap.

Resection and Ablation of the Radius.—As the heading indicates, this bone may be operated upon in whole or some part of its continuity. Its articular surface in relation with the humerus is easily managed by the surgeon, while the inferior or radio-carpal surface is more complicated and justifies a brief mention.

The wrist-joint is enarthrodial. The parts entering into its formation are the lower end of the radius, and under surface of the triangular interarticular fibro-cartilage above; and
the scaphoid, semilunar and cuneiform bones below. The articular surfaces of the radius and interarticular fibro-cartilage form a transversely elliptical concave surface. The radius is subdivided into two parts by a line extending from before backwards; and these, together with the interarticular cartilage form three facets, one for each carpal bone. The three carpal bones are connected together and form a rounded convex surface, which is received into the cavity above mentioned. All the bony surfaces of this articulation are covered with cartilage, and connected together by the ligaments known as external and internal lateral, anterior and posterior, and these are invested with synovial membrane.

It will be perceived from the above description, given by Gray, that the manoeuvring of the knife is more difficult at the carpo-radial than at the humero-radial extremities.

Resection of the Inferior Extremity of the Radius is represented by figure 15, plate IV, and may be thus described: Make a straight incision along the outer and posterior part of the bone (where it is nearest the surface) and parallel with its longitudinal axis. Keeping the knife close to its surface, detach the soft parts and introduce the chain saw. As soon as section is accomplished, the knife should graze the ulnar side of the radius, and the surgeon, grasping in his left hand the part to be detached, disarticulates it while carefully avoiding the artery and preserving the tendons.

Another step in the operation for the same purpose is shown by figure 16, plate IV, where, after denuding the bone and sawing through its shaft, the left hand of the operator seizes the cardiac or proximal extremity of the portion to be removed, while the right, properly using the point of the knife at the articulation, opens it and avoids the artery, a.

Resections and Ablation of the Ulna.—Like the radius, the ulna may be removed entirely or in part. It may be resected at either extremity or any part of its continuity. The superior articular surface of the bone having several inequalities, becomes more difficult of removal than the inferior, and requires more time and caution.

The lower extremity of this bone articulates with the radius externally, an anterior and posterior ligament binds it to the same, while a lateral ligament connects its styloid process with the carpus. The operation for its removal is performed as follows: Place the hand in a supine position and forcibly ab-
duct it—this stretches the lateral ligament; make a longitudinal incision along the internal border of the ulna and a transverse incision over the dorsal part of the articulation, forming a right angle outwards, with the inferior extremity of the first. The triangular flap, thus formed, is carefully dissected up, the bone properly denuded and disarticulated, while an aid cautiously draws aside the tendons, and the operator avoids both them and the vessels and nerves. A spatula or any flat instrument is next carried under the extremity of bone, and final section and removal are readily accomplished by a small straight or chain saw.

In preference to the foregoing, other surgeons prefer the single linear incision, parallel with the longitudinal axis of the bone. Others again prefer making the transverse incision inwards. The figures will explain the lines of incision.

Figure 17, plate IV. represents the ordinary operation by a single longitudinal incision. Figure 18, plate IV. is the modification of figure 17, by making the transverse incision above alluded to: \( a \) is the angle of triangular flap turned outwards; \( b \), the bone; \( c \), the spatula or slip of wood or ivory; and \( d \), the saw acting at the point of section.

**SECTION OF THE UPPER EXTREMITY OF THE ULNA.**

This operation, as well as that for removal of the olecranon, is performed in a manner very similar to the processes above-mentioned, and the surgeon will readily discriminate between the propriety of the flap and the longitudinal incision, avoiding at the same time the nerve and vessels. The operations upon the shaft are usually performed by making a linear incision parallel with the longitudinal axis of the bone, and the cutting edge of the knife is kept in close contact with the bone, in order to preserve as much periosteum as possible and prevent injuring important soft parts.

**SECTION OF THE LOWER ENDS OF BOTH BONES, (Figure 19, plate IV.)**—An incision, of a length suitable to the circumstances demanding the operation, is made along the inner border of the ulna and the outer border of the radius, in the same way as if the lower end of either bone were to be removed; these two incisions are connected on a level with the line of articulation by a transverse dorsal one, and the flap is then dissected up. Due care should then be taken to avoid the tendons, vessels and nerves; the bones are divided with the chain saw, and, while both the anterior and posterior
tendons are carefully displaced, the surgeon manipulates the articulation with the point of the knife, according to rules already given. Some surgeons prefer not to employ the transverse incision, but simply to resect each bone separately, by cutting on either side in a line with the longitudinal axis of the fore-arm.

Figure 19, plate IV. a, b, c, d, represents the outlines of the bones—their articular relations, their direction, the radiocarpal joint and the lines of incision.

A modification of the methods above referred to was suggested by Roux, who made two longitudinal incisions similar to those already mentioned and two transverse, extending backwards from the lower ends of the first to either side of the extensor tendons that partly cover the posterior surface of the articulation. Two V shaped flaps are thus obtained, which are reflected, and the tendons that glide in the bony grooves are carefully respected. He isolated these and then (as a protection) passed a compress, spatula or piece of card between them and the bone, and while an assistant turned the hand outwards, after sawing the ulna, he detached this fragment of bone from its articular connexions. The hand was next turned inwards and the end of the radius managed in a similar way.

This operation, as performed by Roux, was intended to involve the entire wrist-joint; but, as it may stop short of the carpus, it might be of service in the removal of the lower ends of the radius and ulna.

Resection of the entire Carpus, (Figure 20, plate IV.)—Blackburn says, that “excision is advisable in the shoulder and elbow, and that it is inadmissible, except under very peculiar circumstances, in the wrist.” Pirrie says, “I have twice performed the operation of excision of the wrist-joint; once in the Aberdeen Hospital and once in private practice. The result was a serviceable hand, with three of the fingers decidedly bent, in the latter case. In the former case, I made a long and straight incision behind, deflected the tendons to each side and removed the whole of the carpal bones along with the extremity of the radius, and the gratifying result was that the patient had a most serviceable hand and enjoyed the full use of all her fingers.”

Without undertaking to advise the operation or counsel the adoption of either one of the methods proposed, the surgeon
who undertakes it may find a guide to his incisions in the figure above-mentioned.

Figure 20, plate IV. represents the curved incision of Chas-saignac with a downward convexity. Another method is that of parallel incisions; one on the radial, b; another on the ulnar border, c; and these two incisions are joined by one made transversely over the dorsal surface of the carpus. The flaps are then properly dissected and the tendons cared for. The figure, being intended to represent the various operations at the wrist-joint, needs no further explanation than to state that c, g, mark the limits of Butcher's curvilinear incision, in which he divided all the tendons except those of the thumb, and that f and d are the points limiting his incisions in a case demanding removal of all the carpal, with the fourth and fifth metacarpal bones. The flap thus formed is raised from the dorsum of the hand, beginning a little below and outside the second extensor of the thumb, over the junction of the first and second carpal range, and terminating at a point nearly opposite to where the incision commenced. In order to expose the metacarpal bones sufficiently, a straight incision had to be carried along the fourth metacarpal, d, and a flap dissected outwards.

Carpal Resections have been practised upon single bones, and, by some, the entire carpus has been removed. It is a matter of doubt among surgeons whether operations of this character are legitimate. Should an attempt at removal however be determined upon, the performance of it may be facilitated by reference to figure 21, plate V., which is a vertical section through the articulations at the wrist, showing the five synovial membranes. As it is incumbent upon the surgeon to avoid, as much as possible, entering any one of these synovial sacs not involved in disease or wound, this map of the membranous reflexion has been here inserted.*

* Sir Astley Cooper successfully extracted the scaphoid, in a case of luxation of this bone, occasioned by an accident from machinery. He lays it down as a principle, that when, in an analogous case, one or two bones of the carpus are displaced, they must be removed; but if the injury be more extensive, amputation is necessary. Velpeau was obliged, in a similar case, to remove the injured bone with the two metacarpal bones. After having cut their dorsal attachments to the neighboring bones, he passed a spatula into the articular intervals, using it as a lever for separation. In this way,
RESECTIONS OF THE SUPERIOR EXTREMITY. 283

Metacarpal Resections, (Figures 22, 23, 24, 25, plate V.)—The complete or partial excision of these bones is rendered comparatively easy in consequence of the superficial condition of their dorsal aspect and the facility of detecting the tendons coursing over it. These latter, being simply subcutaneous, are readily put aside and as readily avoided by making a lateral incision. If a complete resection be demanded, the carpal bone, with which the metacarpal is articulated, must also be removed. In such cases, the longitudinal incision is made to the extent required, the tendon drawn aside, the bone closely denuded, the saw applied at the proper point and the portion to be removed carefully disarticulated. The carpal bone is then extirpated. Figure 22, plate V. explains the operation.

Resection of an entire metacarpal bone may become necessary, and, according to the one injured, surgeons recommend different lines of incision or that amputation be preferred.

The anatomical relations of the thumb will at once suggest the proper cut to be made when circumstances demand the removal of its metacarpus. The operation was successfully performed by Troceon in 1816, and subsequently by Roux and Blandin. The rule most usually adopted is to make an incision along the radial border (if it be the metacarpus of the thumb or index finger involved) of the bone, passing half an inch beyond each of its two articulations; detach with caution the skin and extensor tendon from its dorsal surface and the muscles from its palmar. Let an assistant hold the edges well apart; then carry the point of the bistoury on the external side of the carpal articulation; divide the tendon of the long abductor, which is attached to the metacarpal bone, and traverse the articulation; then try to luxate the bone outwards, and pass the knife along its internal surface to completely separate it from all adherent soft parts. Lastly, destroy the metacarpo-phalangeal articulation by dividing the internal, external, lateral, and the anterior ligaments. The radial artery may be easily avoided, but, if divided, can be readily ligated. Lint or graduated compresses should be employed from before he got a bistoury well inserted and completed the section of the palmar ligaments. The dissection of the unciform process, under which the artery and nerve pass, requires an increase of precaution lest they be injured.—Malgaigne.
backwards, in order to secure rapid union, and the thumb kept in its natural position. After cure, there is a temporary uselessness of the thumb and also shortening, but, by degrees, it regains almost all its natural movements. In case the first incision does not suffice, add others to its extremities.

Figure 23, plate V. represents the removal of the entire carpus of the middle finger. Figure 24, plate V. is intended to show the method of removal of the metacarpo-phalangeal joint of the same. Figure 25, that of the thumb.

It may not be inappropriate to state, in this connexion, that surgeons of much celebrity counsel against performing such operations as the foregoing, where disease or traumatic injury involves the metacarpus of the index or little finger. It is given as a reason for such advice, that the "probable shortening of these fingers would leave a deformity, perhaps as great as that of amputation, and would doubtless injure the strength of the hand more."

The metacarpal bones of the middle and ring fingers are differently conditioned, and may, therefore, be operated upon to greater advantage. These fingers might be retained in position by their connection with those bordering them on each side and the hand preserve its normal strength. In case of operation an incision should be made along the dorsal surface of the bone to the side of the extensor tendon, which should not be injured on any account, and the disarticulation commenced at the phalangeal joint.

Modifications of operations have been suggested, but it is conceived that the figures already alluded to will serve every purpose the surgeon may stand in need of should the knife and saw or bone-scissors be required.

Resection of the Phalanges.—It frequently becomes necessary to ablate a phalanx, whether disease should have attacked it or an immediate injury require operation. Paronychia is of frequent occurrence in military surgery, and the hand, being very much exposed, is often wounded in one or the other of its parts. A blow is frequently received upon a finger, inflammation supervenes and suppuration occurs. Death of bone ensues and its removal is demanded. It is extremely rare that necrosis or caries takes place, under ordinary circumstances, in paronychia of the first or second phalanx. It rarely fails to be the case when the third or ungual phalanx is involved. M. Velpeau explains this by referring
to the coverings of the first two as compared with those of the last. In the first, we have skin, subcutaneous cellular tissue, tendon, sheath and bone; in the latter, there is scarcely an interruption of tissue, the skin, subcutaneous structure and bone being closely adherent, one to the other, and forming what is known as the pulp. Here, then, an inflammation arising goes on without interference and invades the series of structures thus closely combined. M. Nelaton adopts Velpeau's explanation and thus accounts for the infrequency of necrosis or caries in whitlow, occurring in the first two phalanges and its frequency in the terminal or ungual phalanx.

In paronychia, it not rarely happens that pus, following the course of the tendons, forms sacs either in the hand or on the anterior aspect of the forearm. Once reaching the forearm, it burrows its way between muscle and muscle, and finally produces a very grievous affection to the patient and an embarrassing one to the surgeon. This, however, is not the result of a paronychia indiscriminately located. In order that such purulent infiltration may occur, the primary source of pus must reside in either the thumb or little finger; if occurring in the other fingers, its flow will be arrested on a level with a line drawn across the middle of the palmar surface or a little above it.

