SYME’S AMPUTATION

The Technical Details Essential for Success

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There is considerable divergence of opinion about the merits of Syme’s amputation. In some countries it is highly regarded; in some it is neglected; in others it even is roundly condemned. In Canada it is thought to be the best of all amputations of the lower extremity above the foot and has been used with consistent success since before the 1914–1918 war to the present day. Experience in Great Britain seems to have been different, for there is an influential and experienced body of opinion which condemns it and states that almost every Syme’s amputation of the 1914–1918 war has had to be converted to a below-knee stump because the Syme’s stump was unsatisfactory in various respects (Ministry of Pensions publication 1939). In the Amputation Centre in Nijmegen in the Netherlands Syme’s amputation is not performed. In the United States before the recent war Syme’s amputation was not highly regarded, but the International Conference on Amputations held in Ottawa and Toronto in March 1944 led to renewed interest in Syme’s amputation in the United States and several papers have since appeared to record the satisfaction of American orthopaedic surgeons with this special amputation.

Such striking differences of opinion must be due to some fundamental difference in the technique of the amputation as performed in different countries. It is the purpose of this paper to set forth the technical details which we have found to be essential factors for success.

HISTORICAL REVIEW

It is interesting and informative to revert to Syme’s original record of this historic landmark in amputation surgery (Fig. 1). His first publication relating to it was published in 1843, twenty-two years before his son-in-law, Joseph Lister, first embarked upon his experiments in antiseptic surgery and three years before Morton first used ether at the Massachusetts General Hospital, and four years before Simpson first recorded the use of chloroform.

Syme’s amputation, therefore, was developed in the period of pre-anaesthetic and pre-antiseptic surgery and his concern was to achieve a simple and safe means of removing an infected or damaged foot. His first report in February 1843 in the London and Edinburgh Monthly Journal of Medical Sciences was entitled “Amputation at the Ankle Joint.” In this he records the successful outcome of his treatment, one year previously, of a case of suppurative disease of the tarsus (probably tuberculosis) by disarticulation of the foot at the ankle and removal of the malleoli flush with the lower articular surface of the tibia. The heel flap was deliberately preserved and was used to cover the end of the tibia but without suture of the incision. The wound healed gradually in spite of an abscess which required drainage. The man left hospital three months after his operation with “the wounds soundly healed and any degree of pressure can be born (sic) by the stump which has a round end well suited for the adaption of a boot or an artificial foot and is strongly protected from external injury by its thick integuments.”

Syme’s interest in this disarticulation-amputation grew from his enthusiasm for Chopart’s disarticulation which he was the first to employ in Great Britain. He had learned that this was a valuable procedure which permitted the removal of a crushed and infected forefoot with a minimum of risk to the patient. By its use the dangerous amputation through the leg
was rendered unnecessary and the patient was left with a support "not less useful than that which is afforded by the whole tarsus." Such success led naturally to consideration of disarticulation at the ankle joint when the calcaneum and talus were involved in disease.

By 1846 Syme had published five articles on this new amputation. In the last of these he was able to state: "I have operated upon more nearly two than one dozen of cases with perfect success." The operative technique had been modified and perfected. The lower articular surface of the tibia together with the malleoli were removed with a single sawcut, and precise details for fashioning and separating the heel flap were given.

Syme stated that the advantages of the operation were, "1st, that the risk of life will be smaller; 2d, that a more comfortable stump will be afforded; 3d, that the limb will be more seemly and useful for progressive motion." Reading between the lines there can be no doubt that in Syme's mind the importance of the first advantage transcended the others. This is confirmed by his modest boast of having operated upon nearly two dozen cases with perfect success at a time when injuries and infections of the foot could only be mastered by the most radical measures. The common treatment was amputation through the leg at the site of election (a hand's breadth below the knee) though the mortality from this amputation was between 25 to 50 per cent from infection in the widely opened tissue spaces and the open medullary cavities of the tibia and fibula (Godlee 1924).

Since Syme's day the risk of infection in surgery has been greatly reduced, first by the development of antisepsic surgery by his son-in-law, Joseph Lister, later by the perfection of aseptic surgery and finally by the introduction of bacteriostatic and antibiotic agents.
To-day the great advantage of Syme's amputation no longer is "that the risk of life will be smaller." It remains the most useful of all amputations of the leg because "a more comfortable stump is provided, more seemly and useful for support and progressive motion." To Syme must be given the credit for bringing to the attention of the surgical world the value of end-bearing in amputations of the lower extremity even though, in the surgical era in which he worked, the merit of end-bearing was secondary in importance to the saving of life.

