

**Reconstructive Strategies for Upper One Third Leg Defects****S. Ganga Bhavani<sup>1</sup>, M. Vijaya Chandra Mouli<sup>2</sup>, D. Sindhu Priyanka<sup>3</sup>, M. Manjula Bai<sup>4</sup>,  
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**Abstract****Background:** Soft-tissue defects of the upper one-third of the leg present a significant reconstructive challenge due to the limited availability of local soft tissue and the frequent exposure of bone, tendons, and implants. Early reconstruction using well-vascularized tissue is essential to reduce infection, promote wound healing, preserve limb function, and improve overall outcomes. This study evaluated the reconstructive methods employed for upper one-third leg defects and assessed their clinical outcomes.**Methods:** A prospective observational study was conducted on 30 patients with upper one-third leg defects admitted to the Department of Plastic and Reconstructive Surgery, Government General Hospital, Kurnool, over a two-year period. Patients aged 15–60 years with defects secondary to trauma, burns, or postoperative wound complications were included. Clinical evaluation, appropriate investigations, wound debridement, and reconstruction using suitable flap techniques were performed. Patients were followed postoperatively to assess flap survival, complications, and hospital stay.**Results:** The mean age of the patients was  $40.53 \pm 10.08$  years, with males accounting for 83.3% of cases. Road traffic accidents were the most common cause (83.3%), followed by postoperative defects (13.3%) and electrical burns (3.3%). The anteromedial aspect of the right leg was the most frequently affected site. The mean defect size was  $14.17 \pm 8.98$  cm<sup>2</sup>. The medial head gastrocnemius muscle flap with split-thickness skin graft was the most commonly performed reconstructive procedure (36.7%), followed by advancement flaps (23.3%). The mean hospital stay was  $9.23 \pm 3.49$  days. Successful wound coverage was achieved in the majority of patients, with 80% experiencing no postoperative complications. Flap tip necrosis and graft loss occurred in 10% of patients each.**Conclusion:** The medial head gastrocnemius muscle flap remains a reliable and versatile option for reconstruction of upper one-third leg defects, providing effective soft-tissue coverage with a low complication rate. Appropriate flap selection based on defect characteristics facilitates limb salvage, functional recovery, and favorable clinical outcomes.**Keywords:** Upper One-Third Leg Defects; Gastrocnemius Muscle Flap; Soft-Tissue Reconstruction; Split-Thickness Skin Graft.

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**Introduction**

Soft-tissue defects of upper one third leg presents a significant challenge in reconstructive surgery. Among the traumatic injuries, open tibial fractures are the main cause of soft tissue defects in legs because the anteromedial surface of the tibia is relatively subcutaneous and vulnerable to exposure following trauma.

In addition to the trauma, several other causes contribute to upper one third leg defects including electrical burns, post-operative wound or after arthroplasty with implant exposure, post cellulitis defects and post oncological resection. The increasing incidence of such cases emphasizes the

importance of timely intervention to achieve adequate coverage and to avoid complications.

Plastic surgeons must continually evaluate and refine their reconstructive approaches ensuring that outcomes are critically assessed to improve the patient care. This has led to the recognition that there are relatively few consolidated studies specifically addressing reconstructive strategies for upper one third leg defects. The current study has therefore been designated with the objective of evaluating available reconstructive methods and clarifying their role in managing such defects. Clinical studies in this field not only to document outcomes but also to assess the effectiveness of various techniques in minimizing the complications.

Various reconstructive choices for the coverage of soft tissue defects of upper one third of leg are available depending on the location, size and depth of the defect. A wide range of reconstructive techniques including local axial pattern fasciocutaneous flaps, musculocutaneous flaps, and muscle flaps perforator based flaps, cross leg flaps and free flaps. Classification of the severity of wounds such as that described Gustillo assists in guiding reconstructive planning and predicting the prognosis. While considering reconstructive options, the plan must always be tailored to the individual patients needs and due attention be given to functional outcome.

Early reconstruction with a well-vascularized tissue associated with excellent healing, improved osteogenesis, low rate of infection while reducing hospital stay and needed for repeated debridements. Aim of reconstructive surgery in the lower extremity is not only wound closure but also the restoration of optimal function ensuring a better quality of life than what would be achieved with an amputated stump and prosthesis.

**Aim:** To study the various reconstructive methods employed for defects of upper one third of leg.

**Objectives:** To study the incidence, age, sex, etiology and presentation of upper one third leg defects. To study the versatility of various flaps used in reconstruction of upper one third of the leg defects.

**Materials & Methods:** A prospective study done in 30 patients with upper one third of leg defects who were admitted under the Department of Plastic and Reconstructive Surgery, Government General Hospital, Kurnool for a period of two years.