If the hand be dissected and the tendinous sheaths of the fingers be inflated, a ridge will be formed by the air distending the synovial membrane; that of the thumb and little finger will extend as far as the annular ligament and follow the tendons of the flexor muscles; whereas, distension of the remaining three sheaths will cease at the line above indicated. This proves that the synovial membrane lining the flexor sheaths of the thumb and little finger extends the length of their tendons and communicates with that of the common flexors of the hand. Pus following this tract will ultimately lodge in the anterior part of the forearm and become sacculated. Hence, dissecting abscesses may result from paronychia of the two fingers alluded to, while that of the other three, should pus gravitate, will be arrested in the palm. If removal of bone is decided upon, a simple median palmar incision will suffice for the last phalanx; a lateral or bilateral incision will answer for removal of the others, and care should be taken to preserve the tendons within their sheaths and to adjust the parts properly after operation. In removal of the ungual pha-
lanx, the nail should be left. The periosteal bed having been preserved to as great an extent as possible, there exudes an adventitious structure, which, after awhile, fills up the space formerly occupied by bone, and, passive motion being exerted, a very useful joint results. There are numerous instances of success in such cases.

Resection of the Ribs.

This operation was performed, according to Malgaigne, by Aymar de Grenoble in the seventeenth century and at a much later period by Richerand. The bone, or that portion of it to be removed, is laid bare by an incision, which may be straight, crucial, curved, or by three incisions, giving a quadrilateral flap. The intercostal muscles, above and below the bone, are next detached by sliding in a grooved sound and cutting down upon it, or carrying the knife along its channel and cutting outwards; the pleura is now separated from the rib by a cautious use of the smooth handle of the scalpel and the bone resected by means of the chain or Hey’s saw.

When the disease has lasted long enough to become chronic, adhesions form between the visceral and parietal reflexions of the membrane, so that introduction of air into the sac is but little to be feared. In some cases, however, the pleura is in a normal state, or its thickening may be of such a character as to require excision of it. Under such latter circumstances, scissors, curved on the cutting surface, should be used; and the suffocating effect of a rapid introduction of air into the thoracic cavity should be relieved by either closing the wound immediately or covering it with a broad compress thoroughly smeared with cerate. The rules for operating in cases of empyema will be of service, in a modified form, when the resection of the rib is performed partially or entirely.

Richerand feared frightful flow of blood from section of the intercostal artery, but, as it is one of very small calibre from the end of the posterior third of the rib, his fear was baseless.

Resections of the Lower Extremity.

Authors differ very much as to the practicability of performing these operations at certain articulations. The joints subject to surgical interference in consequence of long con-
continued disease or recent injury are the coxo-femoral, tibio-
femoral, tibio-tarsal, tarso-metatarsal, metatarso-phalangeal,
and inter-phalangeal. The propriety of resection is commen-
surate with the amount of injury, the length of time it has
occupied, and the general condition of the patient. In recent
gun-shot wounds, which are attended with compound commi-
nuted fracture of joints, the question arising in the mind of
the surgeon is: shall resection or amputation be performed?
The decision must depend upon the character and extent of
wound and its entire condition as regards both the soft and
hard tissues. As a substitute for excision of bone, some sur-
geons have recommended, in cases where joints are involved,
the mere use of mechanical force by which to overcome the
opposing cause. This method is entirely employed in cases
chronic and ankylosed. Yet it is not out of place to give
it some consideration. Ankylosis, as now accepted, means
a stiffened joint, whether bent or straight, though the word
from which it is derived signifies *crooked*. The operations
which it requires are more often performed, according to the
joint involved, upon the straight than the crooked limb; but
the term is significant to every surgeon, and uselessness of
joint in consequence of synovial adhesion, bony fusion, os-
seous deposit in the ligaments, or muscular retraction, accom-
panied with fibrous deposits in the textures external to the
joint, gluing them to each other, all come under the general
head *Ankylosis*.

According to what has preceded, it will be readily inferred
that ankylosis may be complete or partial, and the displace-
ment which it sustains must decide the operation to be per-
formed. In such chronic cases as we now consider the ques-
tion very naturally arises, whether a subcutaneous incision of
tendons should be first practised, the wound allowed to heal,
and force be subsequently employed, or whether force should
be employed without previous division of tendons. This will
depend upon the fact in the case. An author of much cele-
brity has divided ankylosis into true and false, or bony and
fibrous. He says, "generally, when true ankylosis exists,
the sensation, when grasping the limb above and below the
joint, and endeavoring to move one part on the other, is un-
mistakeable; the sensation of solidity, which is communi-
cated under these circumstances, is never felt when the adhe-
sions are fibrous. Yet, as bony ankylosis is the exception,
and fibrous adhesions exist so commonly, as to constitute the rule, the full effect of chloroform should always be obtained before ankylosis is pronounced to be bony. I know no certain test which will enable true and false ankylosis to be at once distinguished, except the peculiar and unmistakable sensation which is communicated by solid bony union. But this is certain, that when the slightest motion exists, union is not bony. And again, when the muscles about a joint are rigid, or the tendons are tense, union is not bony.”* If the adhesions be fibrous, they may be ruptured by forcible extension, and motion be successfully restored. If, together with fibrous adhesions, muscular contractions exist to such an extent as to prevent forcible extension having any effect, then the tendons and fasciae should be divided subcutaneously, and extension be afterwards made use of. The after treatment consists in placing the limb in any easy and properly adjusted splint, keeping it preserved at perfect rest until all inflammation has subsided and pain been removed; after this, passive motion should be employed.