To-day the functional value of end-bearing amputations of the lower extremity is so great that every effort should be made to use them when possible. Since we are more fortunately situated than James Syme in that we do not have to concern ourselves so greatly with infection, we can concentrate our attention upon the development of the technique which will give the best possible end-bearing stump.

**FUNDAMENTAL PRINCIPLES OF END-BEARING AMPUTATIONS**

The important functions of the lower extremity are weight bearing and propulsion. Amputation stumps of the lower limb must be designed to suit these functions. The more perfectly they bear the weight of the body and transmit the forces of locomotion the more competently their prosthetic appliances will be used. For purposes of weight bearing nothing equals a stump which can bear weight upon its end. Propulsion is best performed by the stump which preserves the greatest length of limb with normally functioning muscles and joints above the level of the amputation. Syme's amputation, being end-bearing and of nearly normal length, offers the best possibilities of good function in amputations of the lower extremity.

To provide an end-bearing stump in the lower extremity certain requisites are essential. 1) The bone must be divided where its cross-section area is as great as possible in order to provide a broad area of support. 2) The whole of the cut surface of the bone must be capable of bearing weight. This can be achieved by a strong meshwork of cancellous bone across
the whole area, or in the case of the ankle joint by the retention of the subarticular cortical bone at the lower end of the tibia. The tubular cross-section of the shaft of the tibia at higher levels is unsuited to weight bearing. 3) The skin and subcutaneous tissue covering the end of the stump must be appropriate for weight bearing. Only two levels in the lower extremity meet these requirements. They are the lower end of the femur with a covering of prepatellar skin, and the expanded lower ends of the tibia and fibula covered by the heel pad.

It is interesting to learn that Syme attempted to devise an amputation at the level of the knee joint embodying the principles which proved so successful at the ankle joint. He reported his first two cases in 1845, two years after his first publication, "Amputation at the Ankle Joint." Both patients seem to have been suffering from tuberculosis of the knee joint. In both, the femur was transected through the condyles just above the articular surface, which was carious. The end of the stump was covered with a long posterior flap of skin derived from the calf. Both wounds healed without serious complication though they took some time to do so.

It is evident from Syme's presentation of these two cases that he was chiefly concerned with devising a safer operation than amputation through the mid-shaft of the femur and
believed that section of the bone where it was cancellous involved less risk from sepsis. He took no pains to cover the end of the stump with weight-bearing skin, evidently believing that the achievement of a healed stump without sepsis and without serious risk to the patient’s life was all that was necessary to ensure good function and even weight bearing.

Twenty-one years later, in 1866, he wrote again about transcondylar amputation of the femur. His interest had been renewed by Carden’s (1864) report of his method of amputating at this level using an anterior flap after removing the patella. Syme warmly commended Carden’s amputation, which could be performed with little risk to the patient from sepsis with the additional advantage that “the stump proved eminently serviceable, since the skin over the bone, instead of becoming thinner, acquired additional thickness, so that the patients could rest upon it just as they do after amputation at the ankle.” In this publication Syme acknowledged that his earlier attempt to perfect the technique of transcondylar amputation through the femur had failed and had fallen into disuse because the skin flap derived from the calf of the leg “proved very inconvenient.”
Technique of Syme's amputation, continued. *Left*—The anatomy of the field of operation after the tarsus has been removed from the heel flap. *Right*—Closure of the wound with drainage.

Technique of Syme's amputation, continued. The method of strapping the heel flap to the leg to ensure that its position is exactly correct and will remain so.
Syme, therefore, nearly achieved success in devising an end-bearing stump at the transcondylar level. He failed because his attention was focused upon the avoidance of sepsis, and because he did not appreciate the importance of covering the end of the stump with weight-bearing skin, though in the case of the ankle joint he seems to have been aware of its value.

ADVANTAGES OF SYME’S AMPUTATION

The incomparable merit of Syme’s amputation is that it permits full weight bearing on the end of the stump. Canadian experience indicates that this quality is retained until the end of the patient’s life. The stump is nearly as long as a normal leg. This, added to the quality of end-bearing, gives the patient a stump which approaches the function of a normal foot. The patient can stand and walk upon it without limitations and can undertake the heaviest kind of work. He can even walk upon it without a prosthesis. It is by far the most useful and most serviceable of all amputations of the leg and should be used whenever possible. It is much more valuable than a below-knee amputation. Few below-knee amputees can walk on their prosthesis all day without damaging the stump, because weight is borne, not upon the end but upon the side of the stump, where there is no specialised weight-bearing skin and subcutaneous tissue and where the thrust is not end-bearing but is oblique, and is a shearing force.

