



Plastic Surgery

CLINICAL STUDY AND MANAGEMENT OF LOWER LIMB TRAUMA WITH SOFT TISSUE COVERAGE

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ABSTRACT

Introduction: Aim: The aim of the study is to evaluate lower limb trauma and its management with soft tissue coverage. **Materials and Methods:** 50 patients of lower limb trauma with open wounds presenting to the Surgery OPD or Casualty of Subharti Hospital, referred from medical wards of Subharti hospital OR referred from outside diagnosed as case of avulsion injury between October 2020 to September 2022 were enrolled in the study. **Results:** In our study we found that most of the patients presenting with leg trauma are middle age group male. Skin graft and fascio-cutaneous flap served the purpose of reconstruction in most of the cases. Most common complication was partial flap necrosis. **Conclusion:** Our study may provide useful information to understand to evaluate of soft tissue coverage in lower limb trauma.

KEYWORDS : Limb Trauma, Graft, Free Flap, SSG, Pedicles**INTRODUCTION:**

A flap is a unit of tissue that can be moved from a donor to a recipient site while still receiving its own blood supply. They serve a variety of objectives, including cosmetic enhancement and structural repair. Using cutaneous, musculocutaneous, and fasciocutaneous flaps based along certain dominant vascular pedicles has permitted the direct transfer of tissue that is less reliant on the blood supply of the wound bed. In addition to improving wound covering, they increase local blood flow.¹ Covering the back of the foot, heel, and lower third of the lower leg presents unique technical challenges. The medial and anterior lower leg, as well as the posterior foot and malleolar region, can all benefit from the use of the saphenous flap, making it a versatile and trustworthy option⁽²⁾. The sural flap with a distal origin provides a dependable, fast, and risk-free option for reconstructive surgery. However, depending on the size of the damage, this flap could only be able to cover a spot up to 10cm square. Defects in the heel, which is a weight-bearing area, can be more challenging to repair^(3,4). Providing neurofasciocutaneous coverage with delayed reverse sural flaps has been shown to improve long-term function and rehabilitation after distal tibial and calcaneal fractures. Reducing donor morbidity is possible thanks to the perforator supply to the sural based flap^(5,6,7). Different flaps based on the sural artery, the lateral calcaneal artery, the extensor digitorum brevis muscle, and the abductor hallucis muscle have all been used to successfully cover the foot.⁽⁸⁾ Flaps anchored to the dorsalis pedis are another option typically considered for the foot.^(9,10,11) Successful plantar forefoot repairs using medial plantar flaps, either free or pedicled, have also been documented. This type of flap creates a more sensitive area of the foot, making it more comfortable to bear weight on the forefoot.^(12,13)

Muscle/musculocutaneous flap classification⁽¹³⁾

Type	Pedicle	Example
I	One vascular pedicle	Tensor fascia lata Gastrocnemius
II	One dominant pedicle and minor pedicles	Gracilis Soleus
III	Two dominant pedicles	Gluteus maximus Serratus anterior
IV	Segmental pedicles	Sartorius Extensor hallucis longus
V	One dominant and secondary segmental pedicles	Latissimus dorsi Pectoralis major

AIM:

The aim of the study is to evaluate lower limb trauma and its management with soft tissue coverage.

MATERIALS AND METHODS:

All patients of lower limb trauma with open wounds presenting to the Surgery OPD or Casualty of Subharti Hospital, referred from medical wards of Subharti hospital OR referred from outside diagnosed as case of avulsion injury will be included in the study.

Permission for conducting the study will be granted by Medical Superintendent Office. Approval of Ethics Committee will be taken before starting the study.

Duration Of Study: 1 OCT 2020 - 30 SEP 2022

Type Of Study: Interventional, time bound study

Sample Size: We are expecting a sample size of 50 patients in view of the current admission rate for lower limb trauma patients in our hospital.

