

position, with the part to be amputated projecting over the edge of the operating table, the point of the knife is introduced just beneath the point of the acromion process, and carried down over the external surface for a distance of from two and one-half to four inches, according to the dimensions of the part. This incision should divide all the tissues down to the bone. From the centre of this incision an oval cut is carried around the arm, passing a little below the axillary folds, but involving only the skin and superficial fascia. The flaps thus outlined are carefully liberated from the bone. The capsule is then freely opened by a transverse cut over the head of the humerus, and the arm is rotated inward and outward to facilitate the division of the tendons of the articular muscles; in this part of the operation, the edge of the knife must be kept in close contact with the bone. The operation is completed by dividing the soft parts on the internal surface of the arm on a level with the cutaneous incision already made. While it is not essential, in this operation, to carry the oval incision completely around the arm before beginning the dissection of the flaps, it is preferable, since, without it, the lower part of the oval wound is very apt to be ragged and uneven. The wound following this operation is united so as to leave a linear cicatrix parallel to the axis of the body (Fig. 154, from a photograph of one of Ashhurst's patients).



FIG. 154.

In cases in which the humerus is shattered to such a degree that it cannot easily be used in the manipulations necessary for effecting disarticulation, the following modification of the circular incision will answer admirably: The arm being abducted, a circular incision at the lower border of, or through, the deltoid divides all the soft parts down to the bone. This, if necessary, is divided on the same level, and all the gaping vessels are ligated. When the amputation of the arm is thus completed, a long incision, dividing all the soft parts, is made from the tip of the acromion over the external surface of the shoulder to the circular wound. The remaining stump of the humerus is then seized with a strong pair of forceps, and liberated from its muscular attachments and from the joint by short incisions directed well against the bone (Esmarch).

Amputations at the shoulder by the flap method can be made either by transfixion or by cutting from without inward. The latter method, while less brilliant, is preferable in every way. It should be performed in the following manner: In amputation of the left arm the operator begins his incision at the coracoid process, and carries it down over the anterior surface of the shoulder to the level of the insertion of the deltoid, across which it is carried in a wide curve; it is then prolonged upward on the posterior surface of the shoulder to the junction of the acromion with the spine of the scapula (Fig. 155). This broad flap, including a great part of the deltoid, is then raised by rapid strokes of the knife and reflected over the acromion in order that the joint may be exposed. This is made prominent by pushing the head of the humerus upward, and is to be opened by a transverse cut upon the latter. The head of the bone is now easily dislocated. The knife is then carried behind the humerus (as shown in Fig. 153) and down its inner surface to a point one or two inches below the axillary fold, when,

by rapidly cutting outward, all the soft parts on the inner side are divided.

In making this operation by transfixion (Dupuytren's method) the arm must be held at a right angle with the body, while the surgeon grasps and raises the fleshy part of the shoulder with the left hand. The knife is entered one or two inches behind the acromion and pushed directly across the front of the joint, emerging just outside the coracoid process of the scapula. Transfixion being effected, a broad flap is cut from within outward. The further steps of the operation are similar to those above detailed.

Both of the operations described leave a wound that, from its position, is more readily drained than that which is left by the oval method. The cicatrix which remains is transverse in direction and curvilinear.

A wound closely resembling that left by Larrey's oval operation remains after the formation of postero-external and antero-internal flaps by Lisfranc's method. In practising this method, when the left arm is to be removed, a long and narrow amputating knife is introduced at the margin of the posterior axillary fold. The blade is then pushed along the posterior surface of the humerus until the head of the bone has been cleared, when the counter-puncture can readily be made an inch beneath the clavicle and on the outer side of the coracoid process. A broad postero-external flap must then be shaped by cutting from within outward. The capsule is then opened as in other operations, and an antero-internal flap cut likewise from within outward. In operations on the right side the posterior flap is also made first; the surgeon, standing behind the patient, inserts the point of the knife from above and lets it emerge from the posterior axillary fold.

Professor Spence, of Edinburgh, has recently introduced a method of amputating which is but a modification of the oval operation, in which the perpendicular incision is made upon the head of the humerus, nearer to its inner than its outer surface. This incision is commenced just beneath and outside of the coracoid process and carried through the clavicular fibres of the pectoralis major and deltoid muscles until the humeral attachment of the former is reached. From the lower end of this incision the external and internal curvilinear incisions are almost the same as those of the oval operation as generally practised. The advantages claimed by Professor Spence for this modification are the facility with which the disarticulation can be effected, the avoidance of injury to the main trunk of the posterior circumflex artery, and the better shape of the stump.