STRUCTURE OF THE HEEL PAD

Many factors combine to make a Syme’s amputation a good end-bearing stump, but the detail most essential for success is the preservation of the weight-bearing function of the heel flap. This function derives partly from the thickened skin but chiefly from the specialised structure of the elastic adipose tissue interposed between the skin on the one hand and the calcaneum and plantar aponeurosis on the other. Kuhrs (1949) reviewed our knowledge of elastic adipose tissue and brought to our attention the detailed studies of Tietze (1921) and Blechschmidt (1933). Wherever pressure or weight bearing is applied to localised points on the body (heels, fingertips, thenar and hypothenar eminences, ischial tuberosities and prepatellar fat pads) a specialised form of elastic adipose tissue is developed which resists pressure. This quality is obtained by the presence of dense septa of elastic fibrous tissue enclosing spaces filled with fat. Each loculus is separate from its neighbour and the fat lobules within it are isolated from the surrounding loculi. In the heel pad the fibrous septa extend from the dermis below and are closed above and posteriorly by the inferior surface of the calcaneum and anteriorly by the plantar aponeurosis. They enclose flask-shaped spaces filled with fat lobules. Each space is reinforced by oblique and spirally arranged bands. These compartments, bounded by sheets of elastic fibrous tissue and filled with semi-fluid fat, act as hydraulic buffers. Under pressure they change their form but not their content. When pressure is released they resume their normal shape (Figs. 8 to 13).
A lateral radiograph of the heel, if not over-exposed, will often reveal this fundamental structure of the subcutaneous tissue. The vertical septa of elastic connective tissue are readily seen running from the skin below to the calcaneum above, or to the plantar aponeurosis more anteriorly (Fig. 14).

It is important to preserve this specialised subcutaneous tissue in the heel flap of a Syme's amputation. If the heel flap is dissected through the subcutaneous plane, the loculi are opened and their content of fat is forced out by pressure because they are no longer closed spaces.

In order to preserve intact this specialised weight-bearing subcutaneous tissue it is necessary that the plantar aponeurosis and the periosteum of the inferior surface of the calcaneum be removed intact with the heel flap.

**THE IMPORTANCE OF SUBPERIOSTEAL DISSECTION OF THEHEEL FLAP IN SYME'S AMPUTATION**

Syme elaborated the technique of his amputation with great care. Two incisions, the dorsal one to open into the ankle joint and the plantar incision carried directly through to the bones of the tarsus, outlined the extent of the heel flap. The talus was dislocated downwards and forwards from the mortise of the ankle joint and the calcaneum was freed from the tendo calcaneus and the heel pad by dissection with a sharp, stout knife in a plane which hugged the bone (*i.e.*, in the subperiosteal plane). In advocating this plane Syme was attempting to avoid injury to the calcaneal branches of the posterior tibial artery. That is important,
but a greater accomplishment is the assurance that the subcutaneous tissue with its special weight-bearing qualities will be included intact in the heel flap (Figs. 3 to 7).

Such a flap contains the stumps of origin of the short plantar muscles. It is a clumsy, untidy flap and every meticulous surgeon instinctively desires to tidy it up by removing the bulky muscle stumps (Alldredge and Thompson 1946). But to do so is likely to result also in the removal of the plantar aponeurosis. If this is done the subcutaneous loculi are opened and the fat is squeezed out. They can no longer function as hydraulic buffers.

Subperiosteal dissection of the calcaneum from the heel flap has another advantage. It leaves the heel flap lined with periosteum which more readily adheres to the cut surface of the tibia, and more firmly. Sometimes, indeed, new bone forms from this periosteal lining of the heel flap and this ensures very firm fixation of the heel flap to the tibia and an intact weight-bearing mechanism (Figs. 15 and 16).

