Original Article

Study of Various Modalities of Management of Lower One-third Leg Defects in a Tertiary Care Hospital

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Abstract

Background: Lower extremity reconstruction is essential to plastic surgery and focuses on treating wounds and defects secondary to trauma, cancer, or chronic disease processes. Anatomical features of the lower third of the leg like subcutaneous bone surrounded by tendons with no muscles and vessels in isolated compartments with little intercommunication between them make the coverage of the wounds in the region a challenging problem. **Aim:** to study the various modalities of surgical management of lower 1/3rd leg defects. The study also aims to study the defect size and region in planning various flaps possible in the reconstruction ladder. **Methods:** The study was conducted from September 2014 to June 2017 on patients admitted to the Department of Burns, Plastic & Reconstructive Surgery and referred patients from the Department of General Surgery & Orthopaedic Surgery, S C B Medical College & Hospital, Cuttack. The Study includes all lower 3rd Leg defect varieties for different surgical treatment modalities. **Results:** various reconstructive methods were used to cover the lower 1/3rdleg defects; the maximum was the free muscle transfer in 9 cases. The following typical flap used was the reverse sural flap. **Conclusion:** The goal in lower limb reconstruction involves needing a stable skeleton, allowing weight-bearing status, with adequate soft tissue coverage to nourish and protect the underlying bone. What one would use for reconstruction depends upon the surgeon's familiarity and comfort levels with the technique as much as the various circumstances.

Keywords: Free flaps, lower third leg defects, perforator flaps

Introduction

Lower-extremity reconstruction is essential to plastic surgery and focuses on treating wounds and defects secondary to trauma, cancer, or chronic disease processes. The goal of lower-extremity reconstruction is the coverage of defects and open wounds of the leg to give patients a healed wound and to let them resume their lives, ambulate, and go back to work while preventing amputation. Local fasciocutaneous flaps, perforators, and propeller flaps have gained popularity in tackling these situations. However, free flaps have revolutionized the management of distal third leg defects. The choice depends on the surgeon's familiarity and comfort levels with the technique as much as the various circumstances. It involves a multidisciplinary approach. After the emergency trauma care and evaluation, extremity reconstruction management is planned. This often requires orthopedics intervention, thus emphasizing Levin's concept of the "orthoplastic approach."[1] Lower limb injury severity assessments can be done using different methods and classifications. A less optimal result can be expected when more components (bone, soft tissues, neurovascular bundles, etc.,) are involved.[2] Amputation of a mangled extremity in an unstable patient may be more logical than an extensive reconstructive course. This should be considered in the initial evaluation of the patient.[3]

This work aims to study the different management modalities of lower third leg defects under the following headings: etiology, size of defects and location, distribution of soft-tissue defects ± fracture of tibia and fibula, different modalities of reconstruction surgery, and complications.

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Materials and Methods

The study was conducted on 36 patients admitted to the Plastic Surgery Department of SCB Medical College and Hospital, Cuttack, with lower third leg defects between September 2014 and June 2017. Patients were resuscitated, and associated injuries were handled based on advanced trauma life support guidelines. The extent and severity of injuries were assessed using the "Gustilo-Anderson" classification of open leg wounds. Orthopedics performed emergency irrigation, debridement, and fracture stabilization using the external fixation device. Patients' demographics, surgical indications, defect features, complications, and clinical outcomes are evaluated and presented as uncontrolled cases. All the patients with defects in the lower third of the lower leg underwent standard diagnostic procedures and preoperative preparation for surgery.

Surgical technique

Patient selection

Based on the location and size of the defects of the lower third of the leg, planning was done for a particular reconstructive option. Minor defects can be covered by a muscle flap or a small fasciocutaneous flap and, in some cases, even by skin grafts. Moderate-size defects needed a propeller, fasciocutaneous, reverse sural, or free flap. A free or cross-leg flap covered significant defects in the lower third. However, the final decision regarding the choice of reconstructive modality rested on the clinical planning, location, and size of the defect and preoperative Doppler for perforators [Figures 1-5].

