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Local Flaps in Lower Leg Defect

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Abstract: ***Whenever bone, osteo-synthesis material, or tendons are exposed in the lower leg, the reconstructive procedure will be a challenge for the reconstructive surgeon. Because of the lack of available local soft tissue, the middle and distal thirds of the lower leg are the most problematic areas. Local flaps continue to be the gold standard for the coverage of lower leg wounds because of their ability to cover large defects with high success rates and feasibility of using it in acute situations.With the introduction of angiosome concept and the availability of handheld Doppler, the incidence of perforator flaps has increased and the need for microvascular reconstruction has come down. Of the muscle flaps, the peroneus brevis flap can be used in lower leg defects around the malleolar region. In spite of all recent advances in microsurgery, cross-leg flaps still continues to remain as a useful technique and can be used as a backup procedure in an urgent situation. In the author's practice local flaps continue to be the first choice of management for coverage of wounds in the lower leg defect.***

Keywords: Local flaps, crossleg flaps, angiosome concept, handheld doppler, perforator flap, peroniusbrevis muscle flap

1. Introduction

Lower limb especially the lower leg is notoriously prone for trauma. This is because of high speed vehicular injury. Bumper fractures with tearing of soft tissues are common in upper leg. In the lower leg, because of sparse soft tissues, bones get exposed. Most muscles become tendons at that level and in the case of soft tissue loss, skin graft may not suffice and flap cover becomes mandatory.

Conventional teaching recommends gastrocnemius muscle and myocutaneous flaps[1] and fasciocutaneous flaps for the upper third leg defects, soleus flaps and posterior calf fasciocutaneous flap for the middle third defects and peroniusbrevis, lateral calcaneal artery and cross leg flaps for the lower third defects. With the introduction of angiosome concept and the availability of handheld Doppler, the incidence of perforator flaps has increased and the need for microvascular reconstruction has come down. In this article, the authors have taken the availability of commonly used local flaps for reconstruction of wound in lower leg defectsand detail the technical aspects which are important for obtaining good results.

2. Materials and Methods

The study involved a period of 18 months from August 2017 to February 2019. Most of the patients are the working force bread earners of the family. Patients age ranging from 20 to 60 years were included. 62 patients with lower leg defects, commomly due to trauma and a small group of patients with tumours and postburn defects were included. Preoperative X-rays of the lower leg and Doppler study of the leg in few cases of major trauma were done. Edge wedge biopsy in tumour were done as preop workup.

Local and Perforator Flaps in Lower Leg Defects

Local transposition flaps can be used to cover small defects in the lower third of the leg and their greatest limitation is the size of the defect they could cover in this region. Increased understanding of the blood flow dynamics has shown us that vessels of small diameter when isolated can supply a large territory of the skin[1]. Local flaps based on the tibial and peronealseptocutaneous perforators can be safely islanded. Flaps based on these perforators can be transposed up to 180 degrees with the base of the perforator as the pivot point. Dissection requires expertise and it can be called as microsurgery without anastomosis.

Figure 1 (A): Soft tissue defect with exposed bone

Figure 1 (B): The defect after debridement

Figure 1 (C): The proposed flap elevated on one side the perforator visualized before the donor area

Figure 1 (D): A well-settled flap and the healed whole flap is raised

These flaps are particularly useful for small- to medium-sized defects around the ankle up to 50 cm^2 in size[1]. For the defects on the medial and anterior leg, propeller flaps based on the perforators of the posterior tibial arterycan be safely used as these perforators are fairly constant and emerge ~8 to 12 cm proximal to the tip of the medial malleolus. On the lateral aspect distally, the peroneal perforators are smaller in size, number and in such a situation, an islanded fasciocutaneous flap based on a perforator adjacent to the defect by propeller technique is a good option.Preoperative identification of the perforators using a handheld Doppler probe is helpful. However, there isa high percentage of false-positive signals. The perforators are best identified on the table by using an exploratory incision. Depending on the number and size of the perforators, one has to be ready to alter the plan. For posterior tibial artery, the exploratory incision is usually made posteriorly taking care to place it over the muscular part and preserve the fascia over the tendoachilles[1,2].

After identifying the perforator of adequate size, a provisional flap design can be drawn with the perforator as the pivot point of the flap. An additional 1 cm length of the flap can be added for easy inset and to avoid kinking.The flap is islanded retaining all the significant perforators to it. After releasing the tourniquet, the flap viability is checked based on the perforator on which it has been planned and in case of finding more than one vessel, a microclamp is placed on one of the vessels to base the flap in only one perforator to allow a rotation of up to 180 degrees,then flap inset is done with loose sutures[3]. The donor defect can be closed primarily or with partial thickness skin graft harvested from contralateral thigh.

Reverse Flow Flap

The reverse flow flap is currently used for reconstruction of small and medium sized wound defect in the distal third of the leg, ankle, and heel. This is a random type of flap, based on the reverse flow of the superficial sural artery, which mainly depends on the anatomy of the perforators of the peroneal artery system.. A constant perforator is available about 5-8 cm proximal to the lateral malleolus.

Figure 2 (A): The defect in the lower third leg exposing the implantsural artery flap

Figure 2 (B): The defect covered by reverse flow

Figure 3 (A): Post traumatic raw area posterior heel pad region

Figure 3 (B): The defect covered by reverse flow sural artery flap.

Muscle Flap

In the distal third of the leg, most muscles become tendons at that level and in the case of soft tissue loss, skin graft may not suffice and flap cover becomes mandatory. However a distally based peroneus brevis muscle flap is a good alternative especially when the defect is around the distal one-third lower leg and the malleolar regions. This is based on the distal perforator of small segmental branches arising from peroneal artery.

Figure 4 (A): A defect in right Tendo-achilles region

Figure 4 (B): The PeroniusBrevis muscle raised

Figure 4 (C): Defect covered

Figure 4 (D): The healed wound with a Primarily closed donor defect

Cross Leg Flap

Cross-leg flaps remain a useful and highly reliable tool for the reconstruction of difficult wounds of the lower limb.It offers the possibility of salvaging limbs that are otherwise nonreconstructable. By incorporating fascia or muscle and the use of external fixator, the versatility of the flap can be enhanced and flap can be raised in a proportion up to 3: 1 to 5: 1. This flap is easy to perform and does not require the sophisticated equipment or expertise of microanastomosis.

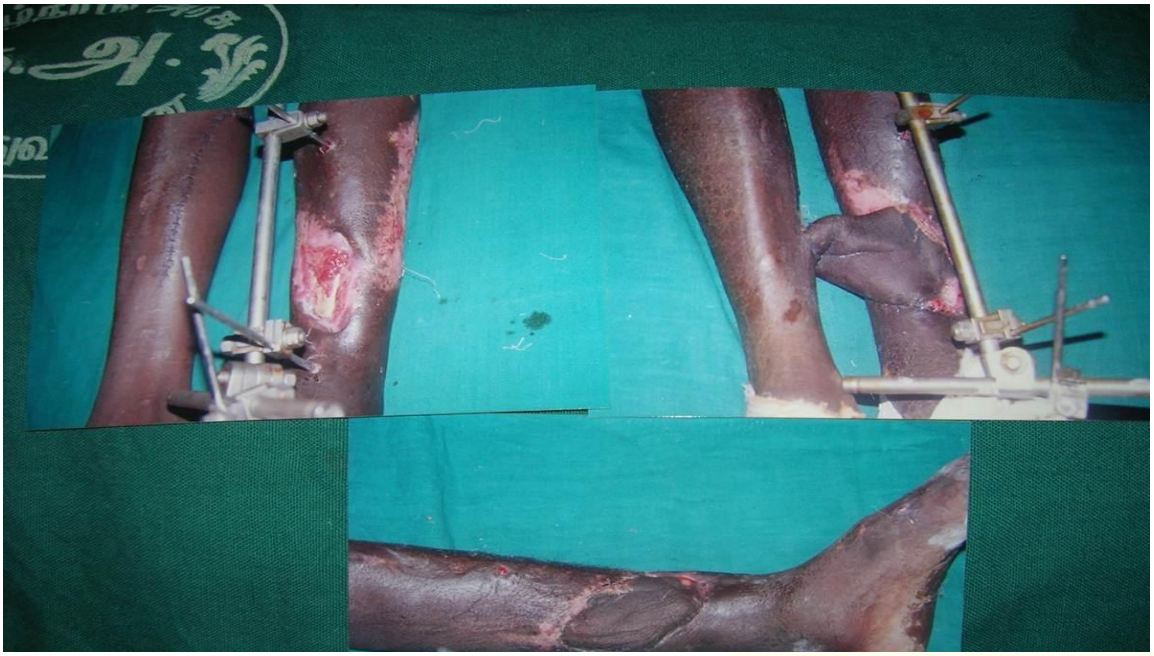

Figure 4 (A): Soft tissue defect with exposed bone in lower-third left leg. B: Distally based cross leg flap, where the proximal edge attaches to the length of the defect C: After completion of reconstruction

Figure 5 (A): Forefoot amputation with raw area

Figure 5 (B): Superiorly based cross leg flap

Figure 5 (C): After completion of reconstruction

3. Discussion

In all these trauma patients after triage, patients were assessed for soft tissue damage. Vascularity of the limb and the fixation modality were discussed with Orthopedic Surgeon in the preoperative planning. The pattern of the flap was also taken into account. Local pedicled flaps were done as fasciocutaneous, myocutaneous, muscle flaps with split skin graft, perforator plus flap, propeller flaps and posterior fasciocutaneous flap. In perforator flaps, preoperative handheld 8 MHZ Doppler is used to locate the perforator. These flaps are used as pedicled transposition, propeller and perforator flaps. With the knowledge of perforators supplying the lower third leg, local flaps and perforator flaps are being done with increasing frequencyand the need for microvascular reconstruction has come down. The common muscle flaps used in lower leg defect are peroniusbrevis muscle flap which are based on the distal perforator of small segmental branches arising from peroneal artery.In spite of all recent advances in microsurgery, cross-leg flaps still continues to remain as a useful technique and can be used as a backup procedure in an urgent situation.

Why the lower leg skin coverage is important and previous

1) Blood supply in the lower third leg is less.
2) Subcutaneous bone with less of soft tissue.

So, achieving early and durable skin cover in lower third leg defect is important.

4. Conclusion

Local flaps are thin pliable and easily available, usually done as a single stage procedure. After the introduction of angiosome concept and availability of handheld Doppler, the incidence of perforator flaps has increased and the need for microvascular reconstruction has come down.

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