It is of interest to quote an observation of Jacobson's (1889) which confirms this point. He described the technique of removal of the calcaneum from the heel flap by an approach from above. "The foot being still more pressed" (i.e., downwards to dislocate the talus from the ankle joint), "the upper nonarticular surface of the os calcis comes into view and then the tendo achillis. This is severed and the heel flap next dissected off the os calcis from.
above downwards, special care being taken to cut this flap as thick as possible; not to score or puncture it, but rather to peel it off the bone with the left thumbnail kept in front of the knife aided by touches of this.” To this is appended a footnote: “If, in a young subject, the epiphysis comes away in the heel flap, it may remain there if the parts are healthy. The same course may be followed with the periosteum, if it is found loose and peels easily away. Mr Johnston Smith, when amputating both feet for frost bite, left the periosteum on one side, on the other no attempt was made to save it. The first stump was much larger than the other, harder and more rounded; more like that of a Pirogoff’s amputation.”
This quotation is from the 1889 American edition of Jacobson's *The Operations of Surgery* and hence antedates the introduction of the Roentgen ray. In all respects, save the radiographic picture, his description indicates clearly the advantages of subperiosteal separation of the heel flap from the calcaneum.

We may conclude, then, that subperiosteal separation of the calcaneum from the heel flap is important for the maintenance of an intact weight-bearing covering of the stump and for the firm anchorage of the flap to the lower end of the tibia. It is unwise to tidy up the stump. This may damage the weight-bearing mechanism of the subcutaneous tissue and certainly will remove the periosteal lining of the heel flap and invite an unstable end to the stump.

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**Fig. 12**

Figure 12—Horizontal section through heel (parallel to the sole of the foot and below the level of the calcaneum) to show the structure of the heel pad. The septa and the loculi they enclose have been cut across at right angles to their vertical axis. The skin of the heel bounds this section medially, posteriorly and laterally. Figure 13—Thick frozen transverse vertical section of heel pad. (× 2.) Stained with Oil Red 0 for fat and counterstained with light green. *From above downwards*—A—bellies of short muscles of foot; B—plantar aponeurosis; C—specialised elastic adipose tissue; D—skin.

**IMPERFECTIONS WHICH MAR THE FUNCTION OF A SYME'S AMPUTATION STUMP AND HOW TO AVOID THEM**

Not all Syme's stumps are perfect. Nevertheless most of the imperfections can be eliminated by meticulous attention to the technique of the operation and some can be compensated by the fitting and use of the prosthesis. In addition to damage to the heel flap the following are the most important faults which may prevent the achievement of a perfect result.

**Misplaced heel flap**—Care must be taken to place the heel flap beneath the tibia in such a manner that the plantar surface of the flap is exactly beneath the centre of the cut lower end of the tibia, and it must be maintained there until sound healing has occurred. This requires painstaking care because the heel flap is a large deep cup which fits loosely over the lower end of the tibia. At the end of the operation the correct position can best be secured by adhesive strips (Fig. 6). These should be inspected frequently during the first two weeks after operation to ensure that the correct position is maintained. If necessary they should be adjusted to keep the heel flap in its proper position. If the heel flap is improperly placed on the end of the tibia the margin of the cut surface of the lower end of the tibia will press through the skin against the inside of the prosthesis and cause discomfort (Fig. 17).
Lateral radiographs of the foot to show the fibro-elastic septa of the heel pad when no weight is borne on the heel (top), and when the patient’s weight is transmitted through the heel.
Sloping cut surface of the lower end of the tibia—When weight is borne upon the cut surface of the tibia which is not parallel to the ground the heel flap tends to be pushed to the high side of the slope. To avoid this the lower end of the tibia must be transected parallel to the ground, both in the transverse and in the antero-posterior plane. This does not necessarily mean at right angles to the long axis of the shaft of the tibia. For example, when the leg is bowed, the plane of section of the lower end of the tibia must be parallel to the ground, not at right angles to the long axis of the lower half of the tibial shaft.

Too small cross-section to cut end of tibia—The largest possible cross-section area of the cut end of the tibia and fibula is desirable. Smaller areas may result in localised pressure from weight bearing and consequent callus formation. Therefore the plane of transection should be just above the articular cartilage of the lower end of the tibia, to ensure the greatest possible area for the support of the heel flap.

"Wobbly" or unstable heel flap—If the heel flap is loose and easily displaced the pressure from use of the prosthesis may wipe it to one or other side or backwards. The bone edge then presses upon the scar. A flaccid, loose heel flap can be prevented by subperiosteal dissection of the heel flap. The deep surface of the heel flap then attaches itself firmly to the cut surface of the bone and the firm intact pad of adipose subcutaneous tissue resists changes in its shape. An unstable heel flap can be avoided only by proper technique. Once it has occurred it cannot be corrected by further operation, though its shortcomings can be minimised by modifying the lacing of the prosthesis (Fig. 17).