Method Of Patient Preparation For Dressing:

The patient's wound(s) were assessed and evaluated for soft tissue coverage in lower limbs based on wound bed score.⁽¹⁴⁾

Clinical assessment of SSG or flap was done on postoperative day 3rd, day 7th and day 10th. Assessment of complications and secondary infections were done and recovery was also assessed.

RESULTS AND OBSERVATIONS:

Debridement, skeletal stability, and providing proper soft tissue cover are all surgical skills necessary for effective management of open, high-velocity lower limb injuries. It is typically challenging yet desirable for orthopaedic and plastic surgeons to coordinate their efforts in a timely manner.

The vast majority of patients (93%) reportedly want to avoid amputation by having a limb salvage treatment instead, and in the case of a chronic wound, reconstruction offers the patient a chance to keep their independence and mobility.⁽¹³⁾

The current study aimed to examine the prevalence of lower limb defects, as well as the limitations and results of different approaches to limb reconstruction. This study also included an analysis of the risk factors and complications linked with lower limb reconstruction.

Lower limb trauma is most common among farmers (44%), middle age men according to the current study. Farmers are more likely to experience lower limb trauma because they work in fields or with heavy gear. Farmers can avoid these injuries by learning to identify and avoid potential foot dangers at work and by having their feet checked routinely.⁽¹⁵⁾

We found that split skin grafts account for the vast majority (54%) of reconstruction cases, followed by fasciocutaneous flaps (38%), muscle flaps with skin grafts (4%), and in very rare instances, cross leg flaps (4%). The majority of patients with lower limb trauma (62%), however, are caused by motor vehicle accidents, while only 2% are caused by injuries sustained in machinery.



Fig –Right showing Split skin graft fixed over raw area, and Left showing Transpositional flap over left heel

In a single-center retrospective cohort research and literature meta-analysis, **Christopher Tam Song et al.** This meta-analysis is the first to show that free perforator flaps in the lower extremity are just as reliable as non-perforator flaps, which has long been assumed. This does necessitate an understanding of the anatomical nuances, care when manipulating these flaps, and a willingness to go back and try again if necessary.⁽¹⁶⁾

Reconstruction choices are presented as a spectrum on the reconstructive ladder. When possible, the quickest and least invasive method should be used to close the wound. In the case of minor cuts, secondary intention is used to permit healing. In cases where local pedicle flaps are either unavailable or too tiny to cover a significant defect, a free flap may be necessary. This is especially true when a substantial defect is present, especially if bone, vascular, or nerve exposure is present. Lower extremity salvage using iIFH retention was the topic of a study by **Hyuma A et al.**¹⁷

Pedicated cross-leg flaps are considered when free or local flaps are not an option, according to research by **Roba Khundkar**⁽¹⁸⁾. The tissue transferred by this flap is of high grade because it comes from the unharmed leg. The donor site is visible on the healthy leg, and it can be difficult to achieve secure immobilisation and placement of the limbs. To get around this, some advocate using external fixators.⁽¹⁹⁾

Patients with lower limb trauma wounds need careful planning that takes into account their specific needs and those of the wound, as well as the severity of the injury, the availability of donor tissue, and the need for bony reconstruction. Among the participants in our study, 6% experienced partial flap necrosis, and 2% experienced partial graft failure. Three of the patients had flap revision surgery, and the fourth had SSG. In order to reduce the risk of complications, we perform reconstructive surgery only after adequate recipient bed formation (i.e., granulation tissue free of infection), and we then perform routine postoperative monitoring of the flap, checking for signs of hematoma, immobilisation, and elevation, as well as checking for compression in the flap's pedicle. Necrosis, which can ultimately result in graft failure, can also be caused by local infections.

Flap infections, flap loss, total flap-specific problems, and total recipient site complications were the major outcomes in a comparable study by **Charles W. Patterson et al.** that analysed 88 patients having free flap repair of traumatic lower extremity wounds over 8 years⁽²⁰⁾.