The author, above quoted, furnishes a statistical table of thirty-two cases occurring under the one or the other of his two divisions, as already mentioned—those requiring and those not requiring subcutaneous section previous to using forcible extension. He says, “of thirty-two cases which I have submitted to rupture, the following has been the result: in eleven instances, complete power of motion, or nearly complete power, has been gained; in fourteen, partial but useful motion has been restored; and in seven, the limb has been rendered straight and the joint has remained stiff. Of the eleven first-mentioned cases, eight were of the hip, one of the shoulder, one of the elbow and one of the ankle. Of the fourteen in the second series, five were of the knee, four of the hip, two of the elbow, one of the shoulder and two of the ankle; and of the remaining seven, four were of the knee, one of the hip, one of the ankle and one of the elbow.

If the above treatment should be deemed of no avail, then the surgeon must resort to other measures, and if the object aimed at, in the treatment of certain articular diseases, is to obtain ankylosis, the maintaining of the limb in a serviceable position should be strictly enjoined.

* Bradhurst, (Treatment of Ankylosis.)
Resection of the Coxo-Femoral Articulation, (Figs. 20, 27, 28, plate VI.)—Mr. Guthrie informs us that, in his opinion, the above operation should be invariably practised in cases where the bone, though injured, is entire. He also says that it should always be done in cases of injury, when the bone can be sawn through immediately behind the trochanter major, and sufficient flaps can be preserved to close the wound thus made.

The operation, we are told, "was first performed by Mr. Anthony White, in 1821, with perfect success, although Sir E. Home and the medical officers of St. George's Hospital gave it as their opinion that it would be useless, impracticable and fatal." So many cases of success have been made known, that it may now fairly rank among the established operations of surgery; and, as an argument in its favor, it may be stated, that whether the acetabulum be involved or not, it frequently sets up a process of repair and becomes filled with fibrous tissue as soon as it is relieved of the head of the femur.

Various modes of incising the superjacent soft parts have been suggested and practised, as the figures will show. Malgaigne prefers the simple longitudinal incision, extending from the crest of the ilium to three inches below the trochanter major, in consequence, he says, of the favorable results attending a similar incision when the head of the humerus is excised. Many surgeons, however, are of an opposite opinion in regard to both operations—shoulder and hip—and contend that the straight incision, from above downwards, is followed by the burrowing of pus and the subsequent formation of deep-seated abscesses, giving rise to pyaemia, erysipelas or exhaustion, either of which may result fatally. Should the surgeon prefer this mode, he will make the incision as above indicated, clear away from the bone the soft tissues, apply the chain saw below the trochanter, and grasping, with a proper forceps, the upper fragment, remove the head of bone by entering the capsule and keeping the knife in close contact with its surface, in order to avoid injuring the important vessels and nerves, which an incautious manipulation might involve. After the operation, the limb must be brought into the straight position and kept at rest by means of a long splint, and the case be treated on general principles. If every thing goes on well, the patient will recover with a useful limb, having a
considerable degree of motion at the hip and can walk comfortably with a high-heeled shoe.

The same precautions appertain to the after treatment in all cases, it matters not what the incision—straight, curved or semilunar.

Figure 26, plate VI, represents the last step in the operation, which is performed by making a curved cut, as seen at figure 28. In this latter figure, which serves to show the mode of procedure before the bone has been divided by the saw, the incision has its convexity backwards, and embraces the posterior part of the great trochanter, its limits being the iliac crest and two inches below the process mentioned; the bone, $b$, is next reached, and the chain-saw, $g$, is applied at the point of section and passed under it with the needle, $d$, held in the right hand, $f$; the index finger of the left hand, $e$, is passed under the external side to free the point; after sawing the bone, the lower end of the upper fragment, $a$, figure 26, is grasped with forceps, or a tool, $b$, and disarticulation practised with caution by properly employing the point of the knife, $c$.

