

## STUDY ON RECONSTRUCTION OF SOFT TISSUE DEFECTS OF LOWER ONE-THIRD OF LEG

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**Abstract**

**Background:** Wounds with soft tissue anomalies remain a challenging task for plastic surgeons, despite advancements in technology. This is mainly due to the reduced vascularity of the skin in the lower third of the leg, which is attributed to its anatomical and structural design. The primary objective of reconstruction is to preserve the aesthetic appearance of the limb while ensuring maximum functionality. **Materials and Methods:** An observational study was conducted at the Department of Plastic Surgery for a duration of one year in patients with soft tissue defects involving the lower one-third of the leg requiring a flap cover. The orthopaedic intervention was obtained as per requirement. Patient data collection was based on age, gender, defect of tissue size, surgical procedure, post-operative complications, and hospital stay. **Result:** The study included 30 patients, with a male predominance of 83.3% and a mean age of approximately 41 years. The majority of patients were between the age of 31-50 years (43.3%), and the majority of the defects were less than 30 cm<sup>2</sup> in size (70.0%). The inferiorly-based fasciocutaneous flap was the most frequently used, accounting for 46.67% of the cases, followed by the inferiorly-based superficial peroneal nerve flaps and the reverse sural neurofasciocutaneous island flap. Edema was the most frequent postoperative complication observed in 10 patients (33.3%), while the majority of patients (53.3%) did not experience any complications post-surgery. **Conclusion:** The study concludes that the inferiorly based fasciocutaneous flap is an excellent option for covering soft tissue defects from the lateral aspect of the leg with hospitalization between 11-20 days after surgery.

## INTRODUCTION

Soft tissue defects of the lower one-third of the leg can result from various causes including trauma, infections, tumours or surgical excisions. The reconstruction of these defects presents a major challenge due to the complex anatomy and biomechanics of the area. The soft tissue cover of the lower leg is thin and adherent to the underlying bone, which limits the options for reconstruction.<sup>[1]</sup> In addition, the rich vascularity of the area requires careful consideration to ensure adequate blood supply to the reconstructed tissue.<sup>[2]</sup> Over the years, several surgical techniques have been developed for the reconstruction of soft tissue defects of the lower leg, each with its advantages and limitations. One of the most commonly used techniques for soft tissue reconstruction of the lower leg is the local flap. Local flaps are based on the principle of utilizing nearby tissues to reconstruct the defect.<sup>[3]</sup> Several types of local flaps have been described for the lower leg, including the inferiorly based fasciocutaneous flap (reverse sural artery flap),

various perforated flap, medial plantar flap, lateral supra malleolar flap, and reverse sural artery island flap.<sup>[4,5]</sup> The choice of flap depends on the size and location of the defect, the availability of tissue, and the surgeon's preference and experience. In cases where local flaps are not feasible, distant flaps may be used. Distant flaps involve harvesting tissue from a distant site and transferring it to the defect site. The most commonly used distant flaps for lower leg reconstruction are the free flaps and cross leg flaps. Free flaps which are based on a vascular pedicle and can be transferred to the defect site as a composite tissue unit.<sup>[6]</sup> Free flaps have the advantage of providing a large amount of well-vascularized tissue, but they also require a longer operating time, and the risk of flap failure is higher than with local flaps.

The choice of reconstruction technique should be based on several factors, including the size and location of the defect, the presence of underlying bone or hardware, the patient's comorbidities, and the surgeon's experience and preference.<sup>[7]</sup> In addition, the patient's expectations and desires should also be taken into consideration when

selecting the appropriate reconstruction technique. Regardless of the reconstruction technique used, attention must be given to ensuring adequate blood supply to the reconstructed tissue. The blood supply to the lower leg is complex, with multiple arteries and veins supplying the area. The anterior tibial artery and vein, posterior tibial artery and vein, and peroneal artery and vein all contribute to the blood supply of the lower leg.<sup>[8]</sup>

The surgeon must carefully plan the incisions and flap design to avoid disrupting the blood supply to the area. The reconstruction of soft tissue defects in the lower one-third of the leg is a challenging task that requires careful planning and consideration of multiple factors. Local flaps and free flaps are the most commonly used techniques for reconstruction, each with its advantages and limitations. The choice of reconstruction technique should be based on several factors, including the size and location of the defect, the presence of underlying bone or hardware, the patient's comorbidities, and the surgeon's experience and preference. Regardless of the technique used, attention must be given to ensuring adequate blood supply to the reconstructed tissue.

