

GASTROCNEMIUS MUSCLE FLAP FOR COVERAGE OF KNEE & PROXIMAL THIRD OF TIBIAL DEFECTS

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Summary

Gastrocnemius is the muscle of choice for reconstruction of defects involving soft tissue loss over the upper third tibia as well as knee joint. We present a series of 12 patients who underwent gastrocnemius muscle flap (Medial head, proximally based) coverage for this type of defects. Patients age-18 years or above. There were 9 males and 3 females. In all cases, delayed reconstruction was performed ranging from 1 week to 3 months after the creation of defects. Maximum number of pts were within 18-35 years age groups (66.66%), 75% were victims of RTA, 75% had associated fractures. Results of surgery were graded as excellent (83.33%) to good (16.67%) depending upon the outcome and functional restoration of patients. There was no case of complete muscle flap failure. Minor complications were (1 pt. developed partial flap necrosis & 1 pt. developed infection) noted but none required a separate operative procedure. We have found this procedure to be reliable, technically easy, biologically sound and esthetically acceptable.

Key words

Gastrocnemius muscle flap; compound fracture tibia; defects of knee joint and upper third of tibia

Introduction

- High velocity injuries involving the knee & proximal third of tibia often results in skin & subcutaneous tissue loss along with fracture patella / proximal third of tibia.
- Important goal of management to obtain adequate soft tissue coverage as early as possible. It provides,
 - An open wound to convert it into a close one
 - Revascularization of the injured bone and soft tissues and
 - Prevent late infections and non-union that may occur secondary to persistent bone ischemia.

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- Options for reconstruction of soft tissue defects with exposed proximal third tibia & extensor apparatus of knee are non-microvascular and microvascular technique and are
 - Gastrocnemius muscle or myocutaneous flap
 - Free Latissimus dorsi muscle flap
 - Free Rectus Femoris muscle flap
 - Semitendinosus flap
 - Allograft etc

In this series, wounds were treated by non-microvascularized Gastrocnemius muscle flap (Medial head, proximally based) because in developing countries like Bangladesh where there is always a disparity in between pt's demand and facilities (Expertise and logistic support) where fracture site is stabilized first followed by wound coverage are done by orthopedic surgeons simultaneously. Advantages of medial head of gastrocnemius muscle flap are

- It is cost-effective
- It is relatively easy to extract
- Has constant blood supply
- Larger than the lateral head
- Has no obstacle of fibula during its mobilization.
- Has wide range of rotation.

The purpose of this study is to analyze the functional outcome in terms of

- Time taken for union of fracture tibia by increasing local vascularity.
- Prevention of complications by resolution of infection, Increasing early motion of knee.
- Aesthetic look of the part.

The aim of this study is to analyze the functional outcome in terms of its survivability.

Materials & methods

- Prospective, cross-sectional study of exposed proximal third of tibia (open #, Gustillo type III B) & its condyles, extensor apparatus of knee, treated by non-microvascular Gastrocnemius muscle flap.
- Study Place & time :-
 - Department of Orthopedics, Chittagong Medical College Hospital
 - January 2007 to June 2011
- No of Patient : 15 (fifteen); 03 pt's lost during follow up, 12 patients evaluated.

Inclusion Criteria

Age of patient above 18 years
 Injuries with exposed proximal third tibia &/or knee joint

Exclusion criteria

- Children below 18 years
- Patients having ipsilateral & contralateral fractures of other bones (ex: # pelvis, Femur Humerus etc)
- Life threatening injuries of other systems/organs of the body
- Intra-articular fractures of knee joint
- Concomitant diseases-eg-DM, HTN, Preexisting peripheral vascular diseases etc.

