

# Versality of Gastrocnemius flap for knee joint and upper leg defect in current scenario: An institutional experience

Pookhraj Choudhary<sup>1</sup>, Devendra Singh<sup>2</sup>, Rajneesh Galwa<sup>3</sup>, Jaipal<sup>4</sup>, Manoj<sup>5</sup>,  
Ompraksh<sup>6</sup>

<sup>1</sup>Associate Professor, Dept of Orthopaedics, Geetanjali medical college and Hospital Udaipur

<sup>2</sup>Assistant Professor, Dept of Orthopaedics, Dr SN Medical College, Jodhpur, Rajasthan

<sup>3</sup>Assistant Professor, Unit of Plastic & Reconstructive Surgery, Dept of Surgery, Dr SN Medical College Jodhpur

<sup>4,5,6</sup>Senior Resident, Dept. of Gen Surgery, Dr SN Medical College Jodhpur

## Correspondence author:-

Rajneesh Galwa

Unit of Plastic & Reconstructive surgery, Dept of surgery, Dr SN Medical College Jodhpur, Rajasthan, India

mail:-rajneeshgalwa@gmail.com

---

## ABSTRACT

**Gastrocnemius flap is the flap of choice for reconstruction of defects involving soft tissue loss over the upper leg and knee joint. We are presenting a series of 25 patients who underwent gastrocnemius flap for cover of this type of leg defects involving knee joint. Patients ranged from 5 years to 75 years. There were 18 males and 7 females. In most of the cases primary reconstruction was performed immediate after the trauma of the limbs. There was no complication related to flap. Minor complications were noted and managed conservatively none of required separate operative procedure. Thus we have concluded this flap to be versatile, reliable, robust, technically sound and widely acceptable. Gastrocnemius flap is probably one of the safest flaps, and relatively easy to dissect.**

**Keywords: Gastrocnemius Flap, exposed knee joint and upper leg defect.**

---

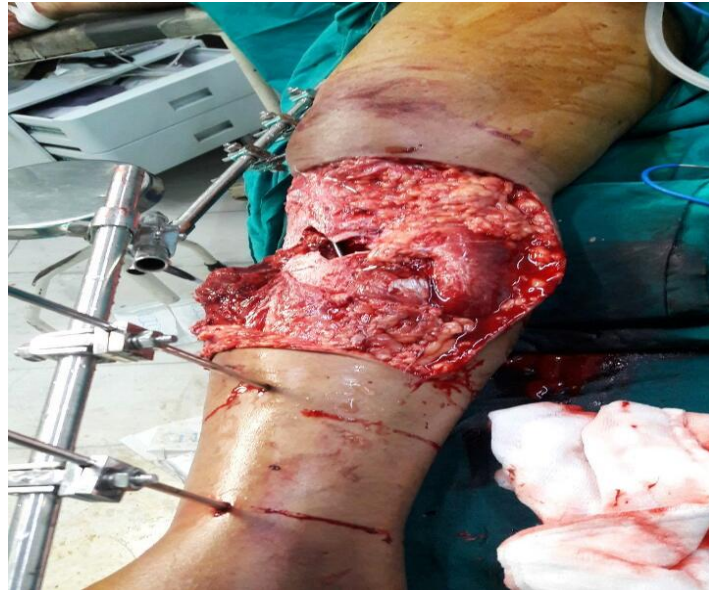
## INTRODUCTION

In trauma centre usually it is seen that managing patients with compound fractures of leg bones with or without involvement of knee joint present difficulties to the treating surgeons. Reconstruction is frequently needed to cover the exposed leg bones and knee joint and to prepare the wound for subsequent bone grafting with a vascularised tissue in compound communicated leg bone fractures. Muscle flaps are flap of choice in these conditions. These flaps are also suitable for coverage of open joints and exposed bones in acute cases of trauma unit. Early procedure to fracture fixation and simultaneous coverage to the exposed bone and implants in need of hour.

