

Study of Free Anterolateral thigh (ALT) flaps in reconstruction of traumatic complex lower limb soft tissue defects

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Abstract

The reconstruction of extensive traumatic lower limb defects need free flaps for covering the defects when no local flaps are available for covering the defects. Free ALT flap is one of the most commonly used flaps for reconstruction of extensive lower limb defects. This is a prospective study of the thirty seven patients who had undergone Free ALT flap cover for the extensive traumatic lower limb wound defects between January 2018 to April 2021 at our Trauma care Hospital. One hundred and thirty patients had undergone reconstruction of traumatic lower limb with one of the flap surgery. Thirty seven of this patients had underwent a free ALT flap surgery for limb reconstruction. Only traumatic lower limb wound defects were included in the study. Non traumatic wounds like diabetic limb wounds or cancer wound defects were excluded. All the patient data including (age, sex and comorbidities), mode of injury (Road traffic accident, Fall of heavy object, Crush injury), wound defect data (site, size, underlying fracture and exposed structures), presence of any vascular injury in the limb, the micro vascular flap data, postoperative complications and management data, follow up data were recorded. Among patients who were managed with ALT flap, 62.6% of patients presented with Post traumatic raw area, 25% of patients presented with Heel pad avulsion, 6.2% of patients presented with Post fasciotomy wound and 6.2% of patients presented with Ankle contracture. Among patients who were managed with ALT flap, the success rate was found to be 81.2%, 9.4% of patients had partial flap necrosis and 9.4% of patients had complete flap necrosis.

Keywords: Free anterolateral thigh flaps, complex lower limb soft tissue defects, ALT

Introduction

The primary goal of any lower limb reconstruction is to restore extremity function by skeletal fixation and adequate soft tissue coverage of the defects. Many factors need to be considered while reconstructing the lower limbs such as patient general condition especially after trauma, paucity of the soft tissue options for coverage and the state of the limb blood vessels. The

micro vascular free ALT flaps for reconstruction of extensive soft tissue defects of lower limb is a well-established and a challenging tool of reconstructive option in lower limbs [1, 2].

The traditional reconstructive tools for lower limb defects suggest local muscle flaps for defects in thigh and proximal and middle third leg and micro vascular free flaps for the distal leg and foot defects. Although muscle flaps serve the purpose of reconstruction. Attempts to reduce donor site morbidity led to use of fasciocutaneous and perforator based flaps wherever feasible. The ideal flap for the defect should be a technically simple, a single stage procedure, replacing like with like, minimizing donor site morbidity and with a good limb functional outcome. The simplest flap may not always be the best flap of reconstructive option [3, 4].

The Anterolateral Free Flap (ALT flap), since it was first described by Song *et al.* in 1984 has been one of the most popular flaps for reconstruction of extensive soft tissue defects of lower limbs [5]. It is a versatile flap with many advantages like large skin paddle, long vascular pedicle, a reliable and stable pedicle anatomy, no need for sacrificing a major artery, two team working simultaneously and a well-accepted donor site morbidity. The ALT flap can be harvested as multiple tissue components in various combinations and configurations as per the need of the defects. The flap can be harvested as fasciocutaneous flap or myofasciocutaneous flap or adipofascial flap or as a chimeric flap based on the same lateral circumflex femoral artery (LCFA) [6].

Methodology

Thirty seven patients who underwent Free Anterolateral thigh flap for covering extensive traumatic lower limb wound defects among the one hundred and thirty patients requiring flap cover for limbs were included in the study. The study included patients who underwent surgery between January 2018 and April 2021, at Sanjay Gandhi Institute of Trauma and Orthopedics, Bangalore.

The patient data including general condition of the patients, mode of injury, associated limb fractures, any compromising limb vascular injuries, extent of limb wound defects, size, location were documented.

The various surgical procedures that the patients underwent in chronological order were noted.