## MATERIALS AND METHODS

This study aimed to evaluate the effectiveness of different surgical techniques for reconstructing soft tissue defects of the lower one-third of the leg. An observational study was conducted for patients who underwent soft tissue reconstruction surgery for lower leg defects at a tertiary care hospital. The study was approved by the ethics committee. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for reporting observational studies.

### Inclusion Criteria

Patients with soft tissue defects of the lower one-third of the leg, underwent surgical reconstruction using one of the following techniques: inferior based fasciocutaneous flap (reverse sural artery flap), medial plantar flap, anterolateral thigh flap, perforator flaps and superficial peroneal nerve based flaps.

### Exclusion Criteria

Patients with incomplete medical records or those who underwent reconstruction with a different surgical technique were excluded from the study.

### Data Collection

Demographic data, including age, sex, comorbidities, and defect size, were collected from the medical records. Surgical details, including the type of flap used, flap size, flap survival, and complications, were also recorded.

The primary outcome measure was flap survival, defined as the absence of any major flap-related complications requiring additional surgery or resulting in flap loss. Secondary outcome measures included the occurrence of complications such as wound dehiscence, infection, hematoma, or seroma.

### Data Analysis

Data were analyzed using descriptive statistics. Continuous variables were expressed as means and standard deviations or medians and interquartile ranges, depending on the normality of the distribution. Categorical variables were expressed as frequencies and percentages.

The Kaplan-Meier method was used to estimate the survival rate of the flaps, and the log-rank test was used to compare the survival curves between the different flap types. Multivariate logistic regression analysis was performed to identify factors associated with flap failure and complications.

All statistical analyses were performed using IBM SPSS Statistics version 28.0 (IBM Corp., Armonk, NY, USA). A p-value <0.05 was considered statistically significant.

## RESULTS

[Table 1] represents the distribution of patients by age group who underwent soft tissue reconstruction surgery for the lower one-third of the leg defects. The study included 30 patients, with an equal distribution of male and female patients. The majority of the patients were between the age of 31-50 years (43.3%), followed by patients who were <20 years and 21-30 years (16.7% each). The remaining patients were between the age of 51-60 years (16.7%) and >61 years (6.7%). Overall, the study sample had a wide range of age groups, with a mean age of approximately 41 years.

**Table 1: Age distribution of patients**

Age group	Frequency	Percentage
<20	5	16.7%
21-30	5	16.7%
31-40	6	20.0%
41-50	7	23.3%
51-60	5	16.7%
>61	2	6.7%
Total	30	100.0%

A male predominance was reported in the current study with 25 males (83.3%) and five females (16.7%) respectively. [Table 2]

[Table 3] represents the distribution of soft tissue defect sizes in the lower one-third of the leg among patients who underwent surgical reconstruction. The study included 30 patients, with the majority of the defects being less than 30 cm<sup>2</sup> in size in 21 patients (70.0%). The remaining defects were between 31-90 cm<sup>2</sup> in seven patients (23.3%) and greater than 91 cm<sup>2</sup> in two patients (6.7%). Overall, the majority of the defects were small to moderate in size.

**Table 2: Gender distribution**

	Frequency	Percentage
Male	25	83.3%
Female	5	16.7%

**Table 3: Size of the soft tissue**

Size (cm <sup>2</sup> )	Frequency	Percentage
<30	21	70.0%
31-90	7	23.3%
>91	2	6.7%

The inferiorly based fasciocutaneous flap was the most frequently used flap (conventional sural flap), accounting for 46.67% of the cases (n=14). This flap is based on the perforating branches of the peroneal artery and vein with sural nerve, and it is an excellent option for covering soft tissue defects from the lateral aspect of the leg. The inferiorly based superficial peroneal nerve flaps were used in 20.00% of the cases (n=6), based on the superficial peroneal artery, and can be used to cover defects on the medial and lateral aspects of the leg. In addition, a reverse sural neurofasciocutaneous island flap was also used in 20.00% of the cases (n=6). Other flaps such as the peroneus brevis muscle flap, the propeller flap, the anterolateral thigh-free flap, and the latissimus dorsi-free flap were used in a smaller percentage of cases (3.33% each) in single patients. [Table 4]

**Table 4: Flap used for reconstruction**

Flap	Frequency	Percentage
Inferiorly based fasciocutaneous flap with sural nerve	14	46.67%
Inferiorly based fasciocutaneous flap with superficial peroneal nerve	6	20.00%
Reverse sural neurofasciocutaneous island flap	6	20.00%
Peroneus brevis muscle flap	1	3.33%
Propeller flap	1	3.33%
Anterolateral thigh-free flap	1	3.33%
Latissimus dorsi-free flap	1	3.33%