Results

In this study, 36 patients were treated and followed-up, and their results were critically analyzed and observed. The patients were admitted under the Department of Plastic and Reconstructive Surgery, SCB Medical College, Cuttack. The patients were admitted between September 2014 and June 2017. The minimum age was 18, and the maximum age was 71 years. The total number of male patients was 28, and female patients were 8. In our study, trauma was the most important etiology of lower third leg defects (26 patients). Postelectric Burn Defect and Chronic Nonhealing ulcers were the next common etiologies, i.e. four each. The tumor was etiology in two cases. In this study, there were 12 patients with defects located around the lower one-third leg with ankle and dorsum of foot, 7 patients with defects around the lower one-third leg only (except the tibialis anterior (TA) region) and 7 patients with defects around the TA region. In this study, 10 patients had fractures in the tibia bone, and 3 had fractures in both the tibia and fibula. All these 13 patients were on external fixators. Only one patient had a metatarsal fracture for which K-wire was given. The maximum size of the defect was 32 cm × 12 cm in dimension, whereas the lowest measured 5 cm × 4 cm. The maximum number of defects was 6–10 cm (in largest dimension), i.e. 16 numbers. The size of the defect is one of the criteria required for planning the reconstructive method for the same [Table 1].

In our study, various reconstructive methods were used to cover the lower one-third leg defects, with the maximum used to be the free muscle transfer in nine cases. The free flaps used were free antero-lateral thigh (ALT) (5 cases), radial forearm free flap (RAFF) (2 cases), free gracilis muscle transfer (1 case), free cross-leg (latissimus dorsi muscle) (1 case). The following common flap used was the reverse sural flap. The complications included flap congestion (9 cases), wound infection (7 cases), marginal

Table 1: The type of reconstruction

Type of reconstruction	Number of patients
Reverse sural flap	6
Fasciocutaneous flap (peroneal artery based)	5
Fasciocutaneous flap (posterior tibial a. based)	4
Propeller flap	5
Free flap	9
Peroneus brevis muscle flap	2
Cross leg flap	1
SSG	3
Dorsalis pedis flap	2

SSG: Site skin grafting

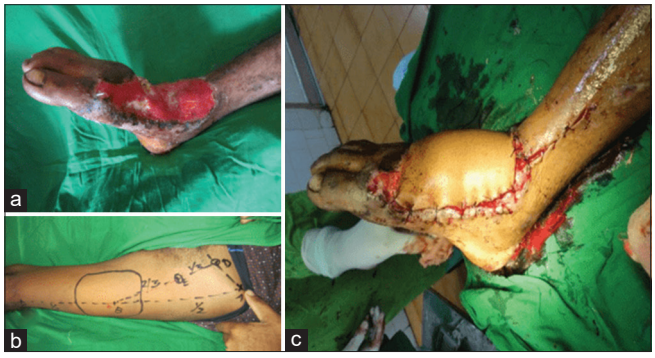

Figure 1: (a) Defect over right leg near third ankle joint dorsum. (b) Marking of antero-lateral thigh (ALT) flap on left thigh. (c) Free ALT flab done with insetting over defect

Figure 2: (a) Defect over lower third left leg (postaspect). (b) Propeller flap harvested. (c) Flap insetting done

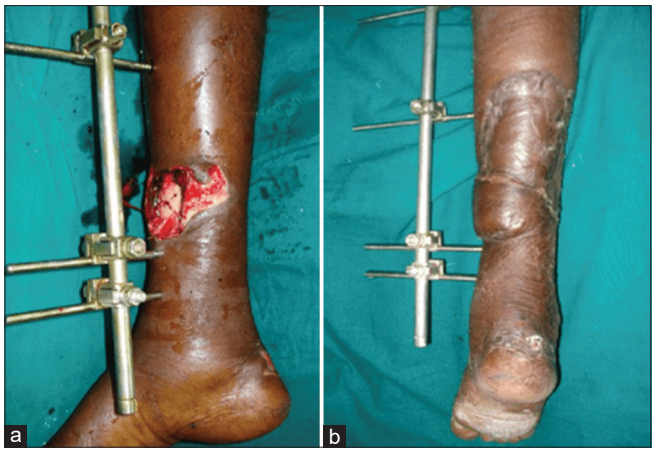

Figure 3: (a) Defect over lower third left leg with exposed tibia. (b) Reverse sural flap for covering the defect

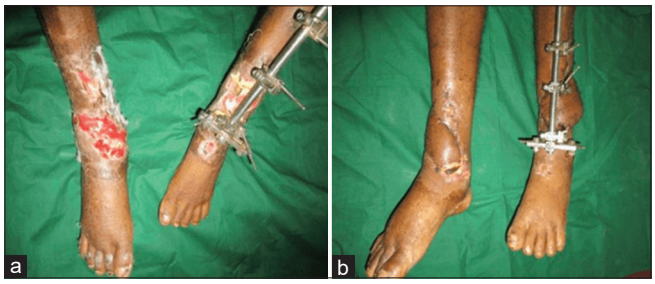

Figure 4: (a) Defect over lower third left leg (bilateral). (b) Perforator-based flap done for leg based on the peroneal artery

Figure 5: (a) Dorsalis pedis islanded flap for the medial malleolar defect. (b) Flap in setting done (tunneled) with donor site skin grafting

necrosis (9 cases), graft loss (8 cases), hematoma and flap edema (3 cases each), and flap loss (1 case) [Table 2].

