

Augmenting the Benefit of Reversed Sural Flap in Coverage of Large Defects Over Exposed Fractured Tibia

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ABSTRACT

Over a 2 1/2-year period, from June 2005 to December 2007 nine cases of large defects over exposed distal tibia secondary to fracture of bone. The resultant defect after debridement was relatively large, which was not expected to be covered by the reversed sural flap only. Flaps used to cover these defects were a combination of distally based reversed sural flap and lateral leg proximally based flap. This study was done in Cairo University Hospitals and Haram Hospital centre for trauma and Emergency. The patients were 8 males and one female. Age of the patient ranged from 24 to 61 years. The average size of the defect after debridement was about 14.4cm by 5.8cm. Each patient was followed-up for an average period of 6 to 8 weeks, from the time of operation up to complete healing. All the lateral proximal fasciocutaneous flaps healed uneventfully over approximately 2 weeks. 7 cases of the sural flap evolved favorably with perfect healing within a normal period of 15 days. One of the reversed sural flaps had venous congestion of the distal part of it with partial necrosis of the flap this part necessitated daily dressing until granulation tissue covered the defect and split thickness skin graft was put. The other one has wound dehiscence in part of the suture line of the flap to the defect edge this part healed by secondary intention by daily dressing for a period of four weeks. The combination of the lateral leg proximal fasciocutaneous flap with the well known reversed sural distally based flap in covering large defects of the lower leg proved to be effective and successful in this small series of patients.

INTRODUCTION

The reconstruction of soft-tissue defects of the lower third of the leg and the calcaneal area presents a challenging problem for plastic surgeons. A better knowledge of the cutaneous blood supply from the neurovascular axis has allowed the creation and use of new skin flaps, such as the distally based neurocutaneous flap of the sural nerve, to treat these defects. This particular new flap allows surgeons to reach the lower third of the leg and the calcaneal area without a problem [2].

The use of fasciocutaneous flaps from the sural angiosome in the repair of soft-tissue defects was first reported by Ponte'n in his 1981 report on the use of 23 proximally based fasciocutaneous flaps

[10]. The distally based sural fasciocutaneous flap was introduced by Donski and Fogdestam two years later [4].

After the work of Masquelet et al., the distally based sural fasciocutaneous flap has become a mainstay in the reconstruction of the lower leg, heel and foot. Over the past decade, several flap modifications have been reported to improve flap viability and to solve a myriad of reconstructive needs [9].

The classically described arterial supply to the distally based sural flap is provided by septocutaneous perforators arising from the peroneal artery, of which the average leg has three to six [1]. These perforators pass between the fibula and flexor hallucis longus proximally and between the soleus and peroneus longus more distally. The most distal of these is located 4 to 7cm proximal to the lateral malleolus [4].

The sural fasciocutaneous flap can generally be used to cover any soft-tissue defect of the proximal third of the foot and the lower leg, provided that the defect is small enough to be covered by the maximal flap size and that the defect can be reached by the fascial pedicle.

The flap can be used to cover exposed vessels, bones, tendons and internal fixation hardware [11]. As always, adequate debridement of the recipient site is the single most important step for ensuring success.

Open fractures of the long bones have a 2 to 7 percent risk of developing chronic osteomyelitis [1]. The success rate of treating chronic osteomyelitis varies from 70 to 90 percent [12]. Debridement of the osteomyelitic bone, surrounding fistula and scar tissue often ends with bone and soft-tissue defects. Coverage of these defects located within the distal third of the leg represents a challenge for plastic

surgeons because this area has the lowest blood supply compared with other areas of the body [8].

Free flaps represent an excellent option for coverage of defects in this area but require a longer operating time and experience with microsurgery, may result in donor site morbidity and sometimes add bulk in the area.

Exposed fractured bone or exposed internally fixed bones by plate and screws should be rapidly covered by a good vascularised flap to protect this bone from developing osteomyelitis. Also this coverage would make the time needed for the bone to heal shorter [13].