This study was conducted to see the Versality of Gastrocnemius muscle flap for upper leg defects with exposed bones associated with compound fractures, exposed implants and exposed knee joints.

## Material and Methods

We included patients in our study from 2015 to 2018, gastrocnemius muscle and musculocutaneous flap was done in 25 patients in our institute. There were 20 muscle flaps and 5 myocutaneous flap. Medial gastrocnemius was used in 18 cases and lateral gastrocnemius in 2 cases. In 5 cases both heads of muscle were used. All 5 patients in which myocutaneous flap was done, medial head of gastrocnemius was used as myocutaneous flap for upper and middle 1/3rd of tibia. (Picture 1,2,3,4)



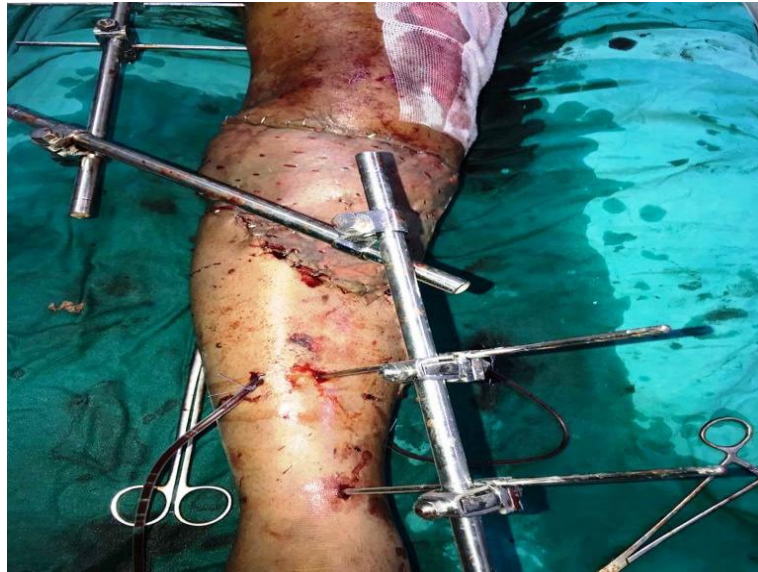
**Fig. 1:**



**Fig. 2:**



**Fig. 3:**



**Fig. 4:**

Most of the patients had compound fractures of leg bones (Grade IIIB). In few cases there was fracture of femoral condyles with soft tissue loss over the knee joint. Few patients presented with marjolin's ulcer over the upper leg that was widely excised deep to the bone and subsequently covered with gastrocnemius myocutaneous flap. In most of the cases bony fixation was done with internal fixation after debridement of the all devitalised tissue and in few cases external fixation was done with flap cover in later stage.

Patients with external fixation and exposed leg bone were discharged and asked to follow up for further definitive procedure. They were managed with frequent dressings, debridement if required and preparation of wound till a clinical healthy wound. Swab culture of wound was also done in almost all cases and treated accordingly with sensitive antibiotics.

Definitive flap coverage was given in later stage. (Muscle, myocutaneous and muscle with skin graft).

All patients were operated in spinal anaesthesia, supine position and under tourniquet control. Thorough debridement was done and all dead necrotic tissue was removed and defect was created. Defect was assessed and planning in reverse was done for the flap. Incision was given 2-3 cm posterior to the medial border of the tibia for medial head of the gastrocnemius muscle. Wound developed in layer and deepened to deep fascia keeping in mind saphenous vein and nerve without damaging both. Gastrocnemius was identified and separated from underlying soleus muscle. Distal end of the muscle was sharply divided from the Achilles tendon taking care to include some portion of tendinous part with the muscle belly for better suture holding during insertion of flap. Muscle was then divided and separated in the midline raphe. Care should be taken to avoid injury to common peroneal nerve while lateral head as a flap.

