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The lateral supramalleolar flap: a reliable option for lower leg and foot reconstruction

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ABSTRACT

Background: The lateral supramalleolar flap is based on a perforator of the peroneal artery, emanating at approximately 5 cm above the lateral malleolus on the anterior aspect of lower third leg.
Methods: Our technique of harvesting the supramalleolar flap is by using a fasciocutaneous pedicle and minimal perforator dissection. We have done 45 cases in the last 7 years and have got favourable results with this technique.
Results: We have not had a single case of total flap necrosis of a supramalleolar flap in our experience over the last 7 years. We routinely perform this flap when the reverse sural flap territory is not available.
Conclusions: The lateral supramalleolar flap is a useful flap for coverage of lower third leg, ankle and dorsal foot defects. If raised as described, the reliability of this flap is increased.

Keywords: Supramalleolar flap, Lower third leg, Foot, Ankle, Reconstruction

INTRODUCTION

The lateral supramalleolar flap was first described by Masquelet et al in 1988.[1] This flap is based on a perforator of the peroneal artery, emanating at approximately 5 cm above the lateral malleolus, with 2-3 ascending cutaneous branches and a deep descending branch.[2] The ascending branches travel in the lateral intermuscular septum between the extensor digitorum longus and peroneus brevis and supply the skin on the lower lateral half of leg. The descending branch runs distally and anastomoses with the anterolateral branch of the anterior tibial artery. A distally based flap based on the perforating branch of the peroneal artery, which can be released as far as its distal most anastomosis around the ankle joint; shifts the pivot point of this flap more distally.[3]

We hereby report our clinical experience with 45 cases of supramalleolar flap done in a tertiary care centre, under the guidance of the first author and share our experience in using this flap as a fasciocutaneous pedicled flap for lower leg, ankle and foot defects.

METHODS

The present study was conducted at the Department of Burns and Plastic Surgery, SMS Hospital Jaipur. Retrospective Data of patients operated in the last 7 years (January 2011- December 2017) for supramalleolar flaps for coverage of lower third leg, ankle and foot defects was collected. All patients from the age of 18-70 years were included in this study. Informed consent and permission for usage of photographic data was obtained from all patients.

The exclusion criteria were patient age <18 and >70 years; extensive crush injury of foot or lower third leg; patients with associated neurovascular injury to the limb.

Operative technique

The procedure is performed under spinal anaesthesia in our centre, with the patient laid in supine position and a pillow under the ipsilateral buttock. The limb is exsanguinated by elevation for 3 minutes and tourniquet applied. The final defect size is measured after debridement and the relevant landmarks are marked as follows:

1. Lateral malleolus.
2. The point where peroneal artery perforator is localized.
3. The axis of the flap is marked by a line joining the anterior tibial crest to the posterior margin of fibula.

Preoperative Doppler of the region above the lateral malleolus is done to identify the perforator of the peroneal artery in all cases. Usually we start at a point 5cm above the lateral malleolus on the axis of the flap and proceed proximally and distally from this point to localize the perforator.

Planning of the flap is done in reverse, a pattern of the flap is made by using sterilized thick foam and the foam is cut as we would cut the skin and tissue from the pivot point to the distal most edge of the flap. This thick a foam helps to estimate the amount of tissue which will be incorporated into turn of the pedicle correctly. The width of the flap at pivot point is kept at least 3 cm. This foam pattern is then transposed to the leg along the axis of the flap.

Flap harvest is done retrogradely in a subfascial plane, preserving the paratenon, especially on the tendinous parts of EDL and peroneal muscles. The superficial peroneal nerve is preserved by gently separating it from the fascia. It is then buried under the muscles and a flat bed is created for graft placement. After flap elevation, the tourniquet is released and hemostasis is ensured. The donor site is covered with a split skin graft and flap insetting is done in a single layer with interrupted vertical mattress sutures.

RESULTS

In a total of 45 flaps performed over a period of 7 years, 34 flaps were done in male patients and 11 flaps were done in females. The average size of the defects was 7×10 cms, the range was from 5×5 cms to 10×9 cms (Table 1 and 2).

Table 1: Demographic data of patients.

Total flaps	Male patients	Female patients
45	34	11

Table 2: Data of defects covered by supramalleolar flap.

	Total number	Healed without intervention	Needed supplemental skin graft	Partial flap necrosis
Ankle defects	29	25	2	2
Dorsal foot defects	10	8	1	1
Lower leg defects	6	5	1	0
Total flaps	45	38 (84%)	4 (8%)	3 (8%)

Figure 1: Preoperative photograph patient 1.

In 39 flaps, wound healing including that of the flap and the donor site graft uptake was uneventful, the healing period from day of surgery to suture removal was 21 days. As shown in Figure 1-3, the flap inset is favourable and with satisfactory graft take for a medial malleolus defect. In 6 patients, we encountered patchy graft loss which were grafted after appearance of healthy granulation by regular dressing for 1-2 weeks.

Figure 2: Postoperative photograph day 10 patient 1.

There was no case of complete flap necrosis, partial flap necrosis occurred in 4 cases, they were managed conservatively for a period of 3-4 weeks postoperatively.

As shown in Figure 4-7, a supramalleolar flap done for a lower third leg and medial foot defect has healed well but with 1 cm of marginal necrosis. This patient was managed conservatively and the eschar was debrided and skin grafted. We did detachment and insetting of flaps by dividing the pedicle of the flap and discarding the limb. We did not encounter any painful neuromas or signs of neuritis as we routinely save and bury the superficial peroneal nerve under the surrounding muscles.