The area which can be covered by the distally based reversed sural flap is small and limited to the flap dimensions. The area needed to be covered in cases of exposed bones in the distal leg or exposed bones with plates and screws may be large especially after debridement of the wound.

So in this work we added to the distally based reversed sural flap, a lateral proximally based leg fasciocutaneous flap to cover a wider area and make the benefit of this flap wider to cover large leg defects over exposed bones.

PATIENTS AND METHODS

Over a 2 1/2-year period, from June 2005 to December 2007 nine cases of large defects over exposed distal tibia secondary to fracture of bone. One case was associated with osteomyelitis of bone which needed debridement of the bone by the orthopedic surgeon before our debridement and coverage. The resultant defect after debridement was relatively large, which was not expected to be covered by the reversed sural flap only. So we decided to add the lateral leg proximally based fasciocutaneous flap to help in covering these relatively large defects.

This study was done in Cairo University Hospitals and Haram Hospital centre for trauma and Emergency. The nine patients included in this study were having defects over exposed tibial fracture. Four patients of them with internal fixation of the tibia and another four with external fixation devices and one patient with osteomyelitic bone which needed debridement of the bone and postponing the orthopedic management after defect coverage.

The patients were 8 males and one female. Age of the patients ranged from 24 to 61 years.

The flap is approached with the patient in the prone position. A pneumatic tourniquet may be

used during flap elevation but is not necessary. Marking is initiated by identifying the distal aspect of the gastrocnemius muscles and the tendinous intersection between them. A line is then marked from a point halfway between the Achilles tendon and the lateral malleolus at the ankle extending to the midline between the two heads of the gastrocnemius muscle. This roughly describes the course of the medial sural cutaneous nerve [7]. The Doppler probe is then used to identify and mark the peroneal perforators. Typically, four to five of these occupy a zone 5 to 13cm above the tip of the lateral malleolus. Every effort is made to incorporate these perforators into the flap, which often determines the point of rotation. After identifying the lateral perforators, the lesser saphenous vein is identified and marked. Again, every effort is made to incorporate this venous structure within the design of the flap. A decision is made regarding the base width of the flap, designed obliquely to the lateral malleolus, to include the maximum number of lateral perforators. Attention is now focused on elevating, on the posterior calf, thin skin and subcutaneous tissue flaps, which are analogous to mastectomy skin flaps. A point 5cm proximal to the tip of the lateral malleolus would represent the most distal point of safe flap elevation. The flap is then turned into the wound and sutured over drains under minimal tension. We elevated the flap as a fasciocutaneous flap then the flap is rotated from the lateral side of the leg to lie on the wound to cover the defect. While rotating from the lateral side of the leg the lateral skin of the leg which was used as a tunnel to pass the flap from, we use the upper half of this skin as a proximally based fasciocutaneous flap to rotate medially and cover the upper part of the defect as shown in the Figures of the flap. Then the raw area resulting from the two flaps is covered by a split thickness skin graft. Elevation of both flaps leaves a continuous defect and not two defects.

The rotation of this flap has many advantages first it helps in covering larger defects, second the tension which may be done by the tunnel on the reversed sural flap pedicle is not present in this case, lastly it helps to rotate the total flap not an island flap as the pedicle is resting on its place.

Also the flap being proximally based will easily cover the higher area of the defect which was not normally reached (limited to the width of the flap). This modification or we can say addition of this rotational flap to the original reversed sural flap helped in covering larger defects included in our study. This flap size was about 5 X 10 Cm (average).



Fig. (1-A): A case of large leg defect over infected tibia.



Fig. (1-B): Wound and bone debridement the defect is larger.



Fig. (1-C): Rotation of both flaps.