**Inclusion Criteria:** All patients aged between 15 and 60 yrs with upper one third leg defects exposing vital structures secondary to: Trauma, Burns, Post-operative defects. **Exclusion Criteria:** Patients with neurological illness and arterial

injury. Patients less than 15years and more than 60years.

Most of the patients came to plastic surgery department immediately after the trauma. Few patients were referred from orthopedics department for coverage of soft tissue defect after stabilization of fracture site. After receiving the patient, history was taken looking in to the etiological factors of the defect and relevant history and patient co-morbidities. Each patient was subjected to thorough clinical examination to assess the present status of the wound, structures exposed, size and location of the defect and vascularity of limb.

All patients underwent baseline investigations like Complete Blood Picture, Renal function tests, Serum total proteins and Albumin, Serum viral markers - HIV, HbsAg and HCV, Random blood sugar, X-ray chest and ECG. X-ray of the affected leg was taken to know the status of bone and Doppler studies done to know the vascularity of the limb. Pus for culture and sensitivity was sent for cases with signs of infection and significant visible purulent discharge. Most of the patients were operated under spinal anesthesia, Debridement of wound was done to create the true defect followed by primary flap cover.

Patients admitted with electrical burns were initially resuscitated from the burn shock after hemodynamic stabilization of patients. Detailed systemic examination of the patient and local examination of the wound was done. Once the patient was found fit for surgery patient was taken up for serial debridement and then was taken up for delayed flap cover. All the patients were kept under constant follow up.

## Results

**Age:** The mean age of study participants was 40.53±10.078 years. Majority (36.7%) of the study participants belonged to the age group of 41 to 50 years followed by 31 to 40 years (30%), 21 to 30 years (16.7%) and 51 to 60 years (16.7%). **Gender:** Majority of the study participant in the study were male (83.3%) followed by female (16.7%). **Mode of Injury:** Majority (83.3%) of the study participants had road traffic accidents as the etiology while 13.3% of them had post-operative defect exposing implant and 3.3% of them had electric burns as etiology.

**Time of presentation:** Majority (53.3%) of the study participants presented within took 4 weeks, about 23.3% took <1 week, about 10% of them presented in 2 months and another 10% also took 5 months of time and 3.3% of them presented within a year. **Limb involvement:** Among the majority (53.3%) of the study participants right limb was involved followed by left (46.7%). **Site of Leg:** Among 53.3% of the study participants had defect

on anteromedial site of the leg while 46.7% of them had on the anterolateral site of the leg.

**Nature of defect:** About 46.7% of the study participants had defect exposing the fracture segment, 33.3% had defect with surrounding raw area and 20% had only defect. Size of the defect: The mean size of defect of the study participants was  $14.17 \pm 8.975$ . Among the study participants about 20% of them had 4cm<sup>2</sup> as the size of defect i.e., small size defects. Among the medium size defects, 23.3% of all the study participants had size of 9 cm<sup>2</sup>, 16.7% of them had 12 cm<sup>2</sup>, 13.3% had 15 cm<sup>2</sup>. Among the large size defects, about 10% of the study participants had 24 cm<sup>2</sup>, 6.7% of them had 25 cm<sup>2</sup> and another 6.7% had 30 cm<sup>2</sup> only 3.3% had 36 cm<sup>2</sup> of defect.

**Reconstructive Procedure:** Among the study participants majority (36.7%) of them had medial head of gastrocnemius muscle flap & SSG as a procedure of reconstruction, 23.3% of them had advancement flap, 10% each had lateral head of gastrocnemius muscle flap & SSG, inferiorly based fasciocutaneous flap and Superiorly based fasciocutaneous flap, about 6.7% had medial head of gastrocnemius myocutaneous flap and 3.3% had lateral head of gastrocnemius myocutaneous flap.

**Duration of hospital stay:** The mean of the duration of hospital stay of all the patients was  $9.23 \pm 3.491$  days. Majority (83.3%) of them > 1 week while about 16.7% of them had hospital stay of <1 week. Complications: Most of the study participants (80%) had no complications, about 10% of them had flap tip necrosis and 10% of them had graft loss.

## Discussion

A common and difficult issue in reconstructive surgery is soft-tissue abnormalities of the upper one-third of the leg. Local fasciocutaneous flaps, local muscle flaps, and microvascular free tissue transfers have all been better understood in recent years, leading to improvements in soft tissue management. Depending on the location, size, and depth of the soft tissue defect, there are several reconstructive options for 13 covering upper portion of the leg. Local axial pattern fasciocutaneous flaps, musculocutaneous flaps, muscle flaps, perforator-based flaps, cross-leg flaps, and free flaps are among the reconstructive alternatives.

