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Original Research Article

Micro-vascular reconstruction of complex post traumatic ankle and foot defects with free anterolateral thigh flap: single centre experience

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ABSTRACT

Background: Ankle and foot reconstruction is challenging for plastic surgeon due to paucity of local soft tissue and poor blood supply. Anterolateral thigh (ALT) free flap become popular reconstructive option where microsurgical expertise available.
Methods: Retrospective study of 26 patients of complex post traumatic ankle and foot defect underwent free anterolateral thigh free flap reconstruction during 2 years duration.
Results: ALT free flap provides satisfactory reconstructive option with only 8% flap loss in our study and minimal donor site morbidity. Flap thinning required in 19% patients on long term for adequate shoe fitting.
Conclusions: ALT free flap provide like with like tissue replacement for foot and ankle reconstruction with supple skin cover for subsequent surgeries if required.

Keywords: Post traumatic, Ankle and foot defect, Microvascular reconstruction, Anterolateral thigh flap

INTRODUCTION

Ankle and foot have a unique importance in human form and function by providing dynamic platform on which we maintain upright posture. Due to paucity of soft tissue, this region is particularly sensitive for trauma. Ankle and foot region are very common site of injury following road traffic accidents and reconstruction of the foot and ankle defects are challenging problem for reconstructive surgeons due to paucity of local tissues and poor vascularity.[1] Resurfaced foot must withstand shearing and load bearing forces. Ankle wound are often associated with fracture of bones and proper fixation of bone is must for limb salvage.

The modern era of lower extremity reconstruction was established by Frank Hamilton in 1854 who described a cross-leg flap using a random pattern flap and delay principles.[2] After world wars I and II, the use of tube and pedicle flaps for lower extremity wounds was further elucidated by Sir Harold Gillies and Captain W. J. Stark.[3,4] Free flap transfer has become well established treatment modality in cases where the local tissues of the foot and ankle were inappropriate.[5] In 1973, O'Brien and colleagues described the first free tissue transplant to the lower extremity using a groin flap to cover a wound on the dorsum of the foot and ankle.[6] The anterolateral thigh flap (ALT) first described by Song et al in 1984 and become popular due to its long pedicle length, sizable vessels for microvascular anastomosis, good donor-site profile, large cutaneous surface area can be harvested from a single donor site, it can be harvested as a sensate flap, its thickness can be reliably thinned at the same sitting and can also be harvested with a cuff of vastus lateralis to obliterate dead space.[7]

Objectives

Objective of current study was to evaluate our institutional experience of free anterolateral thigh flap cover for complex post traumatic ankle and foot defect.

METHODS

Retrospective study conducted at tertiary care centre SMS hospital Jaipur, Rajasthan, India from September 2019 to August 2021. Study performed in accordance with the institutional ethics committee and the ethical standards as laid down in the 1964 declaration of Helsinki and all its later amendments. Written informed consent has been obtained from all individuals for use of their clinical photographs in this study. From September 2019 to August 2021 total 26 patients of post traumatic complex ankle and foot defect underwent reconstructions by free anterolateral thigh flap. Patients with superficial wounds requiring minor reconstruction, skin grafts, and local flaps or other than free ALT flap were excluded from the study. Patients have simultaneously injury to other part of limb or body requires reconstruction or admission was also excluded from study. Patient with history of post traumatic defect of ankle and foot managed with free anterolateral thigh flap are included in this study. Patient data was obtained from hospital record and excel software used to analyze data. Patient demographic data (age, sex, associated co-morbid conditions example: smoking, hypertension, diabetes), Local wound condition (site of injury, defect size, duration of injury, radiograph for associated bony injury), and operative procedure related data (procedure performed, early postoperative complications, delayed complications, secondary operation required, hospital stay) were evaluated.

Surgical technique

After complete wound debridement and bony fixation, pattern of defect formed on foam or plastic sheet. Recipient vessel dissection performed for adequate size artery and vein outside the trauma zone. Preoperative perforators located with hand held Doppler in the vicinity of the midpoint of a line between the anterior superior iliac spine and superio-lateral patella. The skin paddle is centered on the perforator signal given by Doppler according to requirements and pattern of the defect. The flap was harvested with the patient in a supine position. A skin incision is made along the medial border of the flap and dissection carried subfascially until perforators are visualized either septocutaneous or musculocutaneous. Septocutaneous perforators run in the intermuscular space between the rectus femoris and vastus lateralis muscles. Musculocutaneous perforators, which penetrated the vastus lateralis muscle, were followed by intramuscular dissection and a small cuff of the muscle was preserved to protect the perforator. Perforators are dissected in retrograde fashion toward the descending branch of the lateral circumflex femoral artery. Dissection proceeds proximally until adequate vascular pedicle length is obtained. After complete pedicle dissection, flap elevated from all around according to the pattern of the defect. Capillary refill and dermal bleeding are evaluated prior to ligation and division of vessels. Donor defect either closed primarily or with a split thickness skin graft. Recipient site flap insetting done with some tagging suture than vessel anastomosis performed. Musculocutaneous flap require grafting over muscle component. Postoperative management include limb elevation, adequate intravenous fluid to maintain hyper dynamic circulation, anticoagulation with heparin for 5 days and then switch over to oral aspirin with clopidogril, flap monitoring done with scratch test every 2 hr for initial 2 days than every 4 hr for 5 days. Outcomes assessment done by flap complications, wound complications, donor site complications, contour adaptation, sensory recovery and need for additional procedures.

RESULTS

Total 26 patients with post traumatic ankle and foot defect underwent reconstructions by free anterolateral thigh flap included in our study (Table 1). Patients age range from 19 years to 45 years and gender distribution was 22 patients male and 4 female in our study. Co-morbid conditions were associated with 5 patients had history of smoking in our study, 4 patients with history of hypertension and in 2 patients with history of diabetes mellitus. Site of post traumatic defect most common was dorsum of foot in 11 patients, lateral malleolus in 7 patients, medial malleolus in 3 patients, sole/planter of foot in 3 and posterior aspect ankle in 2 patients. Free anterolateral thigh flap have Septocutaneous perforator in 4 patients (15%) and musculocutaneous perforator in 22 patients (85%). Fasciocutaneous flap (Figure 1) used in 18 patients and fasciomusculocutaneous flap (Figure 3) in 8 patients.

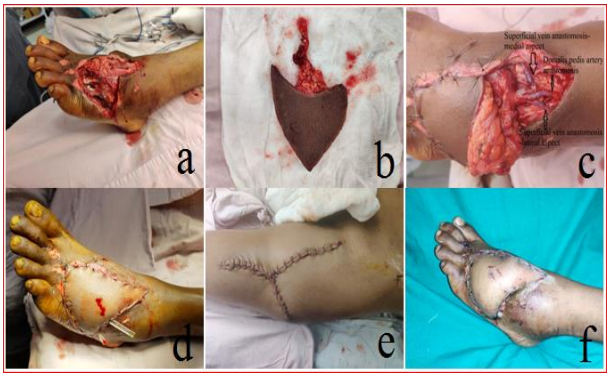

Figure 1: Left dorsum of foot defect covered with free ALT fasciocutaneous flap with donor site primary closure; a) preoperative picture shows defect over dorsum of foot, b) harvested free anterolateral thigh flap with pedicle, c) flap after microvascular anastomosis, d) after complete flap inset, e) donor site primary closure done, f) at 3 week follow up.

Table 1: Patients, wound, flap and outcome analysis.

Patient characteristics	N	%
Age (years)		
11-20	2	8
21-30	9	35
31-40	12	46
41-50	3	11
Sex		
Male	22	85
Female	4	15
Co morbid condition		
Smoking	5	19
Hypertension	4	15
Diabetes mellitus	2	8
Site of defect		
Dorsum of foot	11	42
Lateral malleolus	7	28
Medial malleolus	3	11
Planter surface	3	11
Posterior aspect ankle	2	8
Perforator type		
Septocutaneous	4	15
Musculocutaneous	22	85
Flap component		
Fasciocutaneous	18	69
Fasciomusculocutaneous	8	31
Donor site		
Primary closure	19	73
Split skin grafting	7	27
Recipient vessels		
Artery		
Anterior tibial artery	13	50
Dorsalis pedis artery	8	31
Posterior tibial artery	5	19
Vein		
Both vena comitans	15	58
One vena comitans and one superficial vein	7	27
Both superficial vein	4	15
Flap outcome		
Early re-exploration	6	23
Flap necrosis	2	8
Flap thinning	5	19

Donor site primary closure (Figure 1) achieved in 19 patients and split skin graft (Figure 2) required in 7 patients. Recipient arteries for anastomosis were anterior tibial artery in 13 cases, dorsalis pedis in 8 cases and posterior tibial artery in 5 cases. Recipient veins for anastomosis were both vena comitans in 15 cases, one vena comitans and one superficial vein in 7 cases and both superficial veins in 4 cases. Six patients require re-exploration in postoperative period and 4 patients found venous obstruction due to clot formation and 2 patients have arterial block due to kinking. Two patients developed flap necrosis in post operative period and reoperation required with cross leg flap cover for limb salvage. Flap thinning required in 5 patients in follow-up to wear footwear.

