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AMPUTATION OF THE FOOT WITH A DORSAL
FLAP.

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BAUDENS was the first surgeon to perform amputation of the foot with a dorsal flap, in 1839, on a soldier having caries of the calcaneum and astragalus, who in eight months walked, bearing his weight on the stump without pain. Baudens performed the operation six times in seven years, with five successful results, but in spite of this the operation soon fell into discredit.

Jules Roux, who often performed tibio-tarsal disarticulation, preferred this operation to amputation above the malleoli, because the former allows the patient to walk on the stump with an ordinary boot as well as if he had his foot.

Boeckel was also in favor of disarticulation in every case in which a flap could be made. Chenu, Salleron, Legouest, and Gordon employed tibio-tarsal disarticulation in preference to amputation above the malleoli.

During the Civil War in our country, the majority of surgeons were in favor of amputation above the malleoli, especially as regards the definitive result.

In Germany, Weber comes to the following results in a very excellent work on amputations above and below the malleoli. Leaving aside the mortality from causes of war, the death-rate from supramalleolar amputation is 11 per cent., while for the tibio-tarsal it is 13 per cent. Necrosis of the flap is met with in

7 per cent. of cases in the supramalleolar, and 10 per cent. in the tibio-tarsal operation.

Abscess and fistulæ occur oftener in the tibio-tarsal operation, while the good ultimate results are equally small in the supramalleolar operation. The shortening of the limb is from six to eight centimetres in the former and from fifteen to twenty in the latter operation.

Amputation above the malleoli gives a slightly conical stump with a narrow base badly formed for a useful limb, rendering walking difficult and necessitating a complicated apparatus.

The tibio-tarsal operation gives a far better stump. The results immediately following the operation are better in amputation above the malleoli, while the ultimate results are superior in the tibio-tarsal operation.

Now, if many surgeons to-day prefer tibio-tarsal disarticulation with a flap made by selection, it is not the case regarding the same operation with a posterior flap or one of necessity.

It is now a well-known fact that a flap made from the heel or internal aspect of the sole of the foot are operations of choice, but the equal merits of total disarticulation of the foot with a dorsal flap and amputation above the malleoli are not as yet decided.

In other words, when the integuments of the plantar aspect are of bad quality, or when insufficient to make a flap, is it better to amputate near the lower third of the leg or to perform disarticulation of the foot with a dorsal flap? The great majority of surgeons would probably amputate above the malleoli for fear of a bad stump from the dorsal flap.

Now, it is just this point to which the writer desires to call attention, because he believes that tibio-tarsal disarticulation with a dorsal flap is an excellent operation. To day we can certainly avoid nosocomial complications, and thus we are liberated from the great factor in the formation of conical stumps.

Union by first intention after amputation keeps the skin in its normal condition of elasticity; the cicatrix does not become adherent to the surfaces of the underlying bones, and the stump

presents all the qualities of what may be called a good stump. There is no reason why all this should not be obtained in tibio-tarsal disarticulation with a dorsal flap.

The best amputation of the lower extremity is that which gives the member the greatest length and largest base for the support of the body's weight. A person with an amputation of the foot puts his weight directly on the stump and walks with a simple boot, while usually in amputation above the malleoli, the subject has a less well-formed stump and is obliged to wear an apparatus which receives the weight of the body, partly on the stump and partly on the projections of the condyles of the tibia and patella.

The two cases of tibio-tarsal amputation performed by Poncet, of Lyons, and reported by Brugueirolle in 1893, show that the dorsal flap makes an excellent stump, capable of supporting the weight of the patient while walking as well as in the Syme or Roux amputation.

The indications for total amputation of the foot with a dorsal flap occur from the impossibility of finding enough tissue in good condition on the sole of the foot. Of course, it is to be taken for granted that the integuments of the dorsal aspect are in good condition. Such conditions as perforating plantar ulcer and various forms of atrophic conditions are suited for the operation under consideration. Tumors of the heel, such as cancrroid, melanotic sarcoma, etc., may also require disarticulation of the foot with a dorsal flap.

The contraindications are to be found in the general and local condition of the patient. The vitality of the skin on the dorsal aspect of the foot is naturally of the first importance.

Advanced age of a patient in poor general health is a contra-indication. In such cases the question of life is to be more seriously considered than functional result of the operation.

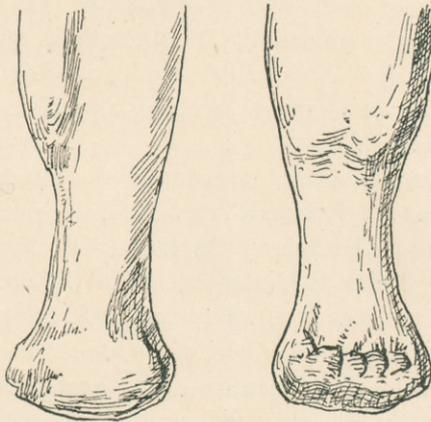
When we find the integuments of the dorsum of the foot are in good condition, we think that, generally speaking, tibio-tarsal amputation with a dorsal flap is better than amputation above the malleoli.

The dorsal flap is made up of the following layers: The

skin, subcutaneous cellular tissue, dorsal aponeurosis, the tendons, a fibrous layer, and, lastly, the pediosus muscle with the artery and nerve.

The skin is thin, quite elastic, and would at first lead one to suppose that it could not serve for a point of application, but numerous cases demonstrate that this thin skin may become thick and hard by friction; thus we see corns develop on the dorsum of the feet of people wearing badly-fitting boots, and not infrequently subjects with *pes equinus* carry all their weight on the dorsal aspect of the foot.