Discussion

The frequency of defect in the lower one-third leg anterior (ant.) with ankle joint and dorsum of foot was the highest, i.e., 12 cases (33%). Of the 26 trauma cases, bone fracture was seen in 14 cases (39%). Necessary treatment and surgery were done for resuscitation and fracture stabilization. The exposed bones and tendon warrant using a flap to cover the defect, protect the underlying bone/tendon from avascularity/necrosis, and promote healing. The leg defects encountered in this study ranged from 5 cm to 32 cm in the largest dimension. The maximum number of defects measured between 6 and 10 cm (44%).

Table 2: Distribution of reconstructive methods about the size of leg defects

Defect size (cm^2)	*n*	Association with fracture	Reconstructive surgery	Frequency
<50	18	7	Propeller	5
			Reverse sural	2
			FC flap	4
			Peroneus brevis m/s	2
			Dorsalis pedis	2
			Free gracilis m/s	1
			SSG	2
50–100	10	3	Reverse sural	4
			FC flap	3
			ALT	1
			RAFF	1
			Cross leg	1
			SSG	1
>100	8	4	ALT	4
			RAFF	1
			Free cross leg (LD)	1
			FC flap	2
Total	36			37

ALT: Antero-lateral thigh, RAFF: Radial Forearm Free Flap, SSG: Site skin grafting, FC: Fasciocutaneous, LD: Leg Defects

The most common flap used as our reconstructive tool was the free flap (in 9 cases), followed by the reverse sural flap (in 6 cases). Free flaps are considered the gold standard for coverage of lower third leg defects and have become the first choice for reconstructive procedures in the lower leg.[4] However, local flaps can still be indicated in selected cases and give good results.[5,6]

Local transposition flaps can cover minor defects; however, flaps based on perforators can be used for reconstructing extensive defects. When turned over 180°, it is called a propeller flap. Preoperative Doppler study of the perforators eases the raising of the flap and a successful outcome. Our study banked on the peroneal artery perforators and posttibial artery in raising these local flaps.

Musculocutaneous flaps fill up dead spaces and reduce the risk of infection by providing improved circulation and oxygen transport to the wound. On the other hand, fasciocutaneous flaps can provide a better cosmetic and functional result, primarily when related to defects located at the distal third of the lower leg.[7,8]

The most common early complication observed in our series was flap congestion in 9 cases. Most cases were propeller and fasciocutaneous flaps. Tight sutures were removed from the flap insetting tip, leading to normalization in five cases. Late complications include partial graft loss, marginal necrosis, and superficial flap necrosis. Flap loss was seen

in one case (Free ALT flap). Considering all factors, the set of complications can be reduced by optimum planning for the case. Pressure bandages over the flap should be avoided postoperative. The meticulous dissection should be carried out in magnification.

In our experience, local flaps had a lower complication rate (18%) than free flaps (27%). Moreover, local and regional flaps had less severe complications. They are easier to perform and have fewer complications. In our study, the correlation of the size of the defect with reconstructive measures was studied. The defect size of <50 cm^2 was reconstructed with a propeller flap, reverse sural, dorsalis pedis, free Gracilis m/s, and site skin grafting (SSG), propeller flap, and fasciocutaneous flap constituting the majority. The defects in our study, 50–100 cm^2, were covered with options like reverse sural flap, Fasciocutaneous (FC) flap, free ALT, RAFF, cross leg, and SSG, with reverse sural flap highest in frequency. Free flaps covered the defects >100 cm^2 in 75% of cases.

Negative pressure wound therapy (NPWT) is popular. However, it is used in places to delay a flap procedure or get a good granulation cover. No studies have been performed regarding NPWT being used in exclusive lower-third defects. No statistically significant differences were found when comparing the free flap with the local flap in our study group. However, fewer revisions after treatment with a local flap were observed. Free flaps remain the choice for reconstruction in case of larger and more challenging defects, whereas smaller defects can be managed by local flaps.[9-11]

Conclusion

The goal in lower limb reconstruction involves needing a stable bony architecture allowing weight-bearing, with adequate soft-tissue coverage to protect the underlying bone. The newer modalities like the NPWT, acellular dermal matrix, and specific growth factors have shown promise. As studies have yet to deal with them exclusively, we do a surgical procedure often in treating lower third leg defects. The field of reconstruction gained many options, including the improvement of microvascular techniques.

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Conflicts of interest

There are no conflicts of interest.

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