Figure 27, plate VI, exhibits the method of operating by making a semilunar flap with an upward convexity. The incision is marked by $a$, $b$, $c$. It surrounds the trochanter, $d$, except on its lower part. The flap is dissected from above downwards, muscular attachments are severed, the capsular ligament freely opened, the femur is carried towards the median line by an aid, who, at the same time, should rotate it inwards, and thus dislodge its head. The ligamentum teres is cut, and a flattened piece of wood, a spatula, or any similar article, being placed between the bone and subjacent soft structures, section is readily accomplished by the chain or other saw.

Various modifications of the foregoing operations have been proposed, and as Malgaigne very properly says: “If you prefer the method with flaps, you may cut a triangular flap on the outside (Rossi), or a semilunar, with the convexity downward, extending from the spine of the ilium to the sciatic tuberosity (Velpeau); or, lastly, any variety of external flap proposed for the coxo-femoral disarticulation.”

The femur may also be resected at any point between its two articular extremities and the rules already given, with
those which follow, in regard to the operations at its inferior jointures, are sufficiently explicit to guide the operator, whether he considers total ablation of a portion of the shaft necessary, or whether his aim be to remove involucra of bone from their casement in new growth, as evidenced by inserting the probe into the cloacae or openings of fistulous character, caused by the long residence of carious bone acting as a foreign body. In the latter case, the removal of a portion of new growth to an extent sufficient to allow the surgeon to extract the dead spicule or portions of bone, will be sufficient; and the wound being well stuffed with lint, will rapidly granulate, and perhaps several small fragments, which were not at first discovered, will come away during the granulating process. The cavity will soon fill up, and continuity and usefulness of the bony shaft be restored. In the former instance the hiatus left between the upper and lower fragments should be a matter of serious consideration, lest false joint result.

**Resections of the Femoro-Tibial Articulation**, (Figs. 29, 30, plate VI. and 31, 32, plate VII.)—The object of this operation is to produce a firm and useful limb, slightly shortened and with entire bony ankylosis, or fibrous union at the situation of the joint. But all cases are not suitable for excision, as, for example, where the quantity of bone to be removed is too great, or where the quality of diseased bone is such as experience has shown to be incompatible with the exudation of healthy material of repair. (Druitt.) Mr. Price, surgeon to the Great Northern Hospital, London, says that if the "white swelling" has begun with disease of the synovial membrane or so-called ulceration of cartilage, the diseased joint-surfaces may be cut off and the case will do well; or if there be scrofulous exudation into the bone-structure and it be in one or more circumscribed masses, bounded by a layer of lymph and healthy bone, these masses, when laid bare by the section of the bone, may be gouged out, as a dentist would deal with a carious tooth, and, if sound bone be left, the patient will do well.

If, however, there should be an infiltration, throughout the cancellous structure, of strumous deposit—if the bone becomes enlarged and softened, and its periosteum thickened and separating from it—excision would be unadvisable, because the whole disease can scarcely be removed, and diseased bone is left, incapable of healthy exudation. Low inflamma-
tion and repeated abscesses will be the certain result, and if
the patient do not die of exhaustion or pyæmia, he must go
through amputation at last.

Since there are no absolute diagnostic marks of the various
forms and degrees of joint-disease, it may happen that a de-
cision can only be made after exposing the articular surface
or removing a portion of bone connected with the joint.

Mr. Butcher, of Dublin, in his "Second Memoir on Excis-
ion of the Knee-Joint," gives the following rule: The patient,
whilst under chloroform, suffers no prolonged shock, and, if
the bones are found extensively diseased, amputation should
be performed at once. This has been done in many cases.
The patient loses nothing by an attempt to save his limb, and
pedantry only, complaining of such as "disturb her ancient
melancholy reign," could object to the proceeding.

The surgeon, governed by the attending circumstances, will
either select for himself or adopt one of the operative proce-
dures represented by the figures above-mentioned. It is not
necessary, in all cases, to subject the entire articular surface
to removal. The extremity of either one of the bones con-
curring to form the joint may be solely involved, and hence
should be alone interfered with. Figure 29, plate VI. is taken
from the work of Bernard and Huette. It represents Syme's
mode of resecting the joint under consideration and is thus
described: The leg flexed at a right angle with the thigh, the
operator makes a curved incision above the patella, with a
superior convexity, extending from one lateral ligament to
the other. The articulation should be entered by this single
cut. Another curved incision is made below the patella, with
an inferior convexity, meeting the two ends of the first. The
patella is thus circumscribed in an elliptical flap and removed.
The lateral and deeper ligaments are next divided with the
point of the knife; the extremities of the femur and tibia are
then turned out successively, after due care has been prac-
tised in removing from them the soft parts, in order not to
injure the popliteal vessels. A flat instrument, b, c, it matters
not what, is passed under each bone at the point of section as
a support to the saw, d, and a protection to structures subja-
cent, which should also be withdrawn by a split bandage or
retractor, e. The exposed end of the femur is shown by a.
Figure 36, plate VI. is intended to show the lines of section
made by different surgeons in cases of ankylosis of various
characters and directions. In making section, when true an-
chylosis exists, it is advisable to unite the bones at a slight
angle anteriorly; the section, therefore, should be nearly in
the lines, h, h, and i, j.