However, **Michael Wagels and colleagues** conducted a literature assessment on lower limb reconstruction that covered both old and new material. In contrast to our findings, ancient studies focused on wound mortality, amputation mortality, and amputation rate. Lower extremity free flap transplants for soft tissue restoration have been found to have a greater complication rate than transplants in other locations⁽²¹⁾.

Complications from lower extremity free flap surgeries can be minimised and the flap can be protected from edoema and volume overload with the use of elastic compression and patient mobilisation.⁽²²⁾

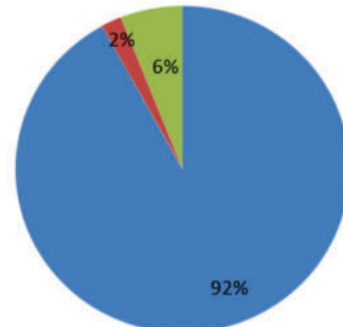
Patients with lower limb damage are more likely to have had an ORIF with nailing and debridement (10% each) than an external fixator application (12%), according to the results of our study. In 42% of these instances, there is no history of surgical intervention.

Patients' ages, body mass indexes, smoking histories, and the number and severity of previous injuries to the affected limb were all shown to

be important factors by **Daniel J Jordan et al.**, crossing scars can rule out both local and distant flap alternatives.⁽¹²⁾

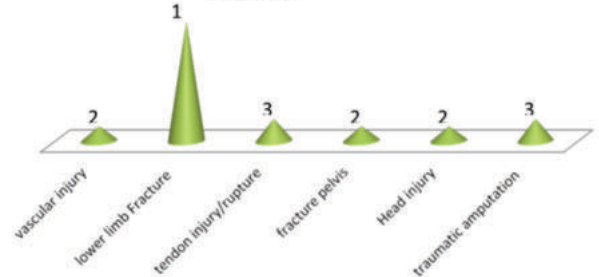
Complication

■ NONE ■ Partial graft failure ■ Partial Flap necrosis



Graph 1 - Complication among study subjects

Associated Injury



Graph 2- Frequency of associated injuries among study subjects

Lower limb fractures are the most often reported secondary injury, occurring in 32% of cases. These fractures may involve the entire lower leg, the tibia, or just the fibula. Soft-tissue injuries were the only reported injury in 46% of patients. Therefore, the plastic surgeon and the orthopaedic team must collaborate for the patient's quickest and healthiest recovery.

CONCLUSION

In our study we found that most of the patients presenting with leg trauma are male of middle age group. Skin graft and fascio-cutaneous flap served the purpose of reconstruction in most of the cases. Most common complication was partial flap necrosis followed by Compression of flap pedicle, infections. Thus judicious use of skin graft / flap is main work horse for lower limb reconstruction.

REFERENCES

1. Soft-tissue coverage of an extensive mid-tibial wound with the combined medial gastrocnemius and medial hemisoleus muscle flaps: the role of local muscle flaps revisited. *J Plast Reconstr Aesthet Surg* 2010; 63(8): e605-10.
2. Lu S, Wang C, Wen G, Han P, Chai Y. Versatility of the Greater Saphenous Fasciocutaneous Perforator Flap in Coverage of the Lower Leg. *J Reconstr Micro Surg* 2014; 30(3): 179-86.
3. Akhtar S, Hameed A. Versatility of the sural fasciocutaneous flap in the coverage of lower third leg and hind foot defects. *J Plast Reconstr Aesthet Surg* 2006; 59(8): 839-45.
4. Mileto D, Cotrufo S, Cuccia G, et al. The distally based sural flap for lower leg reconstruction: versatility in patients with associated morbidity. *Ann Ital Chir* 2007; 78(4):323-7.
5. Ali F, Harunurashid H, Yugasmavanan K. Delayed reverse sural flap for cover of heel defect in a patient with associated vascular injury. A case report. *Indian J Surg* 2013;75(Suppl 1):148-9.
6. Rudig LL, Gercek E, Hessmann MH, Müller LP. The distally based sural neurocutaneous island flap for coverage of soft-tissue defects on the distal lower leg, ankle and heel. *Oper Orthop Traumatol* 2008; 20(3): 252-61.
7. Akhtar S, Hameed A. Versatility of the sural fasciocutaneous flap in the coverage of lower third leg and hind foot defects. *J Plast Reconstr Aesthet Surg* 2006; 59: 839-45.
8. Kilinc H, Bilen BT, Arslan A. A novel flap to repair medial and lateral malleolar defects: anterior tibial artery perforator-based adipofascial flap. *Ann Plast Surg* 2006; 57(4): 396-401.
9. Boopalan PR, Nithyananth M, Titus VT, Cherian VM, Jepegnanam TS. Experience of using local flaps to cover open lower limb injuries at an Indian trauma center. *J Emerg Trauma Shock* 2011; 4(3): 325-9.
10. Sirasanagandla SR, Swamy RS, Nayak SB, et al. Analysis of the morphometry and variations in the extensor digitorum brevis muscle: an anatomic guide for muscle flap and tendon transfer surgical dissection. *Anat Cell Biol* 2013; 46(3): 198-202.
11. Baltensperger MM, Ganzoni N, Jirecek V, Meyer VE. The extensor digitorum brevis island flap: possible applications based on anatomy. *Plast Reconstr Surg* 1998; 101: 107-