Out of 30 patients, 14 (46.7%) had a stay of fewer than 10 days, 15 (50.0%) stayed for 11-20 days, and 5 (16.7%) had a stay of more than 21 days. The majority of patients stayed for 11-20 days after surgery. [Table 5]

**Table 5: Duration of hospital stay**

Duration of stay	Frequency	Percentage
<10	14	46.7%
11-20	15	50.0%
>21	5	16.7%

The study analyzed postoperative complications in 30 patients, where 16 (53.3%) did not experience any complications. Dehiscence was observed in only 1 patient (3.3%), while three patients (10.0%) experienced necrosis and 10 patients (33.3%) had edema. Notably, edema was the most frequent complication observed in 10 patients (33.3%). It is worth noting that the majority of patients (53.3%) did not experience any complications post-surgery.

**Table 6: Post-operative complications**

Complications	Frequency	Percentage
Nil	16	53.3%
Dehiscence	1	3.3%
Necrosis	3	10.0%
Edema	10	33.3%

## DISCUSSION

Due to poor vascularity, dependent location, and limited locally accessible tissue, reconstruction of the lower third of leg lesions is difficult.<sup>[8]</sup> The reconstructive surgery was conducted on a total of

30 patients in our study with a size of tissue defect <30 cm<sup>2</sup> in 21 patients, followed by 7 patients with tissue defect size between 31-90 cm<sup>2</sup>. The use of inferiorly based fasciocutaneous flap was observed in 14 patients (46.7%) of the total study population for reconstructive surgery, followed by inferiorly based superficial peroneal nerve flaps, and reverse

sural neurofasciocutaneous island flap in six patients each (20.0%) respectively. Good outcomes were reported with the use of a flap as an alternative for covering wounds with exposed bones without fractures. Several studies have reported positive results with the use of Fasciocutaneous flaps with better reconstructive ability.<sup>[8,9]</sup> However, the main drawback of perforator flaps is the high risk of congestion and the requirement of advanced skills for raising the flaps as reported by Jainath et al, an Yasir et al.<sup>[10-12]</sup>

The use of reversal sural artery island flaps (RSAF) was reported in six patients in the present study accounting for 15% of the study population. A similar finding was also reported by Mahesh et al. with the use of reverse sural artery flaps in 15% of the study population. RSAF is a highly useful flap for foot and ankle abnormalities because of its consistent vascularity, low donor site morbidity, lack of functional muscle loss, and the wide arc of rotation. The sural artery flap can be modified in several ways. The loss of sensation, which is a drawback of RSAF, can be mitigated via sural nerve preservation.<sup>[13]</sup> Edema was the most common complication observed in our study comprising of 10 patients (33.3%). However, infection was the most common infection observed by Mahesh et al., and Kumar et al.<sup>[9,10]</sup> The duration of hospital stay was majorly between 11-20 days in 15 patients (50.0%), followed by <10 days in 14 patients (46.7%), and >21 days in five patients (16.7%) respectively. The average hospital stay was the shortest in muscle flaps and fasciocutaneous flaps (60% of patients were released within 10 days) and the longest in free flaps (2-3 weeks). This is analogous to other research studies.<sup>[9,10]</sup>

The current study reports Fasciocutaneous flaps as the cost-effective and efficient method for the reconstruction of tissue defect in the lower one-third of the leg.

The present study provides valuable insights into the distribution of patients by age group, size of the soft tissue defect, the frequency of various flaps used, and postoperative complications in patients who underwent soft tissue reconstruction surgery for the lower one-third of the leg defects. The results indicate that the inferiorly based fasciocutaneous flap is the most frequently used flap and edema is the most common postoperative complication observed. Further studies with larger sample sizes are needed to validate these findings.

## CONCLUSION

The lower third of leg injuries is a common presentation at the emergency room, and when soft tissue protection is required, a range of solutions are

available. Inferior based fasciocutaneous flaps were the most commonly done procedure with good outcomes in our study for covering exposed fracture sites with infected wounds in the lower portion of the leg.

Technically difficult and time-consuming free flaps are still the gold standard for covering soft tissue abnormalities in the lower portion of the leg. However, with a better understanding of the vascular anatomy of the lower limb, a broad range of loco-regional flaps have been produced, and they are a useful alternative to free flaps, particularly where microsurgical facilities are unavailable.

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