Tender heel flap with calluses—This is almost always due to failure to preserve the specialised elastic adipose tissue. It is accentuated if the cross-section of the cut end of the tibia is small or has projecting spurs. It can be prevented by proper fashioning of the heel flap during the operation. If the weight-bearing structures of the heel flap have been damaged by the operation their function cannot be restored by any subsequent operation.

Neuroma of the posterior tibial nerve—Careful preservation of the full thickness of the heel flap leaves the posterior tibial nerve in the flap. At the primary operation no attempt should be made to dissect this out and divide it at a higher level lest this cause damage to the weight-bearing qualities of the heel pad. If the neuroma which inevitably develops on its end becomes painful, late transection of the nerve at a level above the ankle joint without removal of the distal segment cures the condition.

Marginal gangrene of the heel flap—Except in cases of peripheral vascular disease this is nearly always due to faulty operative technique. Either the blood supply is impaired in the preparation of the flap by injury to the posterior tibial artery or the dressings are put on too tightly, or swelling occurs beneath the adhesive strips and they are not removed soon enough. With care in operating there is little danger of necrosis of the flap. Should necrosis occur, the stump is not necessarily ruined unless the loss of tissue is very great.

Vascular insufficiency in the heel flap—It has been said that the great length of a Syme's stump results in vascular insufficiency which is manifested by a cold, blue, painful end to the stump,
Unusually large mass of bone laid down in the heel flap of a Syme's amputation stump. A) Four months after operation. B) One year after operation. This cloud of new bone is unusually large and heavy because osteogenesis was stimulated by the inflammatory reaction to tuberculosis of the tarsus for which the amputation was undertaken.

Figure 17—Misplaced and unstable heel pad on Syme's stump of left leg, the result of tidying up the heel flap by removing the stumps of the short plantar muscles, and with them the plantar aponeurosis and the periosteum of the calcaneum. The result is a heel pad imperfectly fused to the end of the tibia and in bad position. Left—With the muscles at rest and the heel pad held in place under the tibia by elastic traction. Right—When the peroneal muscles contract they drag the heel flap to the outer side of the stump. Figure 18—Radiograph of the poor Syme's stump illustrated in Figure 17. In addition to the unstable heel pad, the high level of transection of the tibia provides a small area of support. In spite of these defects the stump has functioned reasonably well for nine years.
Figure 19—A functionally good Syme's stump. The heel pad is firmly fixed to the lower end of the tibia in good position. The area of support is broad. This amputation was undertaken to remove a foot much distorted after many attempts to correct recurrent club foot. Figure 20—Radiograph of the satisfactory Syme's stump shown in Figure 19.

Figure 21
Standard Syme's prosthesis. A front lacing leather bucket moulded to the stump is fastened to a strong steel frame with an ankle block at the lower end; anterior and posterior views.
much accentuated in cold weather. This has not been the experience in Canada where many of our patients, in winter, are subjected to very low temperatures. Our experience would lead us to feel that vascular stasis from exposure to cold is not a problem of any importance.

It may be, however, that long-continued exposure to damp cold can produce vascular problems with which we are not familiar. Certainly chilblains are almost unknown to us while they are common in Great Britain. If this is the explanation of any vascular problem which may arise in Syme’s amputation the cure may well be in sympathectomy rather than re-amputation at a higher level. A paralytic lower extremity after poliomyelitis in Canada is often the source of much discomfort in cold weather. It becomes blue, cold, and painful and sometimes develops trophic skin lesions. This problem is completely relieved by sympathectomy.

SUMMARY

The details in technique which are most essential to ensure a perfect Syme’s stump are the provision of a broad area of support for the heel flap by transecting the tibia and fibula as low as possible; the maintaining intact of the specialised weight-bearing qualities of the heel flap; and the proper placement of the heel flap under the cut ends of the tibia and fibula. If these aims are achieved a good and useful stump is assured; if they are neglected the stump
will be imperfect and may be unsatisfactory and no further operation can restore the qualities of the heel flap which are lacking.

It must be recorded, however, that Syme's stumps which are not technically perfect often function so well that there has been no need to consider re-amputation. A loose heel pad can be held beneath the end of the bone by firm lacing of the corset of the prosthesis. If its area of bony support is reasonably large it may serve well, though not perfectly, as an end-bearing stump. Syme's stumps so completely unsatisfactory as to necessitate re-amputation have been those in which the plane of transection of the tibia is so high that the area supporting the heel flap is too small; or the weight-bearing qualities of the heel flap have been damaged; or there is instability of the heel flap which cannot be controlled; or there is impairment of nutrition of the heel flap.