Figure 3: Postoperative photograph day 20 patient 1.

Figure 4: Preoperative photo patient 2.

Figure 5: Intraoperative photograph patient 2.

Figure 6: Intraoperative photograph showing flap.

Figure 7: Postoperative photograph at Day 10 Patient 2.

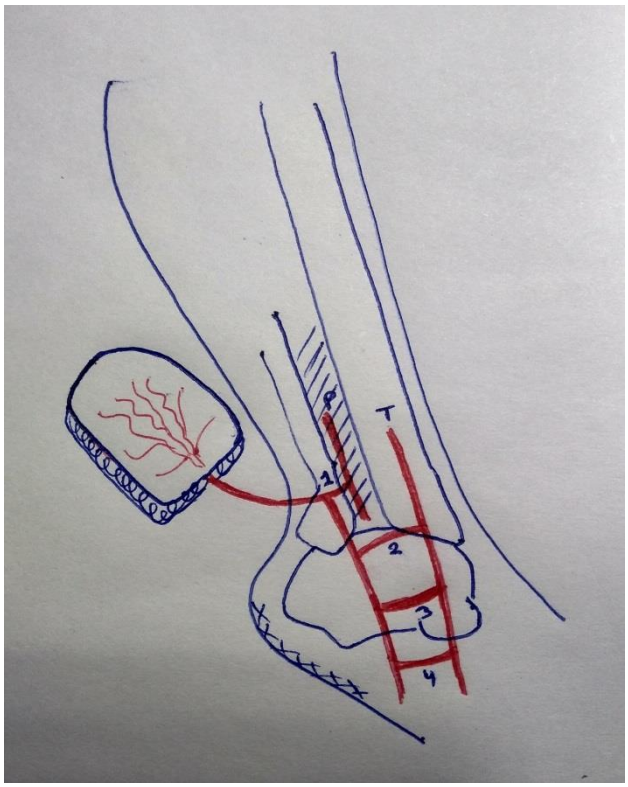

Figure 8: Anatomy of the vessels around the ankle.
P: Peroneal artery; T: Anterior tibial artery; 1: perforator of the peroneal artery, superior branch going into the intermuscular septum and supplying the skin, inferior branch anastomosing with [2]; 2: Anterolateral branch of anterior tibial artery; 3: Lateral tarsal artery; 4: Dorsal arch between dorsalis pedis and tarsi arteries.

DISCUSSION

Coverage of defects of lower third leg has been traditionally managed by distally based fasciocutaneous flaps.[2] These flaps can be either based on

1. Perforating branches of main vascular axis: anterior tibial artery flap.[5]
2. Collateral branches from the main vascular axis: supramalleolar flap.[6]

3. Flaps which cut the main vascular axis: reverse flow posterior tibial artery island flap[7], reverse pedicle anterior tibial flap.[8]

The main advantage of these flaps is a well-defined territory and a reliable vascular axis. The lateral supramalleolar flap and reverse sural flaps are also classified as neurofasciocutaneous flaps.[9]

Rising of a supramalleolar flap has been described using a fasciocutaneous pedicle.[9] We have found this to increase our operative time and increase the risk of flap harvest. Harvest of this flap along with a fasciocutaneous pedicle in our experience has increased the reliability of the flap.

In some descriptions of this flap, division of the perforating branch of peroneal artery, the anterolateral malleolar branch and lateral tarsal artery is recommended.[10] These three arteries can be seen as forming arches between the peroneal artery and the anterior tibial artery. Distal to these three arteries is another dorsal arch between the dorsalis pedis and the tarsi arteries (Figure 8). The proximal three arteries can be divided to get an antegrade blood supply from the anterior tibial artery and shift the pivot point further distally. However, we routinely do not perform this dissection and stop at the first perforator of the peroneal artery. We do this to increase the reliability of our flap as now we have blood supply from both the peroneal and the anterior tibial artery.

It has been studied that the main mechanism of venous return in reverse flow flaps is valvular incompetency rather than veno-venous connections.[11-13] Since all veins have valves, simply increasing the blood pressure will counter the valves. Venous congestion has also been less of a problem in our experience. It might be due to the subdermal plexus and subcutaneous veins acting as a venous efflux from the flap back into circulation. Also, since we leave all the communicating branches between the peroneal and anterior tibial artery intact, venous return from the venae comitantes is also increased.

If the supramalleolar flap is raised carefully, taking care not to disrupt the paratenon, graft take on the donor site can be expected to be reasonably good. In patients with a thick subcutaneous fat layer, we take care to bevel the edges of the flap while insetting the flap into the defect. After completion of the healing process, flap thinning can also be done to improve the contour. However, patients are more bothered by the donor site deformity rather than the recipient site.

The other described and routinely used flap for coverage of similar defects is the reverse sural flap.[14,15] This flap reaches up to the lower third leg, heel, proximal foot and even the midfoot region. So the area it covers is similar to the supramalleolar flap. We routinely do the supramalleolar flap when there is trauma in the region of the sural flap donor area and we have found it to be a reliable flap in our practice. Decreased interest in doing a supramalleolar flap might be due to reports of increased venous congestion with this flap.[16] However, we have not found this in our practice while using a fasciocutaneous pedicle for this flap.

CONCLUSION

The lateral supramalleolar flap is a reliable and useful flap for coverage of lower third leg, ankle and dorsal foot defects. We recommend

- Using this flap along with a fasciocutaneous pedicle; and
- Limiting the dissection up to the perforator of the peroneal artery, to increase the reliability of this flap.

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