

ROLE OF FASCIOCUTANEOUS FLAPS AS A METHOD OF SOFT TISSUE COVERAGE IN TYPE 111 – B OPEN TIBIAL FRACTURES

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Abstract

Object: To determine the role of fasciocutaneous flap as soft tissue coverage in type 111 – B open tibial

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fractures. An experience by orthopaedic surgeons at LUMHS Jamshoro.

Material and Methods: This prospective study was containing 41 patients with type 111 – B fracture of tibia. All cases were managed in department of orthopaedic surgery and traumatology LUMHS Jamshoro from 2008 – 2012. Patients with diabetes mellitus and peripheral vascular disease were excluded from study. After resuscitation and antibiotic cover debridement done and back slab applied. On next day after routine investigations debridement was done and fracture was stabilized with external fixator. After multiple debridements as wound became clean and ready for flap, it is covered with appropriate fasciocutaneous flap. Dressing changed after 5 days and stitches removed after 2 weeks. Patients were assessed for their basic data, site of injury, type of fasciocutaneous flap, their acceptance and complications.

Results: Average age was 31.8 years, According to site of injury 7 (16.66%) cases sustained in proximal tibia, 12 (28.57%) in middle tibia, 17 (40.47%) in distal tibia, 4 (9.52%) in middle 2/3 rd of tibia and 2 (4.76%) in distal 2/3 rd of tibia. The pattern of executed flaps were proximal based medial flaps in 4(9.52), proximal based lateral in 3 (7.14%), distal based medial in 8 (19%), distal based lateral in 17 (40.47%), cross leg in 2 (4.76%), sural flap in 2 (4.76%), distal lateral retrograde in 4 (9.52%), random pattern flaps in 2 (4.76%) and soleus muscle flaps in 2 (4.76%) cases. Out of 42 cases 33 (78.57%) were good, 6 (14.28%)

fair and 3 (7.14%) poor. Complications noted were marginal necrosis in 6 (14.28%), partial or complete necrosis in 3 (7.14%), superficial infection in 3 (14.28%) and deep infection in 5 (11.9%) cases.

Conclusion: It is concluded that fasciocutaneous flap is a simple, safe and cost effective procedure with good acceptance in type 111 – B open tibial fractures.

Key Words: Type 111 – B open tibial fractures – soft tissue coverage – fasciocutaneous flaps.

Introduction

The management of type 111 – b open tibial fractures is major challenge for trauma surgeons.¹ The goal of treatment for these fractures is to prevent infection, achieve bone union and to restore the functions. But initial soft tissue loss, wound contamination and stability of fracture largely affect the result of treatment.² The good vascularity of bone and healthy soft tissue envelope are most important factors in the management of these fractures,³ but often requires a serial debridement's prior to final wound coverage.⁴ The soft tissue coverage converts an open wound into closed and promote the revascularization of fractured bone and soft tissue to provide a coverage to zone of injury and a fresh source of blood, which prevent late infection and non union.^{5,6}

There are many reconstructive procedures for to achieve the closure of the open type 111 – B tibial fractures ,including direct closure, tissue expansion, skin grafting, fasciocutaneous flap, muscle flap, myocutaneous flap and free flaps.⁷ Each technique has its own indications, however still the indications and selection of a particular technique for different cases are not well established and are rather a matter of personal judgment.⁸ Split thickness skin grafting cannot cover exposed bone, tendon, nerves and vessels. Muscle flaps are large and bulky size gives functional and cosmetic deficit at donor site.⁹ Free flaps are highly reliable but needs microvascular technique which is highly technical demanding needs expertise, expensive instruments, cost effective, prolonged operating time and can be performed in big institutions / specific centers.¹⁰ Fasciocutaneous flaps recently gained the popularity on the basis of its simplicity, reliability and versatility. These flaps are chosen on the basis of anatomical consideration specifying the location, size ,depth of defect and availability of local tissues for covering.¹¹ Mc Gregor and Jackson in 1972 introduced axial pattern fasciocutaneous flaps based on axial blood

supply and later on in 1973 random pattern flaps having no specific vascular pattern.¹² Ponten¹³ in 1981 demonstrated that a cutaneous flap which includes deep fascia can be raised safely without respecting the length and breadth ratio, his study is considered as milestone in the flap surgery. Later Cormack and Lamberty in 1991,¹⁴ described its anatomical basis .Fix RJ and vanconez LO¹⁵ described in detail the distribution of vascular pattern and their extent of supply in lower leg, which gives a classical understanding to harvest safer, longer and more useful fasciocutaneous flaps in lower leg and can be taken up to 26 – 27 cm in length with 3:1 length and breadth ratio.

These flaps recently have got popularity in plastic and orthopaedic surgeons due to their single stage surgery, easy to execute, simple, versatile, minimal donor area morbidity, like to like tissue and covering most of soft tissue defects in type 111 – B open tibial fractures. This study was conducted to evaluate the results of optimal care of type 111 – B fracture by debridement, skeletal stabilization and fasciocutaneous flaps as a soft tissue cover by orthopaedic surgeons at Liaquat University Hospital Hyderabad.

Material and Methods

This prospective study was conducted in department of orthopaedic and traumatology surgery (DOST), Liaquat university of medical and health sciences Jamshoro during the period of January 2008 to December 2012. All patients were admitted from emergency department and out door. Only Gustillo type 111 – B open fractures of tibia were included in the study. All patients having diabetes mellitus, peripheral vascular disease and medically unfit excluded from study. Total 41 patients with 42 legs were included in this study. After resuscitation of patients initial care done by analgesic, tetanus prophylaxis, broad spectrum antibiotics and aggressive debridement with pyodine scrub and normal saline, sterilized dressing and applying back slab. On the next day after basic routine investigations extensive debridement and wound assessment is done, and fracture is stabilized with external fixator. After multiple debridements's as wound became clean and ready for soft tissue coverage, the fasciocutaneous flap harvested. The type of fasciocutaneous flap to be harvested was planned on the basis of septocutