

## Research Article

# Novel technique for reconstruction of challenging defects around knee joint: distally based split vastus lateralis myocutaneous flap and review of literature

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## ABSTRACT

**Background:** Reconstruction of soft tissue defects around the knee joint is often challenging because of exposed bone or tendon, infected wound, open joint or exposed implant or prosthesis. The aim of the study was to analyse feasibility of distally based split vastus lateralis myocutaneous (VL-MC) flap for covering soft tissue defects around knee joint and To report a new technique for coverage of soft tissue defects around knee joint with distally based split Vastus Lateralis myocutaneous (VL-MC) flap and to assess functional and aesthetic outcome.

**Methods:** A total of 3 distally based split Vastus Lateralis myocutaneous flaps were used for reconstruction of soft tissue defects and exposed implant around knee and upper third of tibia. Defect sizes ranged from 5x7 cm to 12x10 cm size. A systematic review of Literature was done using key words of distally based split vastus lateralis myocutaneous flap and various articles were reviewed. The patients were followed up in postoperative period for assessment of this flap considering functional and aesthetic parameters.

**Results:** The flap survived well without any loss in all 3 cases. The donor site was closed primarily in all the cases. Complete functional recovery was achieved by 4 weeks. Patients were satisfied with aesthetic appearance as well.

**Conclusion:** Distally based split VL-MC flap is a safe and reliable option for reconstruction of the complex defects around knee.

**Key words:** Split vastus lateralis flap, Vastus lateralis myocutaneous flap, Defect coverage around knee

## INTRODUCTION

Reconstruction of soft tissue defects around the knee joint is often challenging because of exposed bone or tendon, infected wound, open joint or exposed implant or prosthesis<sup>1</sup>. Well vascularised soft tissue coverage after adequate debridement of such defects would ensure wound healing and provide stable soft tissue cover.<sup>2</sup> Various alternatives are local cutaneous, muscle flaps and free tissue transfers. First introduced by Zhang, reverse flow ALT flap is a reliable, effective and durable option in such cases.<sup>3</sup> Occasionally exposed bone and soft tissue

deficit may warrant sufficient tissue volume to fill the defect. Hence in this study, we included split vastus lateralis muscle in distally based ALT flap to give durable cover in these patients.

## METHODS

Three patients with complex soft tissue defects around the knee joint underwent reconstruction with ipsilateral distally based Split Vastus Lateralis myocutaneous flaps. Out of three patients, 2 were female and one was male. The defects occurred due to traffic accidents

accompanied by open knee joint in two cases and open tibial fracture treated with plating in other case.

Defect size ranged from 5x7 cm size to 12x10 cm. There were no underlying diseases in any of the patients. Operations were performed under spinal anaesthesia. All the defects were evaluated for wound contamination, foreign material, necrotic tissue and bone loss. Initially aggressive debridement of bone and adjacent soft tissues was done.

In one case bone fixation was done for tibial fracture prior to the reconstruction surgery. The knees were splinted in extended position with POP slab for 2 weeks post-operatively. The follow up period ranged from 6 to 13 months (mean 9.3 months)

### **Operative technique**

#### **Markings**

A straight line connecting the anterior superior iliac spine and superolateral margin of the ipsilateral patella corresponding to the septum between the rectus femoris and the vastus lateralis was drawn. A Cutaneous perforator was marked with the help of a handheld doppler in the circle with a diameter of 3 cm drawn at the midpoint of this line. The pivot point is marked at 10 cm from the knee joint and flap planning was done. The skin island was marked so as to include the marked ALT perforator.

#### **Surgical technique**

An exploratory incision was made along the medial margin of the planned skin paddle. Subfascial dissection was performed to locate the musculocutaneous perforator arising from the vastus lateralis muscle. The rectus femoris muscle was identified by the V-shaped direction of its fibres and dissection was carried out in the inter-muscular plane between the rectus femoris and vastus lateralis muscles to identify the the descending branch of the lateral femoral circumflex artery with its venae comitantes.

The pedicle was looped and isolated. The musculocutaneous perforator from the descending branch of the lateral femoral circumflex artery to the vastus lateralis muscle was identified and preserved. Intramuscular dissection of the perforator was avoided. To avoid shearing of the skin island and for ease of retraction, tacking sutures were placed between the skin and vastus lateralis muscle and kept long.

The vastus lateralis muscle was split longitudinally at the junction of medial one third and lateral two thirds. A medial part of vastus lateralis muscle with overlying Skin Island was harvested including the pedicle (Figure 1). The flap dissection was completed till the pivot point. At this point the flap was attached proximally by the pedicle

of descending branch of lateral circumflex femoral vessels and distally by the sliver of the vastus lateralis muscle. The motor nerve to the vastus lateralis muscle was identified and preserved. At this stage we confirmed for the adequacy of the communications between the descending branch of the lateral circumflex femoral vessels and the superior lateral genicular vessels using a special technique.



**Figure 1: Defect over knee joint with dissected split vastus lateralis musculocutaneous flap.**

At first the hand held Doppler was used to note the earlier marked perforator. Microvascular clamps were then applied to the descending branch of lateral circumflex femoral vessels at the proximal end of the flap. After clamping the pedicle proximally the perforator was noted again using hand held Doppler and found to have good arterial note.