INTERSCAPULO-THORACIC AMPUTATION.—In the first edition of this work 14 cases of avulsion of the entire upper extremity were referred to, which ended favorably. In the last edition of Ashhurst's "Surgery," 17 cases are recorded of such avulsion which ended favorably. Here also are recorded 89 cases, in which the entire upper extremity including the scapula and part of the clavicles was removed by operation, with 67 recoveries and 22 deaths. Bergmann has put on record 14 amputations of the entire upper extremity, with only 1 death. Favorable cases have likewise been recorded by Chavasse, Ochsner, Keen, Doll, and Heddaens. Barling has recently collected 19 cases operated on within five years without a death (*Clin. Soc. Trans.*, xxxi., p. 182). The operation is indicated in cases of severe crush of the upper extrem-

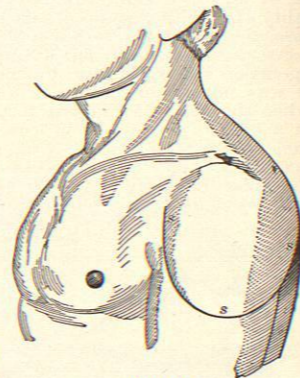


FIG. 155.

ity when exarticulation at the shoulder would not suffice, and in neoplasms of the upper extremity when it is essential to get as far as possible from the disease. The first operation was done by Cumming, in 1808, for gunshot injury; the second, in 1830, by Gaetani for a severe trauma from an explosion. In 1887 Paul Berger tabulated all of the cases recorded up to that time, and submitted the most comprehensive monograph upon the subject.

As in amputations at the shoulder joint, the control of hemorrhage is the essential point of the operation. It is now the consensus of opinion that the first step of the operation should be the resection of the middle third of the clavicle as a preliminary step to the tying of the subclavian artery and vein. It is essential to tie the latter as well as the artery, in order to prevent the ingress of air. According to the publication by Nasse of Berg-

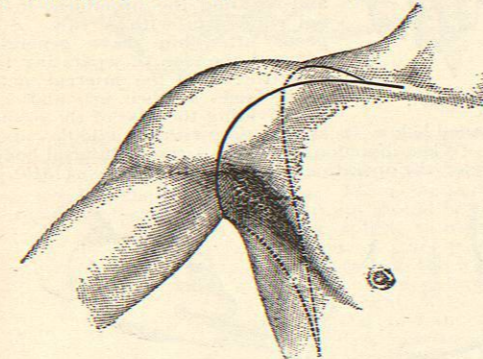


FIG. 156.—Interscapulo-Thoracic Amputation. (After Treves.)

mann's cases, the Berlin surgeon begins his operation with the typical ligation of the subclavian artery to the outer side of the anterior scalenus muscle. This is followed by division of the clavicle. The arm is then elevated and the subclavian vein tied. The brachial plexus is at once divided. Ochsner has called attention to the fact that this plexus ought to be divided with a sharp knife rather than with scissors, since the shock is thereby greatly lessened. The cutaneous incision must vary somewhat according to the degree to which the soft parts about the shoulder are involved. Bergmann makes an anterior incision, through the skin only, from the incision made for the division of the clavicle straight through the axilla to the lower angle of the scapula. The posterior incision is made over the dorsal aspect of the scapula from the resection line of the clavicle to the end of the anterior incision. The illustration will indicate the lines of incisions recommended by Treves.\* That for the antero-inferior flap extends outward from the incision made for the division of the clavicle to the outer and lower border of the axilla, which it crosses directly from before backward, whence it passes downward to the lower tip of the scapula posteriorly. The posterior incision extends across the upper surface of the shoulder, from which it inclines over the scapula to its lower angle, as seen in the illustration. After the lifting of the cutaneous flaps, the muscles are divided and the small vessels tied as they are encountered. In one of Kern's cases, owing to the involvement of the parts about the acromion, an oval incision was made beginning three inches above the acromion, each limb passing in front of and behind the shoulder respectively, and meeting in front of the inferior angle of the scapula. In the cases of recovery, the wounds heal within the course of ten days or two weeks. In operations for malignant disease, the prognosis is far more favorable when it is done for myeloid sarcoma than for periosteal sarcoma. The prognosis

\* Treves: "Operative Surg.," vol. 1., Fig. 98.

is more favorable in those cases in which the soft parts about the shoulder are not involved. Thus in all the cases of Heddaens recurrence rapidly took place.