It has been suggested to saw the bones very obliquely when
a portion of the shaft is involved in disease. The femur and
tibia may be resected when disease extends to the anterior
part of the lower portion of the former and the lines of section
are marked by the corresponding horizontal lines, as mapped
off in the skeleton figure just referred to. The lines will be
reversed when the anterior and upper portion of the tibia is
diseased. The parallel lines may be termed the lines of bony
apposition, and, whether one or other operation be performed,
they must accord with each other.

It is a matter of discussion in regard to removal of the pa-
tella. If it is removed, there can be found very good authority
for the propriety of the operation.

Resection of the patella is performed by the crucial
or H incision, taking care to remove the bone, and to pre-
serve, to as great an extent as possible, the tendinous expan-
sion. It is well known that there are cases of congenital
absence of this bone, and not the slightest impairment of the
function of locomotion attending it. This fact alone would
rather invalidate the arguments of those who contend that it
should never be ablated. Too much care cannot be taken to
preserve the longitudinal continuity of the ligament.*

Figure 31, plate VII. illustrates the method of operating,
by making a semilunar flap anteriorly, and shows the man-
ner in which the saw is applied to the part or parts to be
removed.

Figure 32, plate VII. exhibits the first steps in the same
operation. A curved incision is made which sweeps around
the lower end of the patella. It should commence at or near
the point of insertion of the internal lateral ligament into the
inner condyle of the femur, and terminate at a corresponding
point exteriorly. The flap is then dissected up, (figure 32,)

* In the volume of American Transactions, for the year 1851, will
be found the report of a case of congenital absence of both pa-
tellae, presented by Prof. H. F. Campbell. In this case (a grown
negro man) the subject walked, ran, leaped and performed all the
various functions of locomotion without the slightest inconvenience.
the patella removed, and division of the ligaments next prac-
tised. In order to isolate the soft structures, a bandage of
sufficient width should be passed under the end of bone to be
sawn off; and while an aid draws firmly on it, the operator
applies the saw, first to the end of the femur and next to the
head of the tibia—(figure 31.) Due care should be observed
in not wounding the arteries coursing around the joint, by
making the incision lower than as above recommended.

Modifications of the preceding methods have been pro-
posed. Some surgeons recommend that the flap be carried
below the tuberosity of the tibia, where the quadriceps ex-
tensor has its insertion.

If immediate interference be required for partial or entire
removal of either bone of the leg, the foregoing remarks and
quotations, with reference to the plates and figures, will pro-
ably be of some service to the surgeon who may possess this
manual. We are informed that each bone has been removed
in totality and the result been one of perfect success. As the
superior extremity of the tibia and fibula has each been con-
sidered in the operation termed resection of the knee-joint or
femoro-tibial articulation, it would be useless to mention the
steps to be taken in removing the upper end of either bone,
except to say that the head of the fibula has a synovial re-
flexion independent of the general capsule of the joint, and
hence may be removed without involving the latter. Some
authors are of a different opinion.

Resections of the Tibio-Tarsal Articulation, (Fig-
ures 33, 34, 35, plate VII. and figures 36, 37, plate VIII.)—
The knee-joint having been disposed of, and a brief allusion
made to the resecting of the superior articular extremities or
portions of the bony shaft of either the tibia or fibula, another
case occurs wherein disease of long growth or immediate in-
jury may involve the ankle-joint or its close neighborhood,
while the rest of the foot may be entirely healthy. The as-
tragulus has been excised; the astragalus and os calcis have
been successfully removed; the astragalus, os calcis, and cu-
boid bone have been removed with equal success; and the
only question which the surgeon has to decide for himself is
the one of resection or amputation. If the former be pre-
ferred, a reference to the history of the case must not be over-
looked, nor a careless examination of shattered bone be visited
upon the operator.
Surgeon Henry Hancock, of Charing Cross Hospital, London, says: "This operation was first performed by Moreau, and subsequently by Jüger and others abroad; but, I believe, I am justified in stating that, with the exception of those I have done myself, there is not a single instance upon record in which excision of the ankle-joint has been performed in this country for disease."