After trauma, the comparatively exposed anteromedial part of the tibia need specific soft tissue protection to prevent bone exposure. Patients with leg abnormalities are more common at this institute because several etiological variables that must be addressed as soon as possible to avoid problems, such as electrical burns, trauma from RTA, post-operative wounds or following

arthroplasty with implant exposure, and post-oncological resection.

A clinical research on the treatment of upper one-third defects, including simple and complex leg defects, was conducted in order to evaluate the different reconstructive techniques for leg defects and to improve the caliber of the work performed in order to achieve favorable outcomes with the fewest potential consequences.

A prospective study was done from 2023 to 2025 in the department of Plastic and Reconstructive surgery, GGH, Kurnool among all the patients with post traumatic defects of upper one third of leg with exposed vital structures to evaluate various reconstructive options for upper one third of the leg defects and their merits and demerits. To analyse the incidence, age, sex, aetiology of the defects of the leg and to study the versatility of various flaps used in reconstruction of upper one third of the leg defects.

**Age:** In the current study the mean age of study participants was  $40.53 \pm 10.078$ . Majority (36.7%) of the study participants belonged to the age group of 41 to 50 years followed by 31 to 40 years (30%), 21 to 30 years (16.7%) and 51 to 60 years (16.7%). In a study conducted by Naik et al [1], it was noted that majority (45%) of them were 20 to 30 years of age, followed by 31 to 40 (25%), 41 to 50 years (15%) and 51 to 60 years (15%) with 35 as the mean age of all the study participants. In a study conducted by Rao.J et al [3] it was noted that most of the patients were belonged to the age group of 26 to 50 years (56%), followed by 16 to 25 years (28%), remaining 8% each were 0 to 15 years and >50 years. In a study by Adbelmoheed AM et al [2] it was noted that common age group was 21 to 40 years (74.1%) followed by >45 years (25.9%). In a study conducted by Akhtar MS et al [4] it was noted that most of the patients belonged to the age group of 20 to 30 years (38%) followed by 51 to 60 and >60 years with 19% each. The 31 to 40 years & 41 to 50 years of age group were 12% each.

**Gender:** In the current study, the most of the patients were male (83.3%) followed by female (16.7%). In a study by Naik et al [1] similar to our study it was noted that most of the patients were male (95%) followed by female (5%). In a study conducted by Rao.J et al [3], it was noted that most of the patients were male (88%) followed by female (12%) similar to present study. In a study by S. Lagvankar et al [5] similar to our study most of the patients were male (100%). In a study by Adbelmoheed AM et al [2] similar to our study the most of the patients were male (85.2%) followed by female (14.8%).

**Aetiology:** In the current study majority (83.3%) of the study participants had road traffic accidents as

the etiology while 13.3% of them had post-operative defect exposing implant and 3.3% of them had electric burns as etiology. In a study by Naik et al similar to our study that the most common etiology was trauma-Road traffic accidents (80%), followed by electric burns (15%) and post-operative defect exposing implant (5%). In a study by Adbelmoheed AM et al [2] similar to our study it was noted that the most common etiology was trauma (74.1%) followed by tumors (25.9%). In a study by Akhtar MS et al [4] similar to our study it was noted that among all the patients, the etiology was trauma (62%) followed by burns and infections with 13% each. About 6% each of had tumour excision and post arthroplasty wound dehiscence.

**Time of presentation:** In the current study majority (53.3%) of the study participants presented within 4 weeks, about 23.3% took <1 week, about 10% of them presented in 2 months and another 10% also took 5 months of time and 3.3% of them presented within a year. In a study by Naik et al, most of the patients in contrast to the present study, presented within a week (50%), followed by 4 weeks (25%), 2 months (15%), 5 months (5%) and 1 year (5%).

**Limbs Involved:** In the current study among the majority (53.3%) of the study participants right limb was involved followed by left (46.7%). In a study by Naik et al similar to our study it was noted that among the majority (60%) of the study participants right limb was involved followed by left limb (40%).

**Site of leg:** In the current study among 53.3% of the study participants' had defect on anteromedial site of the leg while 46.7% of them had on the anterolateral site of the leg. In a study by Naik et al similar to our study it was noted that majority (55%) of the study participants had defect on the anteromedial site of leg followed by anterolateral site (45%).

**Nature of defect:** In the current study about 46.7% of the study participants had defect exposing the fracture segment, 33.3% had defect with surrounding raw area and 20% had only defect.

In a study by Naik et al similar to present study, it was observed that most of the patients had defect exposing the fracture segment (45%), while about 25% of them had defect with surrounding raw area and 30% of them had only defect.

