



## A STUDY ON DIFFERENT SURGICAL OPTIONS OF LOWER THIRD LEG DEFECTS AND ITS OUTCOME

### Plastic Surgery

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### ABSTRACT

**Background:** The bones of the lower third are vulnerable to injury. Due to the paucity of soft tissues around them, the fractures that occur are often open. Most muscles become tendons at that level and in the case of soft tissue loss, skin graft may not suffice and flap cover becomes mandatory. Conventional teaching recommends gastrocnemius muscle and myocutaneous flaps and fasciocutaneous flaps for the upper third leg defects, soleus flaps for the middle third defects and free flaps for the lower third defects.

**Aim:** Different surgical options in management of lower third leg defects.

**Material And Method:** The study was conducted from JANUARY 2018 to December 2019, in the Department of Plastic & Reconstructive Surgery Institute of Post Graduate Medical Education and Research (IPGME&R) and SSKM Hospital, KOLKATA.

**Result:** 70 patients admitted to the Department of Plastic & Reconstructive Surgery and referred patients from Department of General Surgery & Orthopaedic Surgery, IPGME&R and SSKM Hospital, KOLKATA. Association of FLAP LOSS with Pedicled flap was statistically significant ( $p=0.0259$ ). We found that association of DONOR SITE MORBIDITY with Pedicled flap was not statistically significant ( $p=0.7679$ ).

**Conclusion:** We consider that perforator propeller flaps are ideal in reconstructing small-medium defects of the middle and distal third of the leg, being safe, easy to perform, providing similar tissue in texture and thickness of damaged tissues, with low donor-site morbidity.

### KEYWORDS

Lower third leg, Skin graft, Flap loss, Pedicled flap.

### INTRODUCTION

The anatomical features of the lower third of the leg make the wound coverage of the soft tissue loss into a challenging problem. The bones of the lower third are vulnerable to injury. Due to the paucity of soft tissues around them, the fractures that occur are often open. Most muscles become tendons at that level and in the case of soft tissue loss, skin graft may not suffice and flap cover becomes mandatory. The three major arteries to the leg, anterior and posterior tibial, and peroneal are in closed compartments and they do not have significant communications between them. Recently lot of work has been done on the perforators arising from these vessels in the lower third of the leg. The ones from the posterior tibial and the peroneal are significant and could be used for flaps in the region. These perforators may be lost in degloving injuries and such flaps may not be possible.

Conventional teaching recommends gastrocnemius muscle and myocutaneous flaps and fasciocutaneous flaps for the upper third leg defects, soleus flaps for the middle third defects and free flaps for the lower third defects. Understanding of the vascular supply of muscles and the mapping of the perforators has widened the resources available for the plastic surgeon for the coverage of the lower third of the leg.

Trauma is one of the main causes of preventable death and one of the main mechanisms of complex wound formation affecting young adults and a large part of the economically active population<sup>1</sup>.

Lower limb wounds reach a variable spectrum, and are generally caused by high-energy trauma, with extensive skin loss and impaired tissue viability, associated with amputations of limbs or fingers, lacerations, crushing and exposures of noble tissues<sup>1</sup>. Over the last 30 years, advances in reconstructive surgery, such as the recognition and use of pediculated fasciocutaneous/ muscular flaps and the introduction of microsurgery have broadened the therapeutic arsenal of the plastic surgeon in the treatment of traumatic injuries<sup>1-3</sup>. In addition, the lower limbs, especially the leg and foot, have some characteristics that make it difficult to treat wounds in this region, such as: thin skin coating; scarce subcutaneous tissue; terminal arterial vascularization; venous return made difficult by the orthostatic position; and of heavy loads for most of the time<sup>4,5</sup>. Functional recovery should always be sought, regardless of the proposed treatment, reconstruction or amputation<sup>5,6</sup>.

The aim of our study was to evaluate the different surgical options of lower third leg defects and its outcome.

### MATERIAL AND METHOD:

Patients admitted to the Department of Plastic & Reconstructive Surgery and referred patients from Department of General Surgery & Orthopaedic Surgery, IPGME&R and SSKM Hospital, KOLKATA. The study was conducted from JANUARY 2018 to December 2019,

**Inclusion Criteria:** Any patient of lower third leg defect admitted in hospital.

**Exclusion Criteria:** Patient of lower third leg defect with

1. Polytrauma with other life threatening injuries
2. Collagen vascular disease
3. Immunocompromised patients
4. Advanced chronic osteomyelitis where an amputation is required

### Study Technique:

Each patient was subjected to detailed history and clinical examination, supplemented by investigative modalities. The treatment was proceed according to prevalent standard of care within the facilities available at the hospital, and findings was note in details in systematic way as per the proforma. The patients would be asked to fill the questionnaires at the aforementioned intervals.