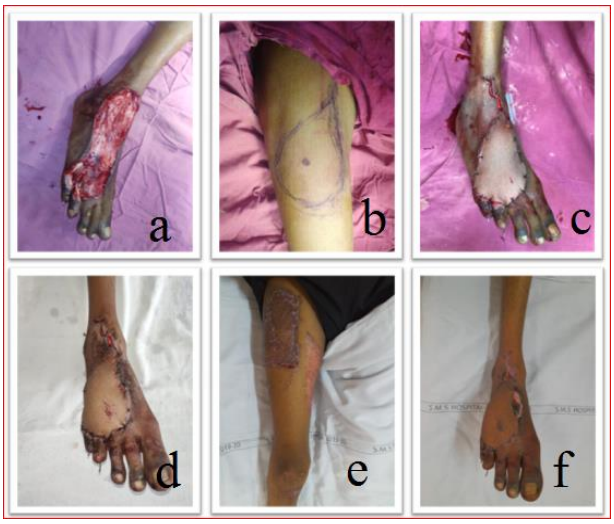

Figure 2: Right dorsum of foot defect covered with free ALT fasciocutaneous flap and donor site covered with split skin grafting; a) preoperative defect over foot dorsum, b) donor site flap marking according to pattern of defect, c) after flap insetting and vascular anastomosis, d) after 1 week duration of flap cover, e) donor site managed with split skin grafting healed well at 3-week duration, f) after 3 week follow up.

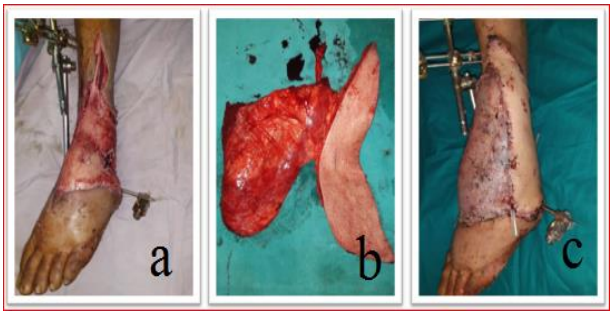

Figure 3: Left ankle defect covered with free ALT fasciomusculocutaneous flap, a) preoperative picture showing defect anterior and lateral malleolus region, b) intraoperative harvested fasciomusculocutaneous anterolateral thigh flap with pedicle, c) after 1 week duration of flap cover.

DISCUSSION

The skin and subcutaneous adipose tissue of the foot and ankle is thin, and reconstruction of soft tissue in this region requires a thin flap to allow for a normal fit into footwear. Primary goal of reconstructing foot and ankle wounds is to preserve function. This can be accomplished by replacing lost or devitalized structures with well-vascularized tissue to enhance underlying bony healing and prevent further soft-tissue desiccation.[8] Reconstruction should be performed as soon as possible (within 72 hours) to reduce infectious complications.[9]

The ALT flap is classically described as a perforator flap, which can be harvested to include skin only or skin and muscle, or as a chimeric flap with a separately perfused skin paddle. The thinned ALT flap, first reported by Koshima et al has been proven to be reliable in clinical application.[10] Saint-Cyr et al believed that primary thinning should not be performed during extended ALT flap harvesting, in order to avoid flap failure.[11] Long vascular pedicle of the ALT flap of approximately 8 to 12 cm in length allows anastomosis to be performed outside the zone of injury. The free-style flap harvest i.e., any cutaneous perforators which can be located by a handheld Doppler probe can potentially be harvested by retrograde dissection as a free flap, regardless of regional anatomy is addressed by Wei et al.[12] Santanelli reported that, flaps without surgical nerve repair showed progressive improvement of sensitive thresholds, achieving a good protective sensibility, similar to the flaps with nerve reconstruction.[13]

Limitations

Relatively low small sample size was the limitation of the current study.

CONCLUSION

The management of foot and ankle wounds can be challenging because of the highly specialized tissues and demands of individual regions. ALT free flap provides like with like tissue replacement for foot and ankle reconstruction with supple skin cover for subsequent surgeries if required.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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