AMPUTATION OF THE TOES.—It is occasionally necessary to remove the toes in consequence of accident, disease, or deformity. While in cases of accident, it may occasionally be well to save a part of one of the smaller phalanges, it is generally best that the amputation be made at the metatarso-phalangeal joint. In amputations of the phalanges, a flap operation, like that for the fingers, must be made, care being taken, as in all amputations of the foot, that the cicatrix is placed on the dorsal aspect of the stump. In amputations of an entire toe, the incision should be commenced on the dorsal surface of the metatarsal bone, a little above the joint, but considerably above the web, and carried directly down an inch or more. It is then carried obliquely around the web on each side, in such a manner as to preserve as much of the soft parts as possible. This preservation of tissue is necessary for a sufficient covering for the large head of the metatarsal bone. When the operation is performed in this manner, the cicatrix is linear and entirely removed from pressure. No part of the metatarsal bone should be removed, lest the strength of the foot be deteriorated. Disarticulation of the great toe may be effected by the oval method just described, or by the formation of an internal flap. In the latter case, an incision is begun on the outer side of the extensor tendon, just below the joint, and carried longitudinally to the head of the first phalanx. From its lower end an incision is carried transversely around the inner side, to the flexor tendon, along the outer side of which it is continued backward to the plantar fold, whence it is again given a transverse direction around the outer side of the toe until it meets the first incision near its centre (Stimson). The rectangular flap thus marked out is dissected up, the tendons are divided, and disarticulation is effected. Although it is sometimes recommended, the head of the first metatarsal bone should never be removed unless it is implicated in the lesion, since it forms one of the most important points of support in the foot.

Amputation of all the toes at the metatarso-phalangeal joints may be made by carrying a curved incision along the groove between the base of the toes and sole of the foot from one margin of the latter to the other. The toes being forcibly flexed, a similar incision is made along the dorsum, which joins the ends of the plantar wound. The semilunar flaps thus formed are dissected back as far as the metatarso-phalangeal joints, when disarticulation of the individual toes can be made. It certainly cannot be often that a formal operation of this nature is called into requisition.

AMPUTATION THROUGH THE METATARSUS.—In consequence of injury or disease it not unfrequently becomes necessary to remove a part or all of the metatarsal bones. In amputations through individual bones of the metatarsus, conservatism must be particularly insisted upon, except in that of the great toe, the complete removal of a metatarsal bone cannot be accomplished without opening the large synovial sac which separates it from the first row of the tarsus. For amputations through the second, third, and fourth metatarsal bones, the longitudinal incision necessary for disarticulation at the metatarso-phalangeal joint must be carried upward for a distance varying according to the extent of bone to be removed. A short transverse incision is then made to facilitate the separation of the soft parts and the use of either chain-saw or bone-cutting forceps. When the bone has been divided, its distal end is drawn from the wound with a pair of stout forceps, and the operation is completed by severing the soft parts on the plantar surface of the foot with short strokes of the scalpel. The removal of the first and fifth metatarsal bones can be accomplished by the oval method or by internal and external flaps respectively. The oval method, where it is practicable, is doubtless preferable, since it yields a smaller wound and a cicatrix protected from pressure. The incisions for the oval amputation of the great toe with its meta-

tarsal bone are well shown in Fig. 157. On account of the great width of the base of the latter bone, a short

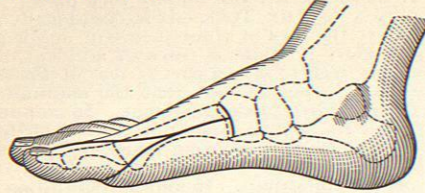


FIG. 157.

transverse incision facilitates the liberation of the flaps. In disarticulations of the fifth metatarsal bone the oblique line of its articulation with the cuboid bone should be borne in mind. When the first or fifth metatarsal bone is amputated in its continuity, the section should be made obliquely to avoid undue prominence of the stump.

