

“Diastally Based Medial Hemi-Soleus Muscle Flap for Wound Coverage in the Distal Third of the Leg”

Dr. Afroza Nazneen¹, Dr. Asim Sarkar²

¹Assistant Professor & Head, Burn and plastic surgery unit, Rajshahi Medical College Hospital, Rajshahi, Bangladesh.

²Registrar, Burn and plastic surgery unit, Rajshahi Medical College Hospital, Rajshahi, Bangladesh.

Corresponding Author: Dr. Afroza Nazneen

Abstract: Reconstruction of exposed lower third tibia and ankle region remains a difficult task and a challenge for many plastic surgeons. Microsurgical flaps have been the method of choice for this reconstruction but in our hospital we do not have equipment or microsurgical trained team for this type of procedure. Moreover, free muscle flaps have more risk of failure and sometimes the patient's clinical condition does not allow a more complex surgery in some cases. Muscle flaps are preferred in these situations.

Methodology: This study was carried out in the Burn and Plastic Surgery Department, Rajshahi medical college hospital, Rajshahi from May 2015 to December 2018 upon 30 patients (29 males and 01 female with the age ranging between 21 and 62 years). Patients with tibial defect in the distal third of the tibia which need soft tissue coverage were selected.

Results: Our study shows diastally based medial hemi-soleus muscle flap had an excellent outcome with short surgical duration, easy implementation, excellent resolution, and low morbidity of the donor area. Moreover, preservation of lateral portion is suitable for plantar flexion showing long arc of rotation.

Conclusion: Medial hemisoleus muscle flap is a reliable option for the reconstruction of soft tissue defects with exposed bone of distal leg based on perforators of posterior tibial artery. Careful flap dissection with preservation of as many perforators as possible is the key to success.

Keywords: Medial hemisoleus muscle flap, Diastally based perforator, Reconstruction

Date of Submission: 10-05-2019

Date of acceptance: 27-05-2019

I. Introduction

Wound coverage of exposed lower third tibia remains a difficult problem. Defects in the lower third of the leg quickly result in the exposure of relevant structures such as bone and tendon, the correction of which requires reconstruction with a well-vascularized tissue^{1,2}. Although the microsurgical flap has been the method of choice for this reconstruction, many hospitals do not have equipment or microsurgical trained team for this type of procedure. Moreover some patients are not fit enough for lengthy microsurgical reconstruction because of their clinical conditions, and the Surgeon is therefore needed to think about the alternative³⁻⁷. The soleus muscle is located in the posterior region of the leg, inferior to the gastrocnemius muscles, and is classified as its major pedicle is the posterior tibial artery, and the perforating branches of this artery are the secondary pedicles³⁻⁴. The viable use of the soleus muscle in a reverse manner, based on its secondary pedicles, has been described by several authors for the reconstruction of defects of the lower third of the leg as an alternative to the use of microsurgical flaps¹⁻⁸. An advantage of using the hemisoleus flap rather than the entire soleus muscle flap is the preservation of plantar flexion of the foot performed by the lateral portion of the muscle, which is left in its original location. Moreover, the medial flap has a greater rotation angle than that of a conventional soleus muscle flap⁹⁻¹². The medial part of the muscle is supplied in its whole length by perforators of the posterior tibial artery. Because of this constant arterial supply, the medial part of the soleus muscle is viable as a flap distally based in a reverse manner⁹⁻¹². This paper reports our experience in the application of this flap. Distally based medial hemi-soleus muscle flap for wound coverage in the distal third of the leg is one of the preferable options as logistic support and trained team for microsurgical technique is not available here. For this reason we have to refer these patients to the super specialized institutes. Another relevant point is the long hospital stay, prolonged operation time; hospital expenses were significantly lower for the patients undergoing this pedicled flap reconstruction.

II. Objectives

- a) To evaluate of clinical applicability and functional outcome.
- b) To analyze the complications.
- c) To observe the recovery period and treatment cost.

III. Materials and Methods

This study was carried out in the Burn and Plastic Surgery Department, Rajshahi medical college hospital, Rajshahi from May 2015 to December 2018. Patients with tibial defects were enrolled and stratified according their site of wound. Only wounds in the distal third of the tibia which need soft tissue coverage were selected. Soft tissue coverage was provided with distally based medial hemisoleus muscle flap on which split thickness skin graft was applied. Postoperatively, patients were followed-up after one week of discharge and then fortnightly for at least 2 months. Outcome variables were taken as flap success.