- 13.
12. Fu D, Zhou L, Yang S, Xiao B. Surgical technique: repair of forefoot skin and soft tissue defects using a lateral tarsal flap with a reverse dorsalis pedis artery pedicle: a retrospective study of 11 patients. *Clin Orthop Relat Res* 2013; 471(1): 317-23.
13. Daniel J Jordan, Marco Malahias, Sandip Hindocha and Ali Juma .Flap Decisions and Options in Soft Tissue Coverage of the Lower Limb. *Open Orthop J*. 2014; 8: 423–432.
14. Vincent Falanga , Liliana J Saap, Alexander Ozonoff .Wound bed score and its correlation with healing of chronic wounds. *Dermatol Ther*. Nov-Dec 2006;19(6):383-90.
15. Janice A Neil. Lower extremity injuries sustained while farming. *J Agromedicine* .2002;8 (2):45-55.
16. Christopher Tam Song, Keith Koh , Bien-Keem Tan , Terence Goh.Free-Flap Lower Extremity Reconstruction: A Cohort Study and Meta-Analysis of Flap Anastomotic Outcomes between Perforator and Nonperforator Flaps. *J Reconstr Microsurg*. 2018 Jul;34(6):455-464.
17. Charlotte L Bendon ,Henk P Giele . Success of free flap anastomoses performed within the zone of trauma in acute lower limb reconstruction .*J Plast Reconstr Aesthet Surg* 2016 Jul;69(7):888-93. Epub 2016 Mar 10.
18. Hyuma A Leland et al. Microsurgery. Soft tissue reconstruction and salvage of infected fixation hardware in lower extremity trauma 2018 Mar.
19. Roba Khundkar Lower extremity flap coverage following trauma. *J Clin Orthop Trauma*.2019 Sep-Oct; 10(5): 839–844.
20. Charles W Patterson, Mark W Stalder , William Richardson , Thomas Steele, M Whitten Wise , Hugo St Hilaire . Timing of Free Flaps for Traumatic Wounds of the Lower Extremity: Have Advances in Perioperative Care Changed the Treatment Algorithm? *J Reconstr Microsurg*. 2019 Oct;35(8):616-621.
21. Michael Wagels , Dan Rowe, Shireen Senewiratne, David R Theile. History of lower limb reconstruction after trauma. *ANZ J Surg*. 2013 May;83(5):348-53.
22. M Cerny , J-T Schantz, H Erne, D Schmauss, R E Giunta , H-G Machens, T Schenck.. Overview and Introduction of a Treatment Concept for Postoperative Care and Mobilisation After Free Flap Transplantation in the Lower Extremity. *Handchir Mikrochir Plast Chir*. 2016 Dec;48(6):363-369