The wound defects extent were categorized into five zones of the limb as Thigh, Knee, Middle leg, Lower leg, Foot and ankle or extended over multiple zones. The various structures lost and exposed in defect were noted. Any associated vascular injury of the limb noted. Photographs and standard consents regarding the nature of surgery, possibilities of flap complications and need for re exploration and requirement of a second flap in case of flap failure were taken.

All necessary routine investigations for surgery were done. CT angiography was advised in patients suspected of vascular injury or elderly patients with compromised vascularity.

Operative procedure: All the surgeries were performed under epidural or general anesthesia with patient in supine position. A two team approach, with one team harvesting the flap and the second team debriding the traumatic wound and dissecting the recipient vessels was done. Wound debridement, recipient vessel dissection, flap harvesting and vessel anastomosis were done with 5X magnification loupes.

Photographs of the wound defects after surgical debridement were taken. Preoperative flap marking was done by drawing a line from anterior superior iliac spine to the superolateral border of the patella which is the axis of the flap. The midway of this line is marked and a circle of 3cm radius is drawn around this point. Most of the perforators are found in puter and

lower quadrant of this circle. A hand held vascular doppler was used to mark the dominant perforator in this circle. The required flap shape and size for the wound defect was marked and photos taken. The recipient artery and veins of the limb were noted.

The incision is made on the medial border of the flap down to the fascia. Once the subfascial is entered, the septum between rectus femoris and vastus lateralis is identified as a yellow fat stripe which is the site where septocutaneous perforators if present emerge. If no septocutaneous perforators are found the dissection was carried out laterally in subfascial plane to look for musculocutaneous perforators emerging from the vastus lateralis muscle. One or two perforators with good calibre supplying the flap skin were preserved. Once the perforator anatomy is confirmed, the rectus femoris is retracted medially to expose the septum entirely and trace the course of descending branch of Lateral circumflex femoral artery. The next step was the meticulous dissection of the perforator through the vastus lateralis muscle to its joining with the descending branch of lateral circumflex femoral artery if it is musculocutaneous perforator. After complete isolation of the flap on its perforator vessels, the flap was left to perfuse for some time and a break is take for 20 to 30 minutes. The flap is then assessed for color and capillary refill time before the pedicles were ligated and flap separated. The flap off time or ischemia time is noted.

The donar site wounds were reduced by undermining and suturing the wound edges. The remaining raw areas were covered by partial thickness skin graft.

All flaps were raised as fasciocutaneous flaps with only primary defatting of the flaps when they were very bulky.

Anastomosis of the flap artery was done end to end with limb recipient artery. Plain Heparin 5000IU was given iv stat before removing the artery clamp in all patients. Two veins were anastomosed for all flaps.

Sterile loose dressing was applied over flap with a slab and a window for flap monitoring. Postoperative monitoring of patient was done for the vital signs of the patient, especially blood pressure for optimal tissue perfusion. IV fluids Normal saline was given at 150ml/hour infusion. Input and output charts were maintained. Low molecular Weight Heparin (LMWH) was given subcutaneous twice a day for 3 days. Patient was kept nil orally on the day of surgery for any re-exploration of the flap.

Flap was monitored clinically by looking for any color change in the flap and by scratching over the flap skin to look for any dark brisk venous bleed due to venous obstruction or absence of bleed due to arterial occlusion.

Patient was shifted to OT for any need for re exploration of flap for arterial or venous obstruction. Flap artery and vein anastomosis sites were opened for any thrombus at the anastomosis site. Thrombus was removed if any. Saline heparin was perfused distally through the artery to flush out any thrombi distally through the flap. Re-anastomosis of the flap vessels was done and checked for normal bleeding over the flap skin. Sterile dressing was done and patient shifted to intensive care unit for monitoring.

Patients were discharged on postoperative day 8 once all wounds were healed and flap was healthy. Patients were followed up for 3 months for any complications.