IV. Results

In our study we operated upon 30 patients presented with lower leg defect. All the patients were post motor vehicle accident with exposed distal Tibia and external fixator in situ. Site of skin defect; 28 patients with skin defect of lower third of the leg, 02 patients with skin defect around ankle joint, Mean age of patients was 38 years. Flap viability assessment showed (**Table 1**) 27 patients showing viable medial hemisoleus muscle flap (90.0%), 1 patients showing mild congested flap which improved spontaneously (3.33%), and 2 patients (6.66%) showing loss of about 2 cm marginal flap necrosis. About 26 patients (86.66%) showed complete graft taken, 03 patients (10%) showed partial loss of skin graft, patients management done conservatively that healed completely within 10 days. One patient (3.33%) showed complete skin graft loss that necessitated another skin grafting session. Lower limb assessment showed no functional motor deficit after hemisoleus muscle harvesting.

Table 1: Result of Flap Viability and Graft taken

| | | |
|----------------|------------------------|----|
| Flap viability | Viabile | 27 |
| | Congested | 01 |
| | Marginal flap necrosis | 02 |
| Graft taken | Taken | 26 |
| | Partially lost | 03 |
| | Completely loss | 01 |

Figure 1: Soft tissue defect with exposed tibia.



Figure 2: Wound covered with hemisoleus muscle flap



Figure 3: Skin graft was laid on the muscle flap immediately



Figure 4: After two weeks postoperatively



V. Discussion

Management of wounds at the distal 1/3rd of leg and ankle regions remains a challenging problem. Muscle flap is always a better option, for exposed bone coverage, the most significant advantage of hemisoleus muscle flap is preservation of foot plantar flexion power by the hemisoleus muscle belly left in situ¹⁶. The medial half of the muscle is supplied constantly throughout its length by the perforators from the posterior tibial artery. This feature makes medial hemisoleus muscle flap more reliable than the lateral half¹³. The medial hemi-soleus muscle flap based on muscular branches of the posterior tibial vessels bears the advantages of a muscle flap and has an appropriate arc of rotation if it used for covering lower third defect in the leg¹⁴. The size of the muscle flap can be up to about 7 cm long x 5cm wide. This is suitable for most small to medium size defects. The bulk of the muscle flap is not a serious problem as it will gradually atrophy. Donor site cosmesis is very acceptable. The operation is not technically demanding and no micro vascular anastomosis is required. The main advantage with this method is not scarifying of the posterior tibial artery. We have been using flaps based on the posterior tibial muscular branches for soleus for more than three and half years, provided that the patients are carefully selected, preoperative vascular assessment by Doppler ultra-sonography study and the indications are appropriate, so we encounter no long-term problems after the use of these flaps. In this study, we used the distal flap of the soleus muscle in a reverse manner, based on the distal perforators of the posterior tibial artery. The use of the flap was successful in almost all cases. In this study flap viability assessment showed 27 patients showing viable medial hemisoleus muscle flap (90.0%), 1 patients showing mild congested flap which improved spontaneously (3.33%), and 2 patients (6.66%) showing loss of about 2 cm marginal flap necrosis. In a study conducted by Makboul M et al showed 23 patients showing viable medial hemisoleus muscle flap (76.7%), 5 patients showing mild congested flap which improved spontaneously (16.7%), and 2 patients (6.7%) showing loss of about 2 cm distal part of (tip) flap¹⁵. Flap viability assessment showed 23 patients showing viable medial hemisoleus muscle flap (76.7%), 5 patients showing mild congested flap which improved spontaneously (16.7%), and 2 patients (6.7%) showing loss of about 2 cm distal part of (tip) flap. The procedure was performed in a quick and safe manner, and extensive morbidity was not observed in the donor area. The defect with exposure of the relevant area was suitably covered, and the patient did not have to undergo the prolonged surgical procedures of a microsurgical flap. However, this coverage was only possible because of the small size of the exposure, and it may be safer to use a microsurgical flap in cases with larger defects. The reverse hemisoleus flap can be used for defects of up to 50 cm², but flap impairment is possible in cases where these measures are exceeded. This flap should not be used for patients with significant peripheral vascular disease or in some cases of diabetes^{1,2,5}.

