

Retrospective study of Gastrocnemius muscle flap for upper 3rd leg defect and knee joint: Study of 75 cases.

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Abstract

Gastrocnemius flap is the flap of choice for reconstruction of defects involving soft tissue loss over the upper 3rd leg and knee joint. We are presenting a series of 75 patients who underwent gastrocnemius muscle flap for coverage of this type of leg defects involving knee joint as well. Patients ranged from 7 years to 80 years. There were 63 males and 12 females. In most of the cases delayed reconstruction was performed ranging from 1 week to 2 months or even 6 months after the trauma of the limbs. There was not complete flap necrosis. Minor complications were noted and some of them required a separate operative procedure. We have concluded this flap to be robust, reliable, technically sound and aesthetically acceptable. Gastrocnemius flap is probably one of the safest flaps, and relatively easy to dissect.

Keywords: Gastrocnemius Flap, Compound Fracture leg bones and upper 3rd leg defect.

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Introduction

In trauma unit it is often seen that management of compound fractures of leg bones with involvement of knee joint present difficult problems to the treating surgeons. Reconstruction is frequently needed to cover the exposed bones/joints, obliterate the dead space, and help to eradicate the infection of chronic osteomyelitis and to prepare the wound for subsequent bone grafting with a vascularised tissue. Muscle flaps are flap of choice in these conditions. These flaps are also suitable for coverage of open joints and exposed implants in chronic cases. Early procedure to cover has been found to reduce the incidence of complications in such trauma cases. This retrospective study was conducted to study the role of Gastrocnemius muscle flap for upper 3rd leg defects with exposed bones associated with compound fractures, exposed implants and cases of chronic osteomyelitis.

Material and methods

From 2013 to 2019, gastrocnemius muscle and myocutaneous flap was done in 75 patients in our institute. There were 70 muscle flaps and 5 myocutaneous flap. Medial gastrocnemius was used in 64 cases and lateral gastrocnemius in 6 cases. In 5 cases both heads of gastrocnemius were required [Figure 1]. Medial gastrocnemius was used as myocutaneous in defects which was large and involving both upper and middle 1/3rd of tibia. [Figure 2] Most of the patients had open fractures of leg bones (Grade IIIB) [figure 3]. In few cases there was fracture of femoral condyles with soft tissue loss over the knee joint. Some patients had chronic osteomyelitis they were managed with debridement of the local part and subsequent muscle flap was done to cover and obliterate the dead space of the bone. [Figure 4]. One patient presented with recurrent marjolin's ulcer over the upper leg that was widely excised deep to the bone and subsequently covered with gastrocnemius myocutaneous flap. Patients with of the cases bony fixation was done with external fixation and debridement all devitalised tissue and in few cases primary fixation was done with cover simultaneously. [Figure 5a,5b] debridement if required and

external fixation and exposed leg bone were transferred to plastic unit. They were managed with frequent dressings, In most of the flap 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 provided (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 in midline posterior aspect of the leg irrespective of the head of the gastrocnemius muscle. Wound developed in layer and deepened to deep fascia keeping in mind short saphenous vein and sural 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 accordingly whether to use medial or lateral head as a flap in the midline raphe. Care should be taken to avoid injury to great saphenous vein while using medial head and common peroneal nerve while lateral head as a flap. Muscle was then tunnelled and transposed anteriorly to cover the defect [Figure 6]. In some patients of knee joint defects we needed to detach the muscle from its origin to improve the arc of rotation [figure 7]. 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 [figure 8]. 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.

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Fig 1: both heads of gastrocnemius



Fig 2: Medial gastrocnemius as myocutaneous in defects which involved upper and middle 1/3rd Of tibia

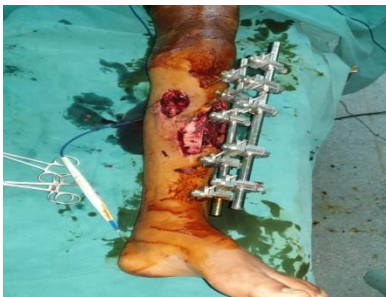


Fig 3: open fractures of leg bones



Fig 4: chronic osteomyelitis managed with debridement of the local part and muscle flap



Fig 5: bony fixation was done with external fixation and debridement of the all devitalised tissue and in few cases primary fixation was done with flap cover simultaneously



Fig 6: Muscle was then tunnelled and transposed anteriorly to cover the defect



Fig 7: In some patients of knee joint defects we needed to detach the muscle from its origin to improve the arc of rotation



Fig 8: Epimysium and investing fascia of the muscle was incised to improve expansion and uniform placement of muscle.

Results

In all 75 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, but in one patient muscle flap was retracted and hence needed secondary procedure for same. [Figure 9]. The period of hospitalization was 15-20 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 transferred back to orthopaedic unit and underwent further definitive surgery by orthopaedic surgeons 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 six months of transfer. However this decrease in bulk was not prominent in myocutaneous flap. In 60 patients, excellent results were found with no evidence of complications. Fifteen patients had minor complications (infection, hematoma, partial graft loss, and retraction of muscle.) 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 myocutaneous flap transfer did have obvious 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. The use of the gastrocnemius flap is one of the best methods of choice for reconstruction of the anterior, medial and lateral side of the knee as well as the proximal third part of lower leg. [1][2][18] Ger first published this procedure in 1971. There is only one neurovascular pedicle for each of both muscle heads composed of a sural artery and one or two veins, and is classified as type I according to the classification of Mathes and Nahai [4][15]. Muscle flaps have been one of the most significant developments in the management of compound fractures. [1] Their importance has increased specially in management of compound tibial fractures because of poor vascularity of the region and subcutaneous nature of the bone [6]. 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. [21] This is most important cause of delayed union and non union of fractures as well as chronic osteomyelitis of tibia. [7][8][13]. 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][5] This is reflected in our study in the form of enhanced rate of bony union and cure of chronic osteomyelitis. [18][22] Aiache [8] 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. [Figure] Careful debridement is imperative for the effective result of the treatment of lower limb trauma. [12]. Smith et al [9] 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 [10] 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. [11] Neale et al [12] [14] 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 [15-18]. If a gastrocnemius muscle flap is not indicated nor possible, the use of random pattern skin transposition flaps can be one salvage option, the advantage of this procedure is that no functional loss occurs [19,20]. And local fasciocutaneous flaps can be done. [3] 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 [23]. We feel that fewer complications would result with careful preoperative evolution and surgical planning, adequate debridement of bone and soft tissue and transfer of healthy, non-traumatised muscle. 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. Tarek [24] 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 [25] 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.

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