Amputation in the continuity of all the metatarsal bones is not very infrequently called for, in consequence of injury or gangrene following frost-bite.

When it can be resorted to, it is preferable to amputation through the tarso-metatarsal articulation. The operation is commenced with a curved incision carried along the anterior furrow of the sole of the foot, from border to border, and the semilunar flap thus outlined is

reflected to the line where section of the bones is to be made. A smaller semilunar flap is then shaped from the dorsal surface of the foot. The interosseous soft parts are then divided transversely with a narrow knife, and retracted by means of narrow strips of linen, when the bones are sufficiently exposed for the application of the saw (Fig. 158). The appearance of the wound resulting from this operation is well shown in Fig. 159.

In this age of conservatism in surgery, in which "the least sacrifice of parts" is the leading tenet of surgical creed and practice, every half-inch of the foot that can be saved to the economy is properly considered of incalculable value. It is for this reason that, whereas before the times of Hey, Cho-

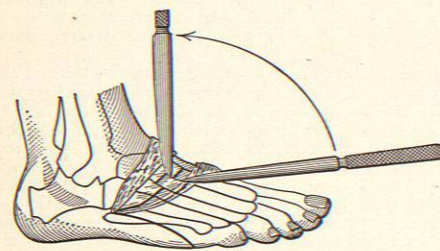


FIG. 158.

part, and Lisfranc, amputations of the foot above the ankle were made comparatively often, they have of late

been largely replaced by partial amputations through the different articulations which it contains. The partial amputations which will be considered are the tarso-metatarsal, the medio-tarsal, the subastragaloid, and their modifications.

**TARSO-METATARSAL AMPUTATION.**—A glance at Fig. 161 shows the difficulty which the surgeon must contend with in this amputation of the foot. It is the firm impaction of the base of the second metatarsal bone between the internal and external cuneiform bones. In 1797, Mr. Hey, of Leeds, overcame this difficulty by disarticulating the outer metatarsal bones, and dividing the prominent internal cuneiform with a saw. Surgeons after him have generally adopted the plan of separating the outer three and the internal metatarsal bones at their articulations, and dividing the base of the second

metatarsal below its articulation with the middle cuneiform. When disarticulation of all the metatarsal bones is effected the operation is known at Lisfranc's (1815).

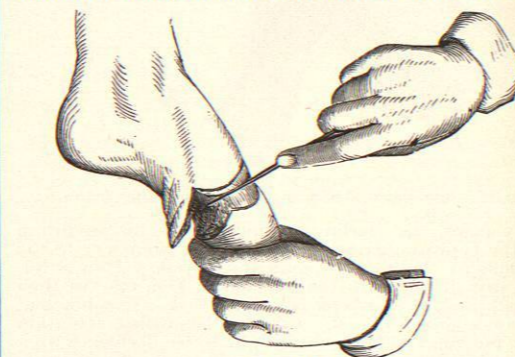


FIG. 161.

**Lisfranc's amputation** of the foot is made as follows: The joint between the cuboid and prominent base of the fifth metatarsal bone having been marked on the outer

side of the foot, and that between the first metatarsal and internal cuneiform (about one inch and a half below the tuberosity of the scaphoid) on the inner side, a large semilunar incision is made between them on the sole of the foot, the convexity of which should pass over the heads of the metatarsal bones. The plantar flap thus outlined may then be dissected up to its base. The foot being then forcibly extended, a slightly convex dorsal incision is carried between the ends of the plantar flap (Fig. 161). The flaps being retracted and the foot forcibly extended, the operator opens the joint from the outer or inner side, according to whether the right or the left foot be the seat of the operation (Fig. 162). The articulation of the second metatarsal bone (Fig. 161), which is less than half an inch above the general level of the joints, must then be opened by a transverse cut, the lateral attachments of the bone to the cuneiform being severed with the point of the knife

with it. It has since been known as "Chopart's amputation," and the joint between the rows of the tarsus is not infrequently designated by his name. Although it was opposed by Larrey, who preferred to amputate in the lower part of the leg, the operation was popularized

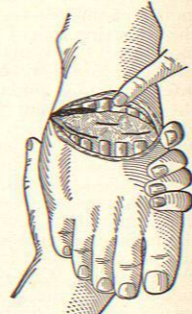


FIG. 162.