### RESULT AND DISCUSSION

70 patients admitted to the Department of Plastic & Reconstructive Surgery and referred patients from Department of General Surgery & Orthopaedic Surgery, IPGME&R and SSKM Hospital, KOLKATA.

**El-Sabbagh AH et al<sup>7</sup> (2018)** found the reconstructive procedures applied five flaps, respectively distally based posterior tibial artery perforator flap ( $n=8$ ), distally based peroneal artery perforator flap ( $n=4$ ), distally based sural flap ( $n=6$ ), medial planter artery flap ( $n=2$ ) and cross leg flaps ( $n=6$ ). In all cases, there were no signs of osteomyelitis of underlying bones or discharge from the undersurface of the flaps. Fat necrosis occurred at the distal end of posterior tibial artery perforator flap in one female patient. The two cases of medial planter artery flap showed excellent healing with closure of donor site primarily. One cross leg flap had distal necrosis. Would at lower third of leg can be efficiently covered by posterior tibial, peroneal artery and sural flaps.

It was found that in ADVANCEMENT FLAP, 1(3.8%) patients had good outcome, In BIPEDICLE, 4(15.4%) patients had good outcome

and 1(5.0%) patient had poor outcome. In TRANSPOSITION, 4(15.4%) patients had good outcome, 1(4.2%) patient had fair outcome and 2(10.0%) patients had poor outcome. Association of outcome with Local Flap was not statistically significant ( $p=0.1712$ ). Association of outcome with Pedicled flap was not statistically significant ( $p=0.6275$ ). Association of COSMESIS with Pedicled flap was not statistically significant ( $p=0.1732$ ). We found that partial FLAP LOSS was higher [3(60.0%)] in Reverse sural fasciocutaneous flap with skin grafting and total FLAP LOSS was higher [3(60.0%)] in Medial planter artery based flap with skin grafting. Association of FLAP LOSS with Pedicled flap was statistically significant ( $p=0.0259$ ).

**Kumar PS et al<sup>8</sup> (2017)** found that the indication for flap cover was exposed tibia (71%), followed by exposed tendon 21% and exposed implant 8%. The most commonly performed procedure is the inferiorly based fasciocutaneous flaps (45%) followed by reverse fasciocutaneous flaps (32%). Edema and infection were the common complications encountered 23 and 18%, respectively. 70% of patients graded the reconstruction as good, 23% as fair, and 7% as poor. Fasciocutaneous flaps may represent a good alternative to the free flaps in the areas where other local reconstructive procedures are not possible.

In our study EDEMA was higher [1(33.3%)] in Lateral supramalleolar flap with skin grafting and Edema,seroma were higher [3(100.0%)] in Medial planter artery based flap with skin grafting. Association of HEMATOMA /SEROMA/EDEMA with Pedicled flap was statistically significant ( $p=0.0207$ ). But we found that association of DONOR SITE MORBIDITY with Pedicled flap was not statistically significant ( $p=0.7679$ ).

**Maresh SG et al<sup>9</sup> (2018)** found that most commonly performed procedure was muscle flap (45%), followed by perforator-based fascio-cutaneous flap (25%). No major complications were observed in the post-operative period. Various types of flap cover were adopted to cover the lower-third of leg defects, depending on the nature of the wound. That study delineated that muscle flaps - particularly the reverse hemi-soleus flap, are an ideal flap for lower third of leg defects with fracture site exposed and wound infected. Local muscle flaps have the advantage of being single-staged, faster to perform and technically easier, compared to free flaps, which have long been considered the gold standard.

In our study association of Perforator flap/Fasciocutaneous with Outcome was not statistically significant ( $p=0.3748$ ). Distribution of Muscle Flap with Outcome was not statistically significant ( $p=0.2814$ ).