In addition to the advantages already discussed, another relevant point is the hospital cost of the procedures. Thornton et al⁷ compared the hospital costs between the reverse soleus flap and microsurgical flaps in patients with similar profiles and defects and observed that the hospitalization time, surgical time, hospital expenses, and the use of the intensive care unit were significantly lower in the group of patients undergoing soleus flap reconstruction. Therefore, when this type of reconstruction is possible, it should be the first choice.

Limitations of the study

This was a single center study with small sample size. So, the study result might not be reflected in the whole country.

VI. Conclusion

Medial hemisoleus muscle flap has longer arc of rotation, easier to inset for a variety of lower leg defects compared to the whole soleus and less bulky, so provides a better contour of reconstruction. For this it is a reliable option for the reconstruction of soft tissue defects of lower leg based on minor pedicle or reversed flow based on posterior tibial artery. Careful flap dissection with preservation of as many perforators as possible is the key to success. The reported cases demonstrated excellent resolution, good progress, and insignificant sequelae in the donor area.

References

- [1]. Pu LL. Soft-tissue reconstruction of an open tibial wound in the distal third of the leg: a new treatment algorithm. *Ann Plast Surg.* 2007;58(1):78-83.
- [2]. Pu LL. Successful soft-tissue coverage of a tibial wound in the distal third of the leg with a medial hemisoleus muscle flap. *PlastReconstr Surg.* 2005;115(1):245-51.
- [3]. Pu LL. The reversed medial hemisoleus muscle flap and its role in reconstruction of an open tibial wound in the lower third of the leg. *Ann Plast Surg.* 2006;56(1):59-63.
- [4]. Pu LL. Soft-tissue coverage of an open tibial wound in the junction of the middle and distal thirds of the leg with the medial hemisoleus muscle flap. *Ann Plast Surg.* 2006;56(6):639-43.
- [5]. Pu LL. Further experience with the medial hemisoleus muscle flap for soft-tissue coverage of a tibial wound in the distal third of the leg. *PlastReconstr Surg.* 2008;121(6):2024-8.
- [6]. Kauffman CA, Lahoda LU, Cederna PS, Kuzon WM. Use of soleus muscle flaps for coverage of distal third tibial defects. *J ReconstrMicrosurg.* 2004;20(8):593-7.
- [7]. Thornton BP, Rosenblum WJ, Pu LL. Reconstruction of limited softtissue defect with open tibialfracture in the distal third of the leg: a costand outcome study. *Ann Plast Surg.* 2005;54(3):276-80.
- [8]. Beck JB, Stile F, Lineaweaver W. Reconsidering the soleus muscle flap for coverage of wounds of the distal third of the leg. *Ann Plast Surg.*2003;50(6):631-5.)
- [9]. Barclay TL, Sharpe DT, Chisholm EM. Cross-leg fasciocutaneous flaps. *PlastReconstrSurg* 1983;72:843-6.
- [10]. Bostwick J. Reconstruction of the heel pad by muscle transposition and split skin graft. *SurgGynaecolObstet* 1976;143:972-4.
- [11]. Clemente CD. *Anatomy of the human body.* 30th American ed. Philadelphia: Lea &Febiger, 1985:577.
- [12]. De Roche R, Vogelin E, Regazzoni P, Luscher NJ. How does a pure muscle cross-leg flap survive? An unusual salvage procedure reviewed. *PlastReconstrSurg* 1994;94:540-3.
- [13]. Raveendran SS, Kumaragama KGJL. Arterial Supply of the Soleus Muscle: Anatomical Study of Fifty Lower Limbs. *ClinAnat* 2003;16:248–52.
- [14]. Wee JTK. Reconstruction of the lower leg and foot with reversepedicled anterior tibial flap: preliminary report of a new fasciocutaneous flap. *Br J PlastSurg* 1986;39:327-37.
- [15]. Makboul M, Mousa A, Elotiefy M and Hamdy M, Ahmed M, Medial Hemisoleus Muscle Flap in Reconstruction of Soft Tissue Defects of Lower Leg. *The Egyptian Journal of Hospital Medicine (January 2019) Vol. 74 (6), Page 1330-133*

Dr. Afroza Nazneen. “Diastally Based Medial Hemi-Soleus Muscle Flap for Wound Coverage in the Distal Third of the Leg.” *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 18, no. 5, 2019, pp 49-53.