Secondary surgery for an alternative flap was performed once the patient was fit for surgery in case the free ALT flap failed. Patients were discharged after all the wound defects healed and patient was completely stable.

Results and Discussion

Table 1: Distribution of patients with ALT flaps based on age

Age group	Frequency	Percentage
Up to 10 years	08	25.0

11-20 years	02	06.2
21-30 years	12	37.5
31-40 years	02	06.2
41-50 years	04	12.4
51-60 years	02	06.2
More than 60 years	02	06.2
Total	32	100

Among patients who were managed with ALT flap, maximum were in the age group of 21-30 years (37.5%) followed by less than 10 years (25%) and 41-50 years (12.4%) among total study subjects, maximum number of patients belong to age group of 21-30 years (30.8%) followed by 31-40 years (12.3%), 51-60 years (12.3%), less than 10 years (11.5%), 11-20 years (11.5%), more than 60 years (11.5%) and 41-50 years (10%). More than 50% of study subjects were less than 40 years.

Table 2: Distribution of patients with ALT flaps based on Gender

Gender	Frequency	Percentage
Male	26	81.2
Female	06	18.8
Total	32	100

Among patients who were managed with ALT flap, 81.2% were male patients and 18.7% were female patients.

Table 3: Distribution of patients with ALT flaps based on Diagnosis

Diagnosis	Frequency	Percentage
Post traumatic raw area	20	62.6
Heel pad avulsion	08	25.0
Ankle contracture	02	06.2
Post fasciotomy wound	02	06.2
Total	32	100

Among patients who were managed with ALT flap, 62.6% of patients presented with Post traumatic raw area, 25% of patients presented with Heel pad avulsion, 6.2% of patients presented with Post fasciotomy wound and 6.2% of patients presented with Ankle contracture

Table 4: Distribution of patients with ALT flaps based on Outcome

Outcome	Frequency	Percentage
Successful inset of flap	26	81.2%
Partial flap necrosis	03	09.4%
Complete flap necrosis	03	09.4%
Total	32	100

Among patients who were managed with ALT flap, the success rate was found to be 81.2% 9.4% of patients had partial flap necrosis and 9.4% of patients had complete flap necrosis.

Conclusion

- The Success rate of Antero lateral Thigh free flap is 81.2%.
- The Common causes for partial flap necrosis were infection, hematoma and patient non compliance
- The Common causes for complete flap necrosis were infection and poor donor vessels

References

1. Michael JB, Ellen JM, James FK, Andrew RB, Lawrence XW, Marc FS. An analysis of outcomes of reconstruction or amputation after leg-threatening injuries. *N Engl. J Med.* 2002;347:1924-1931.
2. Farid B, Christian H, Serge S, Antoine R, Jean LG, Benoit C. Free versus perforator-pedicled propeller flaps in lower extremity reconstruction: what is the safest coverage? A meta-analysis. *Microsurgery.* 2018;38:109-119.
3. Trostler M, Shih J, Klein GM, Dagum AB, Bui DT, Gelfand MA. Role of anterolateral thigh flaps in distal lower extremity reconstruction: assessment of functionality, aesthetics and patient satisfaction. *J Reconstr. Microsurg. Open.* 2017;2:83-89.
4. Koshima I, Fukuda H, Yamamoto H, Moriguchi T, Soeda S, Ohta S. Free anterolateral thigh flaps for reconstruction of head and neck defects. *Plast. Reconstr. Surg.* 1993;92:421-428.
5. Edgar AL. The anterolateral thigh flap: radial forearm's 'big brother' for extensive soft tissue head and neck defects. *Arch Otolaryngol Head Neck Surg.* 2004;130:52-62.
6. Kimata Y, Uchiyama K, Ebihara S, Sakuraba M, Iida H, Nakatsuka T. Anterolateral thigh flap donor-site complications and morbidity. *Plast. Reconstr. Surg.* 2000;106:584-589.