**MACEDO JL et al<sup>10</sup> (2017)** found that a mean age of 25.6 years, predominantly male (62.5%). The most frequent wounds were of the distal third of the lower limb (37.5%). Bone or tendon exposures occurred in 55% had and there was a 35% rate of exposed lower limb fractures. The treatments employed were skin grafting (57.5%), local fasciocutaneous flap (15%), muscle flap (12.5%), cross-leg fasciocutaneous flap, reverse sural flap (12.5%) and microsurgical flap (2.5%). Short-term evaluation showed that 35 patients had excellent or good results (87.5%), four had a regular result (10%), and one had an unsatisfactory result (2.5%). In the long term, of the 18 patients who answered the questionnaire, ten resumed walking, even with support, in the first three months after surgery (55.6%).

**Mofikoya BO et al<sup>11</sup> (2016)** found that Perforator-based

fasciocutaneous flaps were the most commonly used (48%;12), while muscle flaps (24%;6) and adipofascial turnover flaps (20%;5) were less utilized. Two patients died and one underwent a below-knee amputation. Late infection persisted in 16% (4) of the patients seen.

Our study showed that in Anterolateral thigh fasciocutaneous free flap with skin grafting, 1(100.0%) patient had good outcome and 2(40.0%) patients had fair outcome. In Free latissimus dorsi musculocutaneous flap, 2(40.0%) patients had fair outcome and 2(66.7%) patients had poor outcome. Association of Free Microvascular Tissue Transfer with Outcome was not statistically significant ( $p=0.6626$ ).

It was found that in Anterolateral thigh fasciocutaneous free flap with skin grafting, 1(50.0%) patient had partial FLAP LOSS. In Free latissimus dorsi musculocutaneous flap, 1(50.0%) patient had partial FLAP LOSS and 2(66.7%) patients had total FLAP LOSS. Association of Free Microvascular Tissue Transfer with FLAP LOSS was not statistically significant ( $p=0.7243$ ) and Free Microvascular Tissue Transfer with HEMATOMA /SEROMA/EDEMA was not statistically significant ( $p=0.7243$ ). Association of Free Microvascular Tissue Transfer with COSMESIS was not statistically significant ( $p=0.6626$ ).

We found that in Edema, 2(8.3%) patients had fair outcome and 2(10.0%) patients had poor outcome. In Edema,seroma, 2(7.7%) patients had good outcome, 1(4.2%) patient had fair outcome and 2(10.0%) patients had poor outcome. Association of Hematoma /Seroma/Edema with Outcome was not statistically significant ( $p=0.5329$ ).

**Brongo S et al<sup>12</sup> (2014)** found that the reconstruction of lower third of the leg is one of the most challenging problems for plastic and reconstructive surgeons and current approaches are still disappointing. They show an easy option to obtain coverage of traumatic pretibial defects with good aesthetic and functional results: the association of negative pressure wound therapy, acellular dermal matrix, and skin graft. The choice of this combined therapy avoids other surgical procedures such as local perforator flaps and free flaps that require more operating time, special equipment, and adequate training.

It was found that in Skin Grafting, 14(53.8%) patients had good outcome, 22(91.7%) patients had fair outcome and 14(70.0%) patients had poor outcome. Association of outcome with skin grafting was statistically significant ( $p=0.0124$ ).

We found that in Graft Loss, 5(19.2%) patients had good outcome, 10(41.7%) patients had fair outcome and 6(30.0%) patients had poor outcome. Association of Graft Loss with Outcome was not statistically significant ( $p=0.2241$ ). 8(30.8%) patients had good outcome and cosmesis, 23(95.8%) patients had fair outcome and Average cosmesis, 18(90.0%) patients had poor outcome and cosmesis. Association of cosmesis with Outcome was statistically significant ( $p<0.0001$ ). 22(84.6%) patients can walk with good outcome, 10(41.7%) patients can walk with fair outcome and 4(20.0%) patients can walk with poor outcome. Association of Outcome rehabilitation with Outcome was statistically significant ( $p=0.0008$ ).

**Bhatti AZ et al<sup>13</sup> (2007)** found that the overall surgical results were comparable, but more medical complications, a longer operative time, and a longer hospital stay were seen in the free muscle group. Free flap coverage is not mandatory to cover bone in the lower leg.