Muscle was then tunnelled and transposed anteriorly to cover the defect. In some patients of knee joint defects we needed to detach the muscle from its origin to improve the arc of rotation. Epimysium and investing fascia of the muscle was incised to improve expansion and uniform placement of muscle. Muscle was sutured with absorbable sutures over the defect. Skin graft was harvested from thigh in most of the cases and primary skin grafting over the muscle was done in all cases.

For gastrocnemius myocutaneous flap skin paddle was first marked on the belly of respective head of gastrocnemius and then incision was given in mid line and turned medial or lateral depending on the underlying head of muscle and incision was completed. Peroneal nerve needs to be positively identified and safeguarded. When these basic surgical tenets are not violated, gastrocnemius muscle flap provides the best form of coverage for the defect located over upper 3rd of leg [tibia] and knee joint Suction drainage and postoperative splintage was given in all cases.

## RESULTS

In all 25 patients, adequate coverage was provided by gastrocnemius muscle flap. Minor complications were noted in the 5 patients but they all settled with conservative management. No case of complete flap necrosis was found in our study. The period of hospitalization was 10-15 days. The follow up period for earlier operated patients is more than three years. During this period, stable wound coverage was provided by the muscle flap. In patients with compound fracture, satisfactory bony union was noticed on serial x-rays. Patients with external fixators were planned back to

orthopaedic definitive surgery, after 6-8 weeks of flap surgery. The incision was given through the muscle flap and muscle lifted off the bone, even in these cases the part of flap distal to incision was found to be normal.

All muscle flaps showed some degree of decrease in muscle bulk after about 6-8 months of surgery. However this decrease in bulk was not prominent in myocutaneous flap. In all patients, excellent results were found with no evident complications. Except minor complications such as infection, hematoma, partial graft loss. That increased the hospitalisation period. All patients were satisfied with long term results of surgery.

Donor site morbidity was not a problem in gastrocnemius muscle flap. However, patients who required musculocutaneous flap showed some contour deformity and adherent graft over the calf but this was a cheaper price to pay for the type and level of reconstruction that these patients required.

## DISCUSSION

The gastrocnemius flap is one of the best methods of choice for reconstruction of the knee as well as the proximal third part of lower leg. [1][2]

Muscle is classified as type I according to the classification of Mathes and Nahai [3] as it has only single neurovascular pedicle which is of sural artery and accompanying veins.

Muscle flaps, by virtue of their excellent intrinsic blood supply and mouldable nature that fills in the irregular cavities of the bone, are the best solution for such defects.[4]

Muscle flaps have been one of the most significant developments in the management of compound fractures. Their importance has increased specially in management of compound tibial fractures because of poor vascularity of the region and subcutaneous nature of the bone [5]. Displaced fractures deprive the bone of its endosteal blood supply and when this is associated with compounding, the periosteal blood supply may also be damaged.

This is most important cause of delayed union and non union of fractures as well as chronic osteomyelitis of tibia.[6]

Aiache [7] has described the use of lateral head of gastrocnemius to fill in osteomyelitic hole in the femur with excellent results. Lateral head, though smaller in size than its medial counterpart, satisfactory covers the laterally located defects over the anterior tibia and knee joint.

Smith et al [8] based on five year experience described the surgical options in the repair of lower extremity soft tissue wounds. In their series of 60 patients, they found the suitability of muscle and musculocutaneous flaps in 35 patients. Out of these there were 14 cases of ipsilateral muscle transfer and five cases of cross leg muscle flap transfer from the opposite leg.

Basir [9] described the gastrocnemius tenocutaneous island flap that is based on the medial head of the gastrocnemius muscle but the skin island is sited over the tendinous portion of the lower end of the muscle. We have used this modification to improve the arc of rotation and enhance the reach of the flap.