The layer of cellular tissue is thin and contains veins and nerves. The veins are numerous, anastomosing with the deep



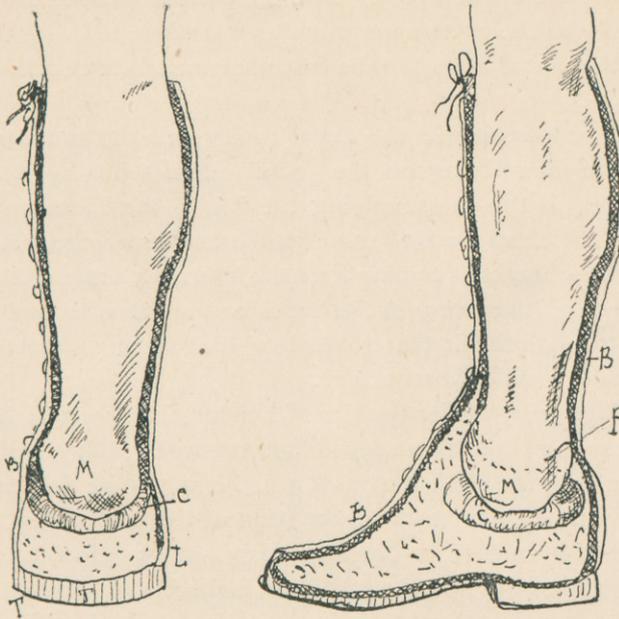
Anterior and posterior aspect of the stump.

veins of the foot, and form the origin of the internal and external saphenous. The nerves come from the external saphenous, which supplies the outer border of the dorsum of the foot, and at its end gives off the superficial dorsal nerves of the fifth and outer half of the fourth toe, and the musculo-cutaneous nerve which innervates the remainder of the dorsum and toes.

The superficial aponeurosis is quite dense, is a part of the aponeurosis of the leg and annular ligament of the tarsus. It is gradually lost on the metatarsal bones, while laterally it becomes intimately mingled with the corresponding borders of the plantar aponeurosis.

The layer of tendons comprises the tibialis anticus, supplied with a synovial sheath, commencing about four centimetres above the tibial arch and ends at the astragalo-scaploid articulation, and the tendon of the extensor proprius hallucis, the four divisions of the tendon of the extensor longus digitorum, the tendon of the peronæus longus, and, lastly, that of the peronæus brevis.

Before the era of antisepsis suppuration in the sheaths of



M.—Stump. L.—Cork foot.
 C.—Hair pad. B.—Boot.
 T.—Heel of boot.

the tendons was greatly feared, and, as in the operation under consideration, they were not opened; this was a point in favor of this method.

The aponeurosis of the pediosus is a very thin layer spread over the muscle and artery, and separates the latter from the tendons of the long extensors; externally it is inserted on the border of the foot, while internally it becomes mingled with the

superficial aponeurosis at a point over the proper extensor of the great toe.

The pediosus is inserted in the astragalo-calcaneum excavation behind and divides into four muscular branches exteriorly, which terminate in as many tendinous prolongations. The internal prolongation obliquely crosses the tarsal artery and is inserted on the external aspect of the first phalanx of the great toe. This tendinous process is quite an important landmark for ligation of the tarsal artery. The three other tendons are found externally to the extensor tendons and are inserted with the latter on the dorsal aspect of the first phalanx of the two following toes.

Below this muscle the tarsal artery and the anterior tibial nerve are found lying on the dorsal interosseous aponeurosis. This artery is the one supplying the flap in the operation under consideration, and sends off some small branches which anastomose with similar branches coming from the internal plantar artery. It also gives off the artery of the tarsus and metatarsus, and finally passes through the first interosseous space to form an anastomosis with the external plantar artery.

When we consider the size of the tarsal artery which occupies the flap and its numerous anastomoses with other good-sized vessels, the vitality of such a flap is not to be doubted.

We now come to the description of the amputation, which may, for convenience, be divided into four steps. In the first the flap is marked out and the soft parts incised.

The incision should begin near the tendo Achillis, below and behind one of the malleoli according to the foot operated on. It follows the line dividing the plantar and dorsal aspects, the point of the knife being kept close to the bony structures, and rounding off in the shape of a gaiter over the interdigital groove of the toes.

The *second step* is the dissection of the flap. This should include the entire thickness of the soft parts of the dorsum of the foot, special care being taken not to injure the tarsal artery. The dissection should be kept close to the bones up to the tibio-tarsal articulation, care being taken not to lacerate the tissues.

The *third step* is the opening of the tibio-tarsal articulation and disarticulation of the foot. The flap being turned back on the dorsum of the foot, the articulation is opened according to the rules of all amputations of the foot. Section of the soft parts at the back of the foot is completed, if necessary. The tendo Achillis is then detached from its insertion on the calcaneum.

Fourth step. Section of the malleoli and toilette of the field of operation. The malleoli are detached with the saw just above the articulation of the tibia, so as to have an even surface. As to the nerves, they are resected as in any amputation and the many tendons are trimmed off. The tendo Achillis is sutured to the extensors of the toes and hæmostasis is then attended to. The flap is then sutured and a drain is placed in both internal and external angle of the incision.

A thick aseptic dressing is applied, in no way differing from any other used in amputations.

According to Poncet, it is well to mark out the flap as high as possible in order to utilize all the skin of the dorsum of the foot. The retraction of the skin is here so great that it is better to have too much than too little.

As to the cicatrix, it is found on the posterior aspect of the heel, as is seen in the drawings taken from the monograph of Brugueirolle, and consequently is not pressed upon when the patient walks. The patient will be ready to use an artificial limb about three months after operation.

Mr. Durant, orthopædist to the Hôtel Dieu, of Lyons, has invented an excellent boot to be worn after this operation, a description of which is not necessary, as a glance at the figures illustrating the apparatus will be quite sufficient for the understanding of their use and construction.