by longitudinal incisions (Fig. 160). When all the joints are widely opened by this process, the remaining ligaments at the side and sole of the foot, and the soft parts still undivided, are severed. As the operation is generally performed, the plantar flap is merely outlined by an incision through the skin in the first step of the operation, the

flap being cut from within outward after disarticulation has been effected. The vessels usually requiring ligation are the dorsal artery of the great toe, the metatarsal branches, and the plantar arteries. When the parts are brought together by suture, the stump should be placed in a posterior splint, to overcome the contraction of the powerful muscles of the calf of the leg. In Hey's amputation, the external incisions are identical with those necessary for the Lisfranc operation. The cicatrix resulting from either of these procedures is far removed from pressure, and the stump, on account of its length, is one admirably fitted for use.

**MEDIO-TARSAL AMPUTATION.**—Although Garengot and Heister mentioned the practicability of amputation between the rows of the tarsal bones, the operation was first performed by Du Vivier, of Rochefort, in 1781. In 1791 Chopart repeated the operation a number of times, and published his experience

with it. It has since been known as "Chopart's amputation," and the joint between the rows of the tarsus is not infrequently designated by his name. Although it was opposed by Larrey, who preferred to amputate in the lower part of the leg, the operation was popularized

hyperextension. This may assume such a degree that the cicatrix itself will be pressed upon in locomotion. This objection to the operation is best overcome by bandaging the leg from above downward, and keeping the limb flexed. In extreme cases the difficulty is easily remedied by division of the tendo Achillis, and forced flexion of the stump.

**SUBASTRAGALOID AMPUTATION.**—Although, according to Velpeau, this operation was made by De Lignerolles and by Textor, it was first given prominence by Malgaigne, in 1846. In this amputation all the bones of the foot, except the astragalus, are removed. The operation is commenced by an incision, which, beginning behind and immediately above the great tuberosity of the os calcis, at once divides the tendo Achillis. The incision is then carried in a wide curve on the outer surface of the os calcis below the external malleolus (Fig. 166, Malgaigne). Thence it is continued over the middle of the cuboid and anterior margin of the scaphoid, across the dorsum of the foot (Fig. 167), and over its internal border to the centre of the sole (Figs. 168 and 169). From this point the incision is turned at a right angle and continued directly back till it meets the beginning of the incision at the inner border of the tendo Achillis (Esmarch). The short internal and long interno-plantar flaps thus formed are dissected up until the lateral surfaces of the os calcis are exposed, when disarticulation of the anterior part of the foot is effected in the medio-tarsal joint. The

small dorsal cutaneous flap thus outlined

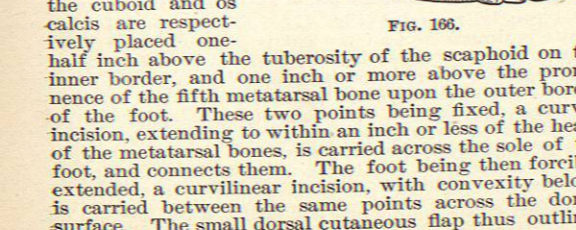


FIG. 160.

is retracted, and by one stroke of the knife the tendons are divided and the joint widely opened. The point of the knife then divides the lateral and plantar ligaments, which are put on the stretch by forcible extension until the articular surfaces of the scaphoid and cuboid bones are completely liberated. By inserting the knife behind these bones, the plantar flap is completed by cutting from within outward (Fig. 164). The vessels requiring ligation are the dorsal and two plantar arteries, and occasionally a few muscular twigs. The appearance of the stump after the completion of Chopart's amputation is well shown in Fig. 165, from Esmarch.

The only difficulty at times encountered in this operation is in the opening of the joint in front of instead of behind the scaphoid bone. The error is readily recognized through the presence of three articular facets on the anterior surface of the scaphoid bone, and can easily be corrected if it is desired, or the operation may be completed by dividing the cuboid bone with a saw on a line with the anterior surface of the scaphoid. In this manner the operator would be practising Forbes' modification of the medio-tarsal amputation, a modification also mentioned by Mr. Hancock and Professor Agnew.

After Chopart's amputation, the gastrocnemius and soleus having exclusive control of the stump, there is a marked tendency toward its

hyperextension. This may assume such a degree that the cicatrix itself will be pressed upon in locomotion. This objection to the operation is best overcome by bandaging the leg from above downward, and keeping the limb flexed. In extreme cases the difficulty is easily remedied by division of the tendo Achillis, and forced flexion of the stump.

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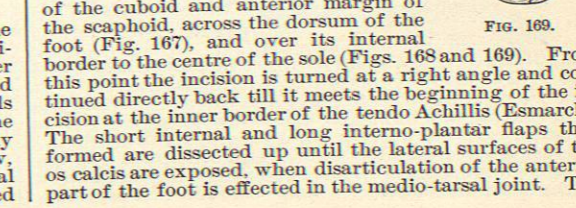


FIG. 164.

anterior end of the os calcis being then seized with a lion-jawed forceps, and rotated from side to side, the operation is completed by dividing the external lateral and interosseous ligaments. The appearance of the stump after this operation is shown in Fig. 170 (Esmarch). The marked irregularities of the inferior surface of the astragalus do not interfere with its usefulness in locomotion. In a case of gangrene in a deformed limb, Linhart performed the subastragaloid amputation, and was enabled two years later to examine the stump. The astragalus, which had maintained a perpendicular position before, and even at the time of amputation, had been forced into its normal horizontal position by the act of walking.

A number of modifications of the subastragaloid amputations, both in the direction of the incisions and in the preservation of parts of the os calcis, have been devised. In the operation of Mr. Hancock, a large plantar flap is reflected as far back as the tuberosities of the calcaneum, and a short dorsal flap is formed by a transverse incision across the foot on a level with the anterior margin of the astragalus. By the use of a saw, the plantar flap being retracted, a perpendicular section of the os calcis is then made in front of the tuberosities. Disarticulation of the foot, with the anterior portion of the os calcis, in the medio-tarsal joint is next effected, and the operation completed by making a transverse section of the astragalus. When the flaps are approximated the divided surfaces of the latter bone and os calcis are brought into apposition. The operation of Mr. Hancock, although as ingenious as that of Pirogoff, is much more difficult of execution, and time will probably show that the results obtained from it are far less valuable. In Tripiet's operation the incision is made in the form of an oval, the apex of which is on the outer side of the foot, just beneath the external malleolus, while the sides pass forward and inward over the back and sole of the foot, and meet at its inner border. After disarticulation in the medio-tarsal joint, a transverse section of the os calcis completes the operation.

Partial amputations of the foot, at least in civil practice, are not attended with great mortality. Of 152 cases of Chopart's amputation examined by Hancock, only 11 terminated fatally, 7 per cent; the fatality following this operation in France has been much greater, 14 out of 38 cases recorded by Larger (36.8 per cent.) having died (Ashhurst). Of 22 cases of the subastragaloid amputation, 20 recovered.

Of 123 partial amputations of the foot, made during the late rebellion, in which the result was determined, 18 were unsuccessful, the mortality being 15 per cent. Of these partial amputations there were 83 of the medio-tarsals, with 11 deaths; 23 Lisfranc operations with 1 death, and 17 Hey's amputations with 6 deaths. Of 16 amputations of the foot at the Cincinnati Hospital, 1 died. The mortality according to Erdman's tables is 7.8 per cent. According to Page's tables the mortality is 3.8 per cent. for traumatic and 1.6 per cent. for pathological cases. In making a partial amputation, it must be remembered that the value of the stump for locomotion is proportionate to the length of foot maintained. Manufacturers of artificial limbs maintain that conserva-

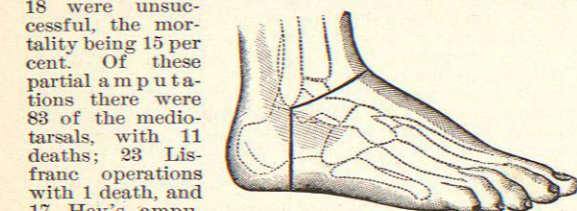


FIG. 170.

tism is out of place here, and that amputation several inches above the ankle should be given preference over partial amputations in front of or at the ankle.

AMPUTATION AT THE ANKLE.—Historically associated with this operation is the name of Syme, of Edinburgh, who, in 1842, devised and practised a method by which a shapely and useful stump could be obtained after removal of the entire foot. Disarticulation at the ankle had been performed during the last and early part of this century. It was performed by Sédillier, Rossi, and Baudens, and recommended by Brasdor and Sabatier. But the circular operation of the latter and the dorsal flap method of Baudens yielded alike unsatisfactory results, and the operation was, therefore, discarded for amputation in the lower part of the leg. Lateral flaps taken from below the malleoli, as suggested by Velpeau, also failed to form a sufficient cushion for the end of the tibia. This great desideratum in amputation at the ankle is squarely met by the operation of Syme, since its principal feature is the retention of the integument of the heel, which is accustomed to pressure, to form the end of the stump. The operation is made in the following manner: The foot being held at a right angle to the body, the malleoli are fixed by the thumb and fingers of

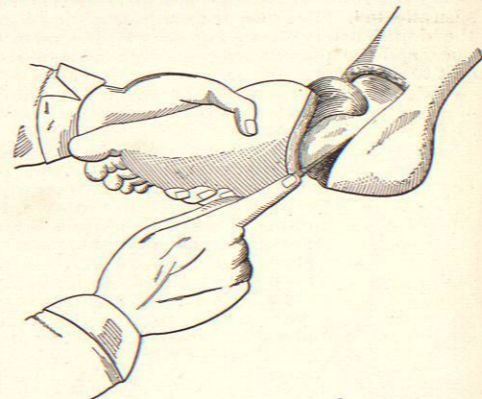


FIG. 172.

the left hand, the heel resting between them. A perpendicular incision touching the bone is then made across the sole of the foot from the tip of one malleolus to that of the other\* (Fig. 171). The posterior lip of the wound is then seized with the left hand, and the soft parts covering the calcaneum are separated from it by short strokes of the knife, which must be kept close against the bone to prevent perforation of the integument and damage to the plantar vessels. When, by this process of dissection, the tuberosities of the os calcis have been fairly exposed, a transverse incision joining the two extremities of the first is carried across the instep (Fig. 171). The ankle joint being thus opened from in front, the knife is carried down on each side of the astragalus until the lateral ligaments are divided, when complete disarticulation is effected. By forcibly depressing the foot the tendo Achillis should then be divided from before backward, when by a few strokes of the knife the foot can be removed (Fig. 172, Esmarch). Lastly, the knife is drawn around the extremities of the tibia and fibula, so as to expose them sufficiently for being grasped in the hand and removed by the saw. "After the vessels have been tied, and before the edges of the wound are stitched together, an opening should be made through the posterior part of the flap where it is thinnest, to afford a dependent drain for the matter."

The appearance of the wound after Syme's amputation is well shown in Fig. 173. It will be seen that the heel flap presents the form of a cup, which must be flattened by pressure against the bones of the leg. While there is danger, therefore, of making the flap too short, there is likewise a danger in making it too long, since a pouch would be formed for the retention of inflammatory products.

The favorable results which follow Syme's amputation in civil practice are shown by the statistics of Hancock and Spence, who, among 316 operations, found only 25 deaths (7 per cent.). In military practice the results are far less favorable. Of 159 amputations made at the ankle during the Civil War, and in which the result was determined, 40 terminated fatally (25.1 per cent.).

Pirogoff's Amputation.—On the principle that by preserving the posterior portion of the calcaneum the natural length of the limb could almost be preserved, Pirogoff, during the Crimean war, devised the osteoplastic operation that bears his name. It differs from the operation of Syme in preserving a portion of the os calcis, in the expectation that it will unite firmly to the divided end of the tibia. The incisions for this amputation are identical with those made in Syme's operation. After opening the joint from in front, the foot is depressed until the posterior extremity of the astragalus is exposed, when a saw is introduced behind this, and the os calcis divided exactly on a level with the incision in the sole of the foot (Figs. 174 and 175, Esmarch). Both malleoli and a thin section of the tibia and fibula are removed, as in Syme's operation. It is generally advisable to divide the tendo Achillis and at the same time to perforate the skin for the passage of a drainage tube. The appearance

of the stump after a successful Pirogoff amputation is well shown in Fig. 176, taken from a man who died three years after the operation was made by Linhart.