The gastrocnemius muscle flap has been studied in detail and seven manoeuvres that will allow the surgeon to gain more versatility with the medial and lateral head gastrocnemius muscle have been emphasised. [10]

Neale et al [11] have reviewed the complications of muscle flap transposition for traumatic leg defects in 71 cases. Total of 95 muscle flaps transpositions were done and only 5 cases of muscle flap necrosis was found. However, they found 31 cases of major and minor complications. Twenty four of these complications were present in the middle 1/3 and lower 1/3 of leg. They agreed that the cause of complications were mainly technical error, inadequate debridement, and use of traumatised muscle.

The split tibialis anterior muscle flap can be additionally used; however, its use is constrained by its little size, restricted mobility, and injury liability by fractured tibia, making it perfect for limited and narrow longitudinal pretibial defects [12].

Tarek [13] successfully used the distally based hemigastrocnemius flap in covering the middle third leg defects in 19 patients and concluded that the flap was useful for reconstruction of the middle third of the leg.

Magdy [14] successfully used the distally based medial head hemigastrocnemius muscle flap based on the blood supply through communicating arteries with the lateral head to cover the defects in the middle third of the leg in seven cases. There was no flap necrosis or failure, one case lost graft and need re grafting, one case had hematoma in the donor site, and one case had wound dehiscence, which was healed by local wound care. The author concluded that the flap was a

simple technique allowing rapid, durable, and reliable coverage of these defects without sacrificing a nerve or a major vessel.

## REFERENCES

- [1] Ger R. The technique of muscle transposition in the operative treatment of traumatic and ulcerative lesion of leg. *J Trauma* 1971; II 6: 502-510.
- [2] Vasconez LO, Bostwick J, McCraw JB. Coverage of exposed bone by Muscle transposition and skin grafting. *Plastic Reconstr. Surg.* 1974; 53: 526-530.
- [3] Mathes SJ, Nahai F. Clinical applications for muscle and musculocutaneous flaps. New York; CV Mosby Company Publishers. 1982: 16-26, 514-524.
- [4] Meller I, Ariche A, Sagi A. The role of gastrocnemius muscle flap in limb sparing surgery for bone sarcomas of the distal femur: A proposed classification of muscle transfers. *Plastic Reconstr Surg* 1997; 99: 751-756.
- [5] Byrd HS, Spicer TE., Cierney G. Management of open tibial fractures. *Plastic Reconstr Surg* 1985; 76: 719-730.
- [6] Charles HM, Thorne JW, Siebert JC, et al. Reconstructive surgery of lower extremity. In "Plastic Surgery" by JG McCarthy. W.B. Saunders Company 1990; Vol. 6: 4029-4088.
- [7] Aiache AE. A gastrocnemius muscle flap to fill an osteomyelitic hole in the femur. *Br Plastic Surg* 1978; 31: 214-215.
- [8] Smith DJ, Loewenstein PW, Bennet JE. Surgical options in the repair of lower extremity soft tissue wounds. *Trauma* 1982; 22: 5 : 374-380.
- [9] Bashir AH. A gastrocnemius tenocutaneous island flap. *Br J Plastic Surg* 1982; 35: 436-437.
- [10] Arnold PG, Mixture RC. Making the most of gastrocnemius muscles. *Plastic Reconstr Surg* 1983; 72: 38-48.
- [11] Neale HW, Stern PJ, Kreitein JG et al. Complications of muscle flap transpositions for traumatic defects of leg. *Plastic Reconstr Surg* 1983; 72: 512-515.
- [12] Nikhil P, Parag S, Ganesh P, Ajay C, Rajendra D, Lalit R. The split tibialis anterior muscle flap: a simple solution for longitudinal middle third tibial defects. *Indian. J Plast surg* 2012; 45:53.
- [13] Tarek K. Reconstruction of the middle third of the leg by distally based hemigastrocnemius muscle flap. *Egypt J Plast Reconstr Surg* 2010; 34:181-186.
- [14] Magdy Ahmed AA Gastrocnemius muscle flap for middle third leg defects. *Egypt J Plast Reconstr Surg* 2014; 38:197-204.