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A New Approach to the Problem of Grossly Deformed Feet

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Many leprosy patients suffering from breakdown of the bony architecture of the foot have undergone below-knee amputation with reasonably satisfactory results. However, to avoid the loss of so much tissue the authors have devised a modification of the old Pirogoff amputation. In this, half the calcaneum is preserved and the stump arthrodesed into the ankle mortice, thus giving a weight-bearing heel and a leg little shorter than normal and capable of accepting a simple stump boot. The operation is described in detail.

Over the last 5 years we have received at this hospital a trickle of crippled leprosy patients redirected from various leprosaria where it is known that we have facilities for fitting artificial limbs. All of them had suffered gross tissue loss and complete breakdown of the bony architecture of the foot (Fig. 1), and below-knee amputation had been considered reasonable treatment. These patients have been pleased with the result, this arising no doubt from their relief at the loss of a foot that had produced only sinuses and offensive discharge for years. Many of these patients were destitute, and even the possession of a prosthesis that originated in New York or Roehampton contributed to the glow of pleasure with which they walked away. But to us there has always been an uncomfortable feeling that something less in tissue loss should be possible, for there is no comparison here with the diabetic or thrombo-angiitic type of patient, for whom below-knee amputation is correct and in fact inevitable.

FIG. 1
Patient no. 4 before operation.

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THE MODIFIED PIROGOFF AMPUTATION

Our experience with definitive surgery in bones distorted by chronic osteomyelitis encouraged us to aim at an end-bearing stump, while keeping the leg as near normal length as possible. We have found that osteotomies of the femur

in bones that have been riddled with osteomyelitis have not produced flare-ups if reasonable precautions are taken, and bony union has been good. In our leprosy patients we have attempted retropulsion of the foot in cases where destruction of the calcaneum has produced a boat-shaped foot. In such cases either an excision of the talus or a modified triple arthrodesis through the most unpromising tissues has healed well.

In the past the standard operation has been the conventional or modified Syme's amputation (Fig. 2 (*a*) and (*b*)); this shortens the leg by 6.25 to 7.5 cm (2½ to 3 in.) and has also made it difficult to fit a good prosthesis or stump boot. The Pirogoff amputation (Fig. 2 (*d*)) has fallen into disuse. In this procedure the malleoli were sawn off just above the ankle joint and a small piece of the calcaneum retained in the dorsal flap was brought to lie across the cut surface of the tibia and fibula. However, this again resulted in a stump as short as in the original Syme's operation. Such a patient can only walk in emergency without a boot.

In the cases we have completed, about half the calcaneum has been preserved in the flap and the ankle mortice denuded of cartilage for the calcaneal stump to be arthrodesed in it (Fig. 2 (*c*)). We expected trouble with the blood circulation in this much larger than normal flap, but in only one patient has gangrene occurred, and even here it was limited and of late occurrence. We drive a Steinmann pin through the heel during the operation and under direct vision (Fig. 3); this holds the arthrodesis firmly and facilitates suture of the flaps. No attempt is made to trim the lateral bulges which appear in suturing this flap, as this would further jeopardize its circulation. The bulges tend to shrink (Fig. 4) and can always be trimmed later. We have observed minor delay in healing, due to haemorrhage, but no sepsis. When the bone unites, the patient is left with a weight-bearing heel only 1.25 to 2.5 cm (½ to 1 in.) shorter than normal (Fig. 4). This means that a simple stump boot can be made without the considerable build-up which rendered the conventional prosthesis unstable. Since devising this operation, we have discovered in an old edition of *Modern Operative Surgery* edited by Grey Turner (1943), a procedure described as Watson's operation, in which the whole calcaneum was retained and arthrodesed into the ankle joint. However, the operation was mentioned only to be condemned!

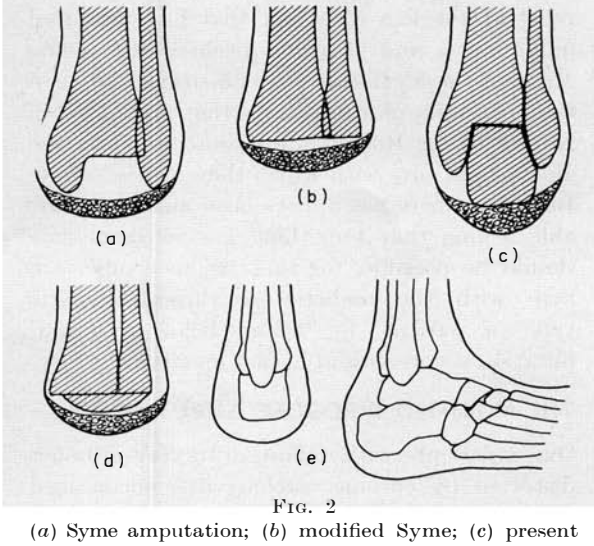

FIG. 2
(*a*) Syme amputation; (*b*) modified Syme; (*c*) present operation; (*d*) Pirogoff; (*e*) stump compared with normal foot.