**Table: Association Between Skin Grafting, Local Flap And Pedicled Flap : Outcome**

|               |                  | OUTCOME |       |       |       | Chi-square value | p-value |
|---------------|------------------|---------|-------|-------|-------|------------------|---------|
|               |                  | Good    | Fair  | Poor  | TOTAL |                  |         |
| Skin Grafting | NO               | 12      | 2     | 6     | 20    | 8.7751           | 0.0124  |
|               | Row %            | 60.0    | 10.0  | 30.0  | 100.0 |                  |         |
|               | Col %            | 46.2    | 8.3   | 30.0  | 28.6  |                  |         |
|               | YES              | 14      | 22    | 14    | 50    |                  |         |
|               | Row %            | 28.0    | 44.0  | 28.0  | 100.0 |                  |         |
| Local Flap    | Col %            | 53.8    | 91.7  | 70.0  | 71.4  | 9.0430           | 0.1712  |
|               | TOTAL            | 26      | 24    | 20    | 70    |                  |         |
|               | Row %            | 37.1    | 34.3  | 28.6  | 100.0 |                  |         |
| Local Flap    | Col %            | 100.0   | 100.0 | 100.0 | 100.0 | 9.0430           | 0.1712  |
|               | ADVANCEMENT FLAP | 1       | 0     | 0     | 1     |                  |         |
|               |                  |         |       |       |       |                  |         |

|               |                                                                  |       |       |       |       |        |        |
|---------------|------------------------------------------------------------------|-------|-------|-------|-------|--------|--------|
|               | Row %                                                            | 100.0 | 0.0   | 0.0   | 100.0 |        |        |
|               | Col %                                                            | 3.8   | 0.0   | 0.0   | 1.4   |        |        |
|               | BIPEDICLE                                                        | 4     | 0     | 1     | 5     |        |        |
|               | Row %                                                            | 80.0  | 0.0   | 20.0  | 100.0 |        |        |
|               | Col %                                                            | 15.4  | 0.0   | 5.0   | 7.1   |        |        |
|               | NO                                                               | 17    | 23    | 17    | 57    |        |        |
|               | Row %                                                            | 29.8  | 40.4  | 29.8  | 100.0 |        |        |
|               | Col %                                                            | 65.4  | 95.8  | 85.0  | 81.4  |        |        |
|               | TRANSPPOSITION                                                   | 4     | 1     | 2     | 7     |        |        |
|               | Row %                                                            | 57.1  | 14.3  | 28.6  | 100.0 |        |        |
|               | Col %                                                            | 15.4  | 4.2   | 10.0  | 10.0  |        |        |
|               | TOTAL                                                            | 26    | 24    | 20    | 70    |        |        |
|               | Row %                                                            | 37.1  | 34.3  | 28.6  | 100.0 |        |        |
|               | Col %                                                            | 100.0 | 100.0 | 100.0 | 100.0 |        |        |
| Pedicled flap | Lateral supramalleolar flap with skin grafting                   | 1     | 1     | 2     | 4     | 8.0133 | 0.6275 |
|               | Row %                                                            | 25.0  | 25.0  | 50.0  | 100.0 |        |        |
|               | Col %                                                            | 10.0  | 7.7   | 25.0  | 12.9  |        |        |
|               | Medial planter artery based flap with skin grafting              | 1     | 2     | 2     | 5     |        |        |
|               | Row %                                                            | 20.0  | 40.0  | 40.0  | 100.0 |        |        |
|               | Col %                                                            | 10.0  | 15.4  | 25.0  | 16.1  |        |        |
|               | Peroneal artery perforator based flap with skin grafting         | 2     | 3     | 0     | 5     |        |        |
|               | Row %                                                            | 40.0  | 60.0  | 0.0   | 100.0 |        |        |
|               | Col %                                                            | 20.0  | 23.1  | 0.0   | 16.1  |        |        |
|               | Peronious brevis muscle flap with skin grafting                  | 0     | 0     | 1     | 1     |        |        |
|               | Row %                                                            | 0.0   | 0.0   | 100.0 | 100.0 |        |        |
|               | Col %                                                            | 0.0   | 0.0   | 12.5  | 3.2   |        |        |
|               | Posterior tibial artery perforator based flap with skin grafting | 2     | 2     | 0     | 4     |        |        |
|               | Row %                                                            | 50.0  | 50.0  | 0.0   | 100.0 |        |        |
|               | Col %                                                            | 20.0  | 15.4  | 0.0   | 12.9  |        |        |
|               | Reverse sural faciocutaneous flap with skin grafting             | 4     | 5     | 3     | 12    |        |        |
|               | Row %                                                            | 33.3  | 41.7  | 25.0  | 100.0 |        |        |
|               | Col %                                                            | 40.0  | 38.5  | 37.5  | 38.7  |        |        |
|               | TOTAL                                                            | 10    | 13    | 8     | 31    |        |        |
|               | Row %                                                            | 32.3  | 41.9  | 25.8  | 100.0 |        |        |
|               | Col %                                                            | 100.0 | 100.0 | 100.0 | 100.0 |        |        |