Procedure

- An incision was made extending from proximal aspect of popliteal fossa upto distal to mid part of calf.
- Skin & subcutaneous tissue were separated from underlying deep fascia. Incision was deepened to deep fascia & care would be taken to secure short saphenous vein & sural nerve.
- Medial head of Gastroc. Was detached of its distal attachment along with a part of aponeurosis, is separated from lateral head as well as from underlying Soleus muscle by blunt dissection.
- Then it was mobilized anteriorly & transposed & fixed with the surrounding soft tissues & was covered with split thickness skin graft on.

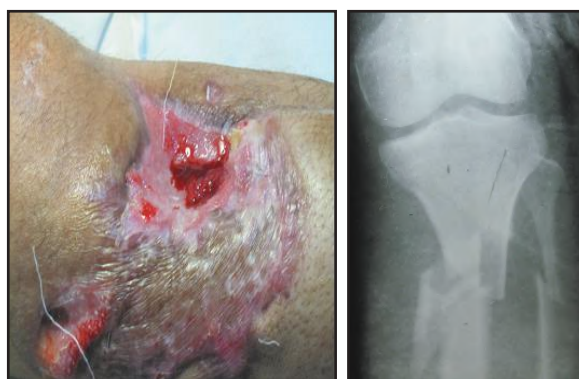


Fig 1 : Open fracture of proximal third of tibia (Gustilo type III B) with exposed tibia.



Fig 2 : Lt. side shows medial head of Gastroc was detached & Rt. side shows its mobilization from Soleus

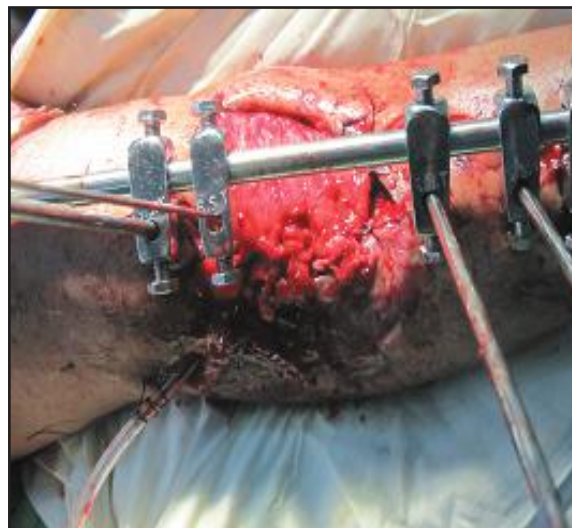


Fig 3 : Lt. side shows medial head of Gastroc was detached & Rt. side shows its mobilization from Soleus



Fig 4 : Fracture site was stabilised by AO External Fixator Flap was transposed anteriorly and wound was covered by split thickness skin graft

Results

Table I : Sex distribution (n=12), Causes of injury (n=12), Injury associated with fracture (n=12)

Sex	Causes of injury	Injury associated With fractures	No. of pt's (n=12)	Percentage(%)
Male	RTA	Associated with fracture	09	75
Female	Fall from height	Not associated with	03	25

Maximum no (75%) of pt's are Male, are the victims of RTA, are associated with fractures.

Table II : Age distribution (n=12)

Age group (year)	No. of Patient	Percentage (%)
18-25	05	41.66%
26-35	03	25%
36-45	02	16.67%
46-55	01	8.33%
56-65	01	8.33%

Above table shows maximum no(66%). of pt's are within (18-35) age groups.

Table III : Side involved (n=12)

Side	No. of Patient	Percentage(%)
Right	07	58.34%
Left	05	41.66%

Table IV : Complications (n=12)

Complications	No. of patient	Percentage
Partial flap necrosis	01	8.33%
Wound infection	01	8.33%

Table V : Overall outcome(n=12)

Result	No of Pt.	Percentage
Excellent	10	83.33%
Good	02	16.67%

Discussion

In open fracture(Gustilo type 111 B) , Patella and soft tissue defects of proximal part of leg and knee soft tissue defects should be covered as soon as possible preferably within 06 days.As because hospitals are over burden of pt's this type of pt's cannot be managed properly due to inadequate facilities and expertise. More over pt's and their near relatives have superstitious belief. Due to these shortcomings no of pt's cannot be increased upto a optimum level.