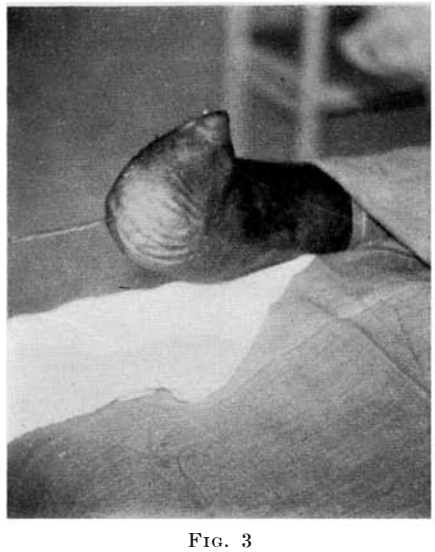

FIG. 3
Patient no. 4 immediately after operation. Note Steinmann pin and flap "bulge".

FIG. 4
Patient no. 1. Note minimal shortening and shrinkage of lateral bulges.

METHODS

A tourniquet is used throughout the operation. It is wise to cut the skin flap generously, for it can be trimmed finally if too large, and it is easy to underestimate the length required. The incision is carried down to bone, the ankle joint opened, and the foot dislocated in extreme plantar flexion. Attention is now paid to the ankle mortice, which must be completely denuded of cartilage. The forefoot and tarsus are separated and the calcaneum fashioned to fit into the ankle. Each case has to be treated individually in this tailoring process, for in each the degree of disorganization varies. In some cases the Achilles tendon has had to be carefully divided to allow the calcaneum to move freely. It is emphasized that the calcaneal remnant remains attached to the dense fibrous pad of the heel and is rotated into the ankle mortice by moving up the heel flap. This ensures the minimum interference with the blood supply. After insertion of a Steinmann pin, if desired, the skin flaps are closed without drainage, the pressure of a firm dressing being sufficient to control haemorrhage. The sutures are removed after about 14 days, and walking with crutches is allowed. Weight-bearing, however, should be delayed for 2 months to allow bony union to occur.

Details of the stump boot are as follows. The patient with the beggar mentality may soon discard any boot given, and with this operation he will be able to move about with little discomfort or awkwardness of gait. However, a simple boot can be made to prevent the development of ulceration of the stump. This incorporates a build-up of wood 1.25 to 2.5 cm ($\frac{1}{2}$ to 1 in.) thick and lined with microcellular rubber. A slight roll on the sole, using a portion of old car tyre, will make for easier ambulation. If the patient wishes for a more sophisticated boot, a mould of the foot can be taken and from this a moulded sole and build-up of cork can be made. This utilizes more of the surface area of the stump for weight-bearing, thus decreasing the risk of ulceration. A Plastizote mould may also be very easily utilized, but whether it is strong enough to withstand the shearing and compression forces to which it may be subjected is not yet proved.

ILLUSTRATIVE CASES

Patient 1. *S. Male, aged* 46 *yr.* The operation was conceived for a patient with thromboangiitis obliterans in whom gangrene was limited to the toes of the right foot. Lumbar sympathectomy had previously been performed. In spite of the vascular condition the blood supply to the flap proved to be adequate, and this encouraged us to proceed with further patients.

Patient 2. *P. N. Male, aged* 48 *yr.* Hansen's disease, tuberculoid type. This patient had anaesthesia of both lower legs with gross disorganization of the left ankle joint of the Charcot type.

Patient 3. *S. S. Male, aged* 38 *yr.* Hansen's disease, tuberculoid type. Severe deformity of all limbs. Median, ulnar and radial paralysis of the left hand; median and ulnar paralysis of the right hand, left foot-drop with osteomyelitis of the forefoot and shortening of the foot, and severe disorganization of the right foot, but no sinuses. He was referred from another hospital for right below-knee amputation. Instead of

this, however, a modified Pirogoff amputation was performed. At operation, the tarsal bones were fused to the tibia, and an ankle mortice had to be created with a chisel into which the the calcaneum could be fitted. The Achilles tendon had to be divided before the flaps could be brought together with some tension.

Patient 4. *K. N. Male, aged* 55 *yr.* Hansen's disease, tuberculoid type. This patient had undergone below-knee amputation of the left leg some 25 years previously and a peg-leg type of prosthesis had been fitted. The right foot became increasingly deformed, with inversion, reversal of the longitudinal arch, and gross lateral border ulceration. This was initially treated by excision and grafting of the ulcer; this healed rapidly, and a fitted boot was supplied. Small recurrences occurred on the weight-bearing area and it was decided that removal of the ulcerated forefoot would cause no greater disability, in spite of the amputated left leg. A modified Pirogoff amputation was therefore performed.

SUMMARY

A technique of osteoplastic amputation through the ankle-joint is described, which has been found useful in the treatment of the disorganized feet of leprosy patients. A weight-bearing stump of near normal length results, and this is a distinct advantage where expertly made prostheses may not be available.