The success of the operation depends, in a great measure, upon leaving the anterior and posterior tibial arteries intact, and on no account to open the sheaths of the tendons.

Commence the incision about two inches above and behind the external malleolus, and carry it across the instep to about two inches above and behind the internal malleolus. Take care that this incision merely divides the skin and does not penetrate beyond the fascia. Reflect the flap so made and next cut down upon the external malleolus, carrying the knife close to the bone, both behind and below the process. Dislodge the peronei tendons and sever the external lateral ligamentous attachments. This accomplished, cut through the fibula with the bone nippers, about an inch above its lower end, and remove the fragment, after dividing the inferior tibio-fibular ligament. Dissect carefully, the tendons of the tibialis posticus and flexor communis digitorum, from behind the internal malleolus, and expose the joint. Carry the knife close around this latter process and detach the internal lateral ligament. The lower end of the tibia being now turned outwards, the diseased portion is sawn off, and afterwards, with a small metacarpal saw, placed back of the astragalus and between it and the tendo-Achillis, remove the former by cutting from behind forwards. Replace the parts in situ, close the wound on the inner side and front of the ankle, and leave a free exit for discharge on the outer side; the last step is to place the limb on a splint applied externally, and fenestrated or bored, so as to allow the escape of pus. Water dressings are best adapted to such operations. Four cases of entire success, by the foregoing method, are reported by an English surgeon, and he says his patients could "walk, run and jump without any inconvenience."

The figures referred to will guide the operator, whether entire or partial resection be required, and the foregoing description of the manner in which the whole articular surface may be removed does away with the necessity for describing mi-
nutely the partial operations at this joint. Preservation of
the tendons and arteries should, however, be always kept in
mind.

In 1858, the writer of this chapter assisted Professor A. E. Petricolas in an operation which he deemed advisable to be
performed upon the ankle-joint, but one in which only the os
calcis was involved. The cause was caries of this bone, but
the mode of extirpating it and the result are worthy of notice.
The whole heel was enlarged and distorted. The foot had
been poulticed and frequently lanced. Pieces of bone had
been removed. Treatment availed but little. The patient
became a confirmed cripple and his general health was failing.
It was determined to extirpate the os calcis. Two incisions
were made through the integument—one vertical, the other
horizontal—the latter, reaching from the outer side of the
articulation with the cuboid, encircled the posterior end of
the calcaneum, and stopped an inch behind the same joint on
the inside of the foot. The former descended vertically, from
a point an inch and a half above the lower attachment of the
tendo-Achillis, to the latter. This tendon was severed and
the outer surface of the os calcis exposed. The tendons of
the two peronei were liberated and turned forwards, and the
middle fasciculus of the external lateral ligament was cut.
The posterior calcaneo-astragaloid articulation was entered,
the strong inter-osseous ligament divided, and the anterior joint
of the same name penetrated. The calcaneum was next freed
from its connections with the cuboid and the short extensor
muscle, and its under surface exposed. Lastly, the bone was
separated from its attachments to the internal malleolus and
scaphoid, and removed. No ligatures were required, and ves-
sels, nerves and tendons were all avoided. The three flaps
resulting were brought together and secured by suture and
adhesive plaster. Cold-water dressings were employed, and
sixty days after the operation, the patient was walking about
with a single crutch. He subsequently recovered complete
use of his foot, and none but those who attended the operation
would have imagined that the calcaneum had been ablated.

Figures 36 and 37, plate VIII. are illustrative—one, of
the partial resection of the os calcis—the other, of the inter-
articular tarsal surfaces and tarso-metatarsal line of joint.
The case of removal of the entire calcaneum above reported,
together with the figure 38, which represents Chassaignac's
curvilinear incision, whether made on the internal or external aspect of the bone, serves to show the result of operation, the importance of abstaining from total removal of foot, and the benefit which conservative surgery may yield the patient.

The same precautions in these operations upon the lower extremity should be observed as in those of the carpal and metacarpal joints, and a repetition of the rules, in regard to avoiding tendons, nerves, vessels and sheaths, is useless.

Figures 38 and 39 are descriptive of operations intended for removal of entire metatarsal bones. The resection of the first and fifth is accomplished by first making a curved incision with a downward convexity—\( a, b, c \), figure 38—and extending it beyond the articulation of both extremities. The middle of the shaft is sawn through, after the soft parts have been carefully detached, and each fragment properly removed. The after-treatment is easily conducted by means of lint and cold-water dressings.

The phalanges of the foot are removable like those of the hand, and, as a general rule, should be attacked upon the plantar surface, if the last be involved, and the dorsal aspect, should either one of the others need excision.