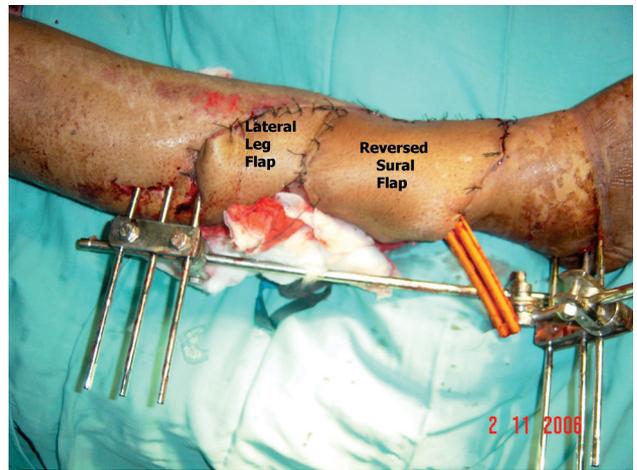


Fig. (1-D): Both flaps labeled showing complete healing of the flaps.

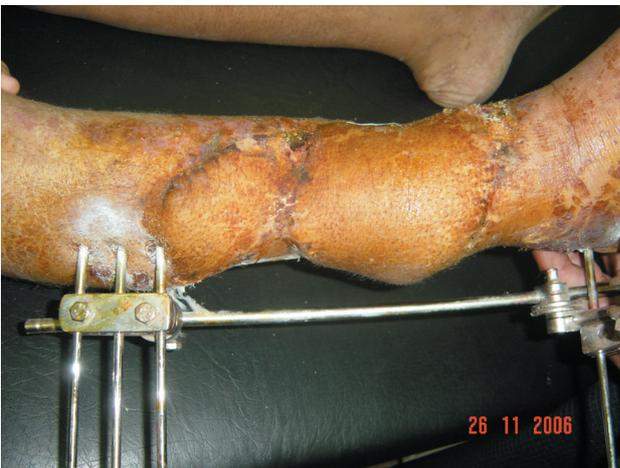


Fig. (1-E): 3 weeks post operative.



Fig. (1-F): Excellent healing of the grafted area.



Fig. (2-A): Osteomyelitic sinuses.

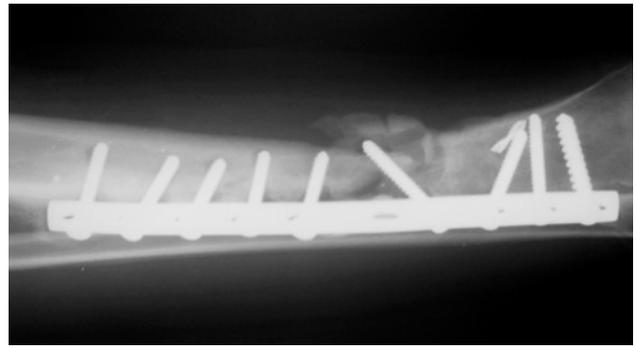


Fig. (2-B): X-ray showing osteomyelitis of tibia (infected plate and screws).



Fig. (2-C): Wound debridement.

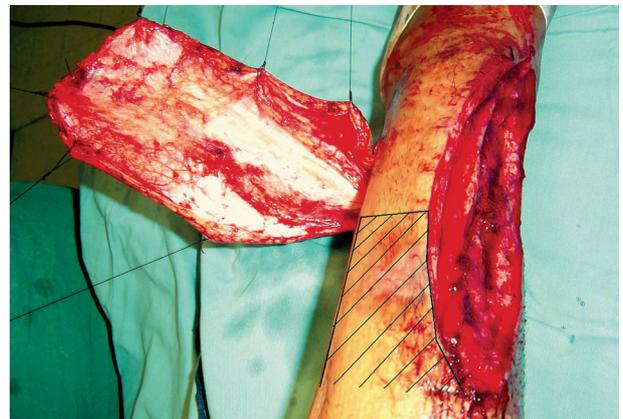


Fig. (2-D): Reversed sural flap elevated lateral leg flap hatched.



Fig. (2-E): Flap after rotation its width is less than the length of the defect.



Fig. (2-F): The lateral leg flap covering the rest of the defect.