INDICATIONS FOR SYME'S AMPUTATION

With a technique which ensures a satisfactory end-bearing stump, Syme's amputation is indicated in all destructive lesions of the foot provided that the skin of the heel is in good condition. The conditions for which it is most frequently performed are the following. *Severe injuries of the foot* such as compound and comminuted fractures of the tarsus and metatarsus or crushing injuries of the foot. If it is evident that the injury to the foot is so severe that much of the foot will be lost or that the foot will become grossly deformed and rigid, a Syme's amputation should be performed as soon as the risk of infection is eliminated. With antibiotics available the amputation can sometimes be performed as a primary measure. More frequently severe contusion of the soft tissues plus actual or potential infection in the open wound will necessitate performance of the amputation as a secondary procedure after the wound has healed, or is reduced to a small size. In dealing with injuries of the foot, especially war injuries, the advantages of Syme's amputation should be borne in mind so that a two-stage operation can be performed rather than immediate resort to a mid-tibial
amputation. The primary stage will remove the shattered and infected foot, preserving the heel flap. The second stage, performed after infection is controlled or even after the wound of the foot has healed, will be a formal Syme’s amputation.  

Intractable infections of the bones and joints of the foot—At the present day this is less often an indication for Syme’s amputation than formerly. Antibiotics enable us to master most pyogenic infections and even tuberculous infections respond well to streptomycin and iso-nicotinic acid hydrazide. A few unusual infections of the tarsus such as blastomycosis and Madura foot, which do not respond well to conservative treatment, can still be effectively treated by resection and the development of a Syme’s stump. Syme’s original operation was for tuberculous infection of the talus and calcaneum.  

Deformities of the foot which cause serious disablement from rigidity and localised pressure. The chief cause of such deformities is previous trauma or infection, but such conditions as old club foot with intractable deformity can also be well treated by Syme’s amputation.  

Selected cases of obliterative vascular disease—Contrary to expectation it has proved feasible to deal with some cases of Buerger’s disease and the occasional case of arteriosclerotic vascular disease by Syme’s amputation. The most suitable case is in the young or middle aged man who has obliterative vascular disease with gangrene of the forefoot and a favourable response to lumbar sympathetic block. In such cases a lumbar sympathectomy followed by Syme’s amputation will often give a good and useful stump which will last for years. Fifty per cent of our Syme’s amputations for obliterative vascular disease have been successful. This is an important group in which function is much greater than would have been the case had their amputation been at a higher level, especially with the possibility that the other leg may need to be amputated later.  

Frost bite and immersion foot—The problem here is similar to that in obliterative vascular disease, but less difficult. The vascular changes in the foot induced by cold cause thrombosis in the vessels of the involved area which can result in gangrene of the forefoot. Such cases are well treated by Syme’s amputation.  

Certain neurological problems such as neuropathic joints from tabes and syringomelia; intractable ulceration of the forefoot from irreparable sciatic nerve injury; spina bifida.  

Malignant disease of the forefoot is an occasional indication for Syme’s amputation.  

SHORTCOMINGS OF SYME’S AMPUTATION  

Syme’s amputation has one shortcoming. It gives a bulbous-ended stump and is unsightly. The prosthesis must be bulky to accommodate the stump and it must be strong to resist the great stresses that are transmitted through it. Hence the patient is condemned to a large and heavy prosthesis, unattractive in appearance (Fig. 21). Some improvement has been accomplished by making the prosthesis of resin-bonded laminated fabric (Fig. 22). Even so the bulky ankle area is still obvious. It is not likely ever to be popular with women because of its appearance, but for men it is an excellent amputation.  

SUMMARY AND CONCLUSIONS  

1. Syme’s amputation is a valuable amputation because it provides an end-bearing stump capable of taking full body weight and of transmitting well the stresses of locomotion.  
2. The best end-bearing in a Syme’s stump will be obtained when the area of bone supporting the heel flap is as broad as possible and when the specialised weight-bearing structure of the heel flap is maintained undamaged.  
3. Technical steps in the operation which are essential for success are: a) Transect the tibia and fibula just above the articular cartilage at the lower end of the tibia. This gives the largest possible area of support. b) The line of transection must be parallel to the ground when the patient stands, not necessarily at right angles to the long axis of the tibia. c) The heel flap
must be separated from the calcaneum by subperiosteal dissection. This ensures the preservation of the weight-bearing elastic adipose tissue in the heel and firm attachment of the heel flap to the lower end of the tibia. d) The heel flap must be precisely placed beneath the tibia and held there until it is soundly healed.

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