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 open tibial fractures because of the poor vascularity of the region and subcutaneous nature of the bone. 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 the most important cause of delayed union and non union of fractures as well as chronic osteomyelitis of tibia [2]. 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 [3]. This is reflected in our study in the form of enhanced rate of bony union and cure of chronic osteomyelitis.

It has described the use of lateral head of gastrocnemius to fill in osteomyelitic hole in the femur with excellent result. Lateral gastrocnemius, though smaller in size than its medial counterpart, satisfactorily covers the laterally located defect over anterior tibia and knee joint [3].

It based on a five year experience described the surgical options in the repair of lower extremity soft tissue wounds. In their series of 60 cases, they found the suitability of muscle and musculocutaneous flaps in 35 cases. Out of these there were 14 cases of ipsilateral gastrocnemius muscle transfer and five cases of cross leg medial gastrocnemius muscle flap transfer from the opposite leg [4]. We have not used the cross leg gastrocnemius muscle flap because of difficulties in postoperative immobilization and its attendant morbidity. If ipsilateral gastrocnemius muscle is not suitable for transfer, then the free flap coverage of the defect is the next best option.

We feel that fewer complications would result with careful preoperative evaluation and surgical planning, adequate debridement of bone and soft tissue and the transfer of healthy, non-traumatized muscle. When these basic surgical tenets are not violated, gastrocnemius muscle provides the best form of coverage for the defects located over upper third of tibia and knee joint.

Muscle flaps have been one of the most significant developments in the management of open fractures [1,5]. Their importance has increased specially in management of open tibial fractures because of the poor vascularity of the region and subcutaneous nature of the bone. Displaced fractures deprive the bone of its endosteal blood supply and when the fracture is open, the periosteal blood supply may also be damaged. This is the most important cause of delayed union and non union of fractures as well as chronic osteomyelitis of tibia [6]. 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 [7]. This is reflected in our study in the form of enhanced rate of bony union and cure of chronic osteomyelitis. It has described the use of lateral head of gastrocnemius to fill in osteomyelitic hole in the femur with excellent result. Lateral gastrocnemius, though smaller in size than its medial counterpart, satisfactorily covers the laterally located defect over anterior tibia and knee joint [3, 8].

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It described the gastrocnemius tenocutaneous island flap that is based on the medial head of gastrocnemius muscle but the skin island is sited over the tendinous portion at the lower end of the muscle [10]. 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 maneuvers that will allow the surgeon to gain more versatility with the medial and lateral gastrocnemius muscle have been emphasized [2].

It have reviewed the complications of muscle flap transposition for traumatic leg defects in 71 patients. Total of 95 muscle flap transpositions were done and only five 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 third and lower third of leg. They agreed that the causes of complications were mainly technical error, inadequate debridement, use of diseased and traumatized muscle and unrealistic objectives [2]. In our study 1(8.33%) had developed partial flap necrosis which was treated by excision of necrosed part followed by flap advancement, 1(8.33%) developed infection which was treated by drainage, repeated cleaning & dressings with intravenous antibiotics [11]. Our results corresponds with the series [1,12].

We feel that fewer complications would result with careful preoperative evaluation and surgical planning, adequate debridement of bone and soft tissue and the transfer of healthy, non-traumatized muscle. When these basic surgical tenets are not violated, gastrocnemius muscle provides the best form of coverage for the defects located over upper third of tibia and knee joint.

Conclusion

Proximally based, medial head of Gastrocnemius is an ideal flap for coverage of wounds with exposed proximal shaft of Tibia and Knee joint. It's a safe and simple procedure. A success rate of wound healing with bone union can normally be achieved. We, therefore, recommend its widespread use in candidate pt's.

Disclosure

All the authors declared no competing interestes.

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