**Size of defect:** In the current study the mean size of defect of the study participants was 14.17±8.975. Among the study participants about 20% of them had 4cm<sup>2</sup> as the size of defect i.e., small size defects. Among the medium size defects, 23.3% of all the study participants had size of 9cm<sup>2</sup>, 16.7% of them had 12 cm<sup>2</sup>, 13.3% had 15 cm<sup>2</sup>. Among

the large size defects, about 10 of the study participants had 24 cm<sup>2</sup>, 6.7% of them had 25 cm<sup>2</sup> and another 6.7% had 30 cm<sup>2</sup> only 3.3% had 36 cm<sup>2</sup> of defect. In a study by Naik et al [1] similar to our study it was noted that the mean size of defect was 14cm. The size of the defect ranged from 4 to 36 sq.cm, they had medium size defects and 25% of them had large size defects. In a study by Rao J et al [3] it was observed that Maximum size about 20% of them had 4cm<sup>2</sup> as the size of defect i.e., small size defects, 55% of defect that was covered by gastrocnemius myocutaneous flap was 16 cm in length, while most of the defects were of 5-10 cm in size.

**Procedure of reconstruction:** In the current study among the study participants majority (36.7%) of them had medial head of gastrocnemius muscle flap & SSG as a procedure of reconstruction, 23.3% of them had advancement flap, 10% each had lateral head of gastrocnemius muscle flap & SSG, inferiorly based fasciocutaneous flap and Superiorly based fasciocutaneous flap, about 6.7% had medial head of gastrocnemius myocutaneous flap and 3.3% had lateral head of gastrocnemius myocutaneous flap.

In a study by Naik et al [1] commonest flap cover were Gastrocnemius flaps in 70% cases followed by Fasciocutaneous Flaps in 20% cases. Venous flap in 5% of study participants and Advancement Flap among 5%. Gastrocnemius muscle flaps were done among 45% patients. In 5 patients (25%) Gastrocnemius Myocutaneous flap were done (3 medial head of Gastrocnemius Myocutaneous Flaps and 2 Lateral head of Gastrocnemius Myocutaneous Flaps). Fasciocutaneous Flaps were done in 4 patients (20%), superiorly based in 2 patients (10%) and inferiorly based in 2 patients (10%) had inferiorly based anteromedial thigh fasciocutaneous flap followed by anterolateral thigh fasciocutaneous flap.

In a study by Adbelmoheed AM et al [2] it was noted that among the majority (51.8%) of the study participants muscle flap was used while among the 48.2% of them myocutaneous flap was used. In a study by Akhtar MS et al it was noted that most of them had inferiorly based anteromedial thigh fasciocutaneous flap followed by anterolateral thigh fasciocutaneous flap

**Duration of hospital stay:** In a study by Akhtar MS et al [4] it was noted that most of them in the current study it was found that the mean duration of hospital stay 1 of all the patients was 9.23±3.491 days. Majority (83.3%) of the patients had hospital stay of > 1 week while about 16.7% of them had hospital stay of <1 week. In a study by Naik et al similar to our study it was noted that the average hospital stay was 10 days following trauma and 24 days following electric burns.

## Complications

In the current study most of the patients had no complications, about 10% of them had flap tip necrosis and 10% of them had graft loss. In a study by Naik et al it was noted that Minor complications were seen in 3(15%) patients. Partial Graft loss was present in 2 patients (10%) over flap donor site which was managed conservatively. Flap tip necrosis (1cm) was present in one patient which healed well with debridement and grafting. In rest of 17 patients (85%) Complete closure of the wound was achieved with flap covers and Split skin grafting, which went on without any further complications. patients had infection as a complication while 8% of them had partial flap necrosis. Grade IIIB Compound fractures in 10 (50%) patients and raw areas in 9(45%) patients were present for which fracture fixation and grafting was done respectively.

In a study by Adbelmoheed AM et al it was observed that the patients with muscle flap 35.7% of them had partial loss of skin graft, 42.9% of them had hematoma and 28.6% of them had infection while patients with In a study by Rao.J et al it was noted that about 16% of the myocutaneous flap 8% had partial loss of skin graft, 15.4% of them had hematoma while 8% had infection as inpatient complications. In a study by Akhtar MS et al it was observed most of them had mild venous congestion (12%) followed by distal flap loss (6%) and dehiscence of suture line (6%).

## Conclusion

In the present study it was concluded that upper one third of the leg defects were commonly seen

between 41 to 50 years of age, trauma (road traffic accidents) as the most common cause with male predominance involving mostly anteromedial site of right limb, having defect exposing the fracture segment majority with medium size defects.

Majority of the study participants reconstructed with medial head of gastrocnemius muscle flap & SSG, most of them had duration of stay more than 1 week with majority of them having no complications.

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