A number of modifications of Pirogoff's amputation have been devised. Ferguson and Agnew have wedged the end of the os calcis into the interval between the malleoli, and have obtained good results. Different methods of dividing the bone have been devised by Sédillot, Günther, Le Fort, and Bruns, to remove the pressure from the thin part of the integument on the back of the heel, which must bear it after the Pirogoff amputation, and to keep the retained part of the os calcis in its natural position. Sédillot and Günther, therefore, advised

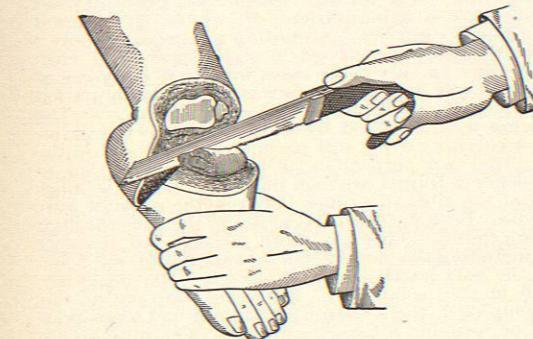


FIG. 174.

that an oblique section (from above downward and forward) of the calcaneum, tibia, and fibula be made. Le Fort (Fig. 175) advised a transverse section of the bone, by which the stump obtains a very broad base. Bruns has modified the operation of Le Fort by sawing the os calcis in such a manner as to make the upper surface of the retained part concave, the concavity thus formed receiving the convex section of the tibia and fibula.

A further modification of Syme's amputation is that of Guyon. It is an amputation above the malleoli. The operation is begun with an elliptical incision beginning one inch above the lower edge of the tibia in front, and, passing obliquely in front of the ankle, crosses the heel below the attachment of the tendo Achillis. The posterior portion of the flap is dissected from the heel and the tendon divided close to its insertion. The an-

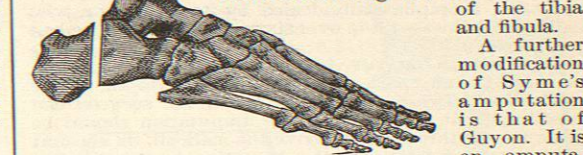


FIG. 175.

terior extensor tendons are divided transversely as high as possible. After the malleoli are exposed the fibula and the tibia are divided just above them. The heel end of the flap is then brought forward to cover them. The suture line is safe from pressure.

A comparison of the merits of Syme's amputation and its osteoplastic modification shows that a cure follows more rapidly after the latter than after the former, although the mortality of Pirogoff's amputation in military practice is 27.7 per cent., against 21.4 per cent. following that of Syme. Of 147 cases of Pirogoff's amputation collected by Hancock, Gross, and Pasquier, only 14 proved fatal, and Volkmann has performed the operation 34 times without a death. Considering the number of reamputations after Syme's and Pirogoff's operations, the latter would seem to be the more successful. Of 83 cases

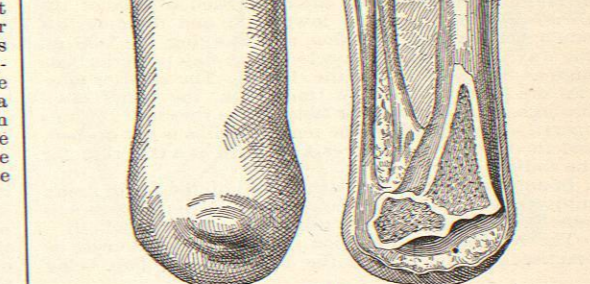


FIG. 176.

Of 83 cases of Pirogoff's amputation collected by Hancock, Gross, and Pasquier, only 14 proved fatal, and Volkmann has performed the operation 34 times without a death. Considering the number of reamputations after Syme's and Pirogoff's operations, the latter would seem to be the more successful. Of 83 cases

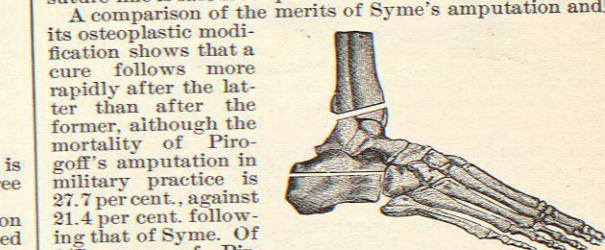


FIG. 177.

Of 83 cases of Pirogoff's amputation collected by Hancock, Gross, and Pasquier, only 14 proved fatal, and Volkmann has performed the operation 34 times without a death. Considering the number of reamputations after Syme's and Pirogoff's operations, the latter would seem to be the more successful. Of 83 cases