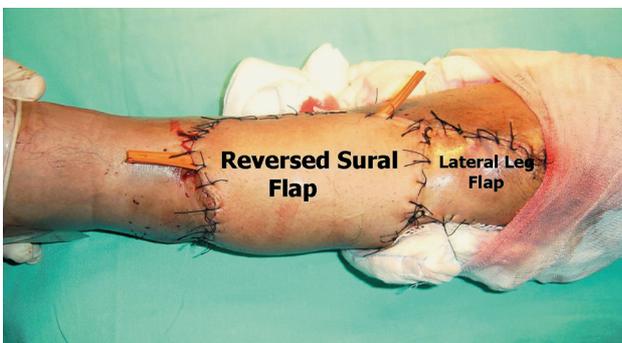


Fig. (2-G): Both flaps labelled.



Fig. (2-H): Late post operative.

RESULTS

Nine cases of leg defects over fractured tibia were included in this study these nine relatively large defects were covered by the combination of distally based reversed sural flap and lateral leg proximally based fasciocutaneous flap.

The patient ages ranged from 24 to 61 years. Eight of them were males and only one female. The fractured tibia was treated by internal fixation in 4 cases and external fixation in another 4 patients, the ninth patient was having osteomyelitis of the bone which needed bone debridement before proper orthopedic management.

The average size of the defect after debridement was about 14.4cm by 5.8cm. The reversed sural flap was used to cover the distal part of the defect and the lateral leg flap to cover the proximal part of the defect. When the reversed sural flap is rotated, the width of the flap should cover the length of the defect if the flap inset is transverse. If the defect position permits the flap to be put obliquely its width will cover a larger area of the length of the defect. In our series of cases the defect could not be covered by the reversed sural flap only. So the lateral leg flap was added to cover a relatively long defect.

A split thickness skin graft was used to cover the donor sites of the flaps. Each patient was followed-up for an average period of 6 to 8 weeks, from the time of operation up to complete healing.

All the lateral proximal fasciocutaneous flaps healed uneventfully over approximately 2 weeks.

Seven cases of the sural flap evolved favorably with perfect healing within a normal period of 15 days. One of the reversed sural flaps had venous congestion of the distal part of it with partial necrosis of the flap this part necessitated daily dressing until granulation tissue covered the defect and split thickness skin graft was put. The other one had wound dehiscence in part of the suture line of the flap to the defect edge this part healed by secondary intention by daily dressing for a period of four weeks. All the donor sites in the nine cases were covered by split thickness skin graft. All the grafts healed primarily with excellent take of the graft, except in one case in which there was partial loss of the graft in the lower part which needed frequent dressing.

DISCUSSION

Defects over the distal part of the leg have always been difficult to cover. Several local and

local-regional flaps have been described during the past two decades; however, some are too small to cover defects over the leg [5]. Free flaps, requiring teams of surgeons and paramedical personnel working in tandem, hold a prominent place in the treatment of these defects, especially when they are extensive (large skin defects, extensive chronic ulcers). We prefer to use the distally based sural neurocutaneous flap [6] because of its numerous advantages (easy execution, reliability, simple postoperative care) compared with the other flaps [3]. The measurements of the flap is related to the width of the back of the leg of the patient. So it will be used to cover small to medium sized defects. This aroused the thinking of addition of any local flap to be used in combination with the reversed sural flap to cover large leg defects. In this work we used the lateral leg proximally based fasciocutaneous flap which proved to be successful with the sural flap to cover larger defects.

The rotation of this flap has many advantages, first it covers wider defects in combination with the reversed sural flap, it also prevent the pressure on the pedicle of the reversed sural flap, lastly the donor site of this flap is continuous with the donor site of the reversed sural distally based flap to give one defect to be covered with a split thickness skin graft.

Conclusion:

The combination of the lateral leg proximal fasciocutaneous flap with the well known reversed sural distally based flap in covering large defects of the lower leg proved to be effective and successful in this small series of patients. As there are no complications regarding this random pattern rotation flap, so its use can be routinely added to the reversed sural flap in large defects. This combination of flaps helped much when the length of the leg defect over the tibia is more than the width of the reversed sural flap harvested. So it appears as if we increase the width of the flap by the proximally based lateral leg flap.

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