**Figure 2: Donor site closed primarily and flap inserted.**

The edge of skin island showed balanced perfusion and there was no venous congestion which proved the retrograde flow in the pedicle. The descending branch of lateral circumflex femoral vessels were ligated and divided proximally. The musculocutaneous flap was delivered into the defect through a subcutaneous tunnel and single layer closure was done over corrugated rubber drain (Figure 2). Donor sites were closed primarily with a suction drain. The knee was splinted by a posterior slab

in extension. A window dressing for flap monitoring was given.

## RESULTS

All the flaps healed well without any flap compromise or venous congestion (Figure 3). The donor site was closed primarily in all the three patients. All the wounds healed at two weeks. All the patients were examined at two weeks and three months postoperatively. All patients achieved full functional range of knee motion by 12 weeks postoperatively.



**Figure 3: Post-operative result.**

## DISCUSSION

Though Mathes SJ et al classified the vastus lateralis muscle as Type I muscle, it receives blood supply from both the descending branch of lateral circumflex femoral artery and the lateral superior genicular artery.<sup>4</sup> Various cadaveric studies have found a connection between the lateral superior genicular artery and the descending branch of the lateral circumflex femoral artery (DLCFA) near the periarticular anastomosis of the knee joint.<sup>5</sup>

The distal part of the vastus lateralis muscle is supplied by the lateral superior genicular artery through multiple segmental muscular perforators which also provide blood supply to the anterolateral thigh skin.<sup>6</sup> The vascular basis of the flap is the retrograde flow in the anastomosis between the DLCFA and the lateral superior genicular artery. The venous drainage is by the pair of accompanying venae comitantes. So Vastus lateralis muscle can be considered as Type V as per Mathes SJ et al classification and its use can be expanded in future.

We tried to search the literature in this context of use of vastus lateralis muscle and reverse flow ALT flap for soft tissue defects around knee joint but we came across most of the studies in which the authors have used entire vastus lateralis muscle in the flap and varying degree of loss of postoperative knee extension was noted.<sup>5-11</sup> We came across one article of Min. Jae. Lee MJ et al in archives of plastic surgery where they have compared VL- MC flap with ALT flap for lower extremity reconstruction.<sup>7</sup>

Study came across only one article of Sahasrabudhe P et al where he has used the split vastus lateralis muscle. Even with the extensive search of literature we could not find any other article mentioning distally based split vastus lateralis myocutaneous flap.<sup>5</sup>

## CONCLUSION

Hence we can conclude this technique is Novel in its originality, understanding and application, needs to further extended and studied in future.

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## REFERENCES

1. Nahabedian MY, Mont MA, Orlando JC, Delanois RE, Hungerford DS. Operative management and outcome of complex wounds following total knee arthroplasty. *Plast Reconstr Surg.* 1999;104:1688-97.
2. Garvvanis A, Britto JA. Venous augmentation of distally based pedicled ALT flap to reconstruct the tibial tuberosity in a severely injured leg. *Ann Plast Surg.* 2009;62:290-2.
3. Zhang G. Reversed anterolateral thigh island flap and myocutaneous flap transplantation. *Zhonghua Yi Xue Za Zhi.* 1990;70:676-8.
4. Mathes SJ, Nahai F. Classification of vascular anatomy of muscles: experimental and clinical correlation. *Plast Reconstr Surg.* 1981;67:177e87.
5. Sahasrabudhe P, Panse N, Baheti B, Jadhav A, Joshi N, Chandanwale A. Reconstruction of complex soft-tissue defects around the knee joint with distally based split vastus lateralis musculocutaneous flap: A new technique. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2015;68:35e39.
6. Wang Y, Begue T, Masquelet AC. Anatomic study of the distally based vastus lateralis muscle flap. *Plast Reconstr Surg.* 1999;103:101e3.
7. Lee MJ, Yun IN, Rah DK, Lee WJ. Lower Extremity Reconstruction using Vastus Lateralis myocutaneous Flap versus Anterolateral Thigh Fasciocutaneous Flap: *Arch Plast Surg.* 2012;39:367-75.
8. Demirseren ME, Efendioglu K, Demiralp CO, Kilicarslan K, Akkaya H. Clinical experience with a reverse-flow Anterolateral thigh perforator flap for the reconstruction of soft-tissue defects of the knee and proximal lower leg. *Journal of plastic, reconstructive and aesthetic surgery.* 2011;64:1613-20.
9. Auregan JC, Bégué T, Tomeno B, Masquelet AC. Distally- based vastus lateralis muscle flap: a salvage alternative to address complex soft tissue defects around the knee. *Orthopaedics & Traumatology: Surgery& Research.* 2010;96:180-4.
10. A Gravvanis, A Kyriakopoulos, K Kateros, D Tsoutsos. Flap reconstruction of the knee: A review

of current concepts and a proposed algorithm. *World J Orthop.* 2014;5(5):603-13.

11. Akhtar MS, Khan AH, Khurram MF, Ahmad I. Inferiorly based thigh flap for reconstruction of defects around the knee joint. *Indian J Plast Surg.* 2014;47(2):221-6.

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