## CONCLUSION

Various types of flap cover were adopted to cover the lower-third of leg defects, depending on the nature of the wound in repair of defect according to reconstructive ladder (Skin grafting, Secondary suturing, Local Flap, Pedicled flap and Microvascular reconstruction).

We found that Pedicled flap was associated with outcome but Reverse sural faciocutaneous flap with skin grafting was good outcome with poor cosmesis.

It was found that partial flap loss was higher in Reverse sural flap which was statistically significant. Hematoma, Seroma and Edema was significantly associated with Pedicled flap.

Cosmesis was better associated with local transposition/ advancement flap.

Fasciocutaneous flaps may represent a good alternative to the free flaps in the areas where other local reconstructive procedures are not possible.

Based on the results obtained in my study, we consider that perforator propeller flaps are ideal in reconstructing small-medium defects of the middle and distal third of the leg, being safe, easy to perform, providing similar tissue in texture and thickness of damaged tissues, with low donor-site morbidity.

## REFERENCES

- Coltro PS, Ferreira MC, Batista BPSN, Nakamoto HA, Milcheski DA, Tuma Júnior P. Atuação da Cirurgia Plástica no tratamento de feridas complexas. *Rev Col Bras Cir*. 2011; 38(6):381-6.
- Fairbanks GA, Murphy RX Jr, Wasser TE, Morrisey WM. Patterns and implications of lower extremity injuries in a community level I trauma center. *Ann Plast Surg*. 2004;53(4):373-7.
- Aldea PA, Shaw WW. The evolution of the surgical management of severe lower extremity trauma. *Cin Plast Surg*. 1986;13(4):549-69.
- Franco D, D'Avila F, Arnaud Júnior M, D'Avila B, Franco T. Tratamento das áreas cruentas de perna com retalhos locais. *Rev Bras Cir Plást*. 2015;30(2):264-9. [Links]

- Whitaker IS, Rozen WM, Shokrollahi K. The management of open lower limb fractures: the journey from amputation to evidence-based reconstruction and harpsichords. *Ann Plast Surg*. 2011;66(1):3-5. [Links]
- Reddy V, Stevenson TR. MOC-PS (SM) CME article: lower extremity reconstruction. *Plast Reconstr Surg*. 2008;121(4 Suppl):1-7. [Links]
- El-Sabbagh AH. Non-microsurgical skin flaps for reconstruction of difficult wounds in distal leg and foot. *Chinese Journal of Traumatology*. 2018 Aug 1;21(4):197-205.
- Kumar PS, Srinivas ER, Anandan H. Reconstruction of lower one-third leg soft tissue defects. *Int J Sci Stud*. 2017;5(7):80-5.
- Mahesh SG, Ramji AN, Balaji R, SM MC. Reconstructive strategies for lower one-third leg soft tissue defects. *International Surgery Journal*. 2018 Nov 28;5(12):4016-21.
- MACEDO JL, ROSA SC, BOTELHO DL, SANTOS CP, QUEIROZ MN, GOMES TG. Lower extremity reconstruction: epidemiology, management and outcomes of patients of the Federal District North Wing Regional Hospital. *Revista do Colégio Brasileiro de Cirurgiões*. 2017 Feb;44(1):9-16.
- Mofikoya BO, Ugboro AO, Enwelu GO. Early outcomes of reconstructing complex distal leg defects in Lagos, Nigeria. *Journal of Clinical Sciences*. 2016 Jan 1;13(1):2.
- Brongo S, Pagliara D, Campitello N, Rubino C. Reconstruction of traumatic defect of the lower third of the leg using a combined therapy: negative pressure wound therapy, acellular dermal matrix, and skin graft. *Case reports in surgery*. 2014;2014.
- Bhatti AZ, Adeshola A, Ismael T, Harris N. Lower leg flaps comparison between free versus local flaps. *Internet J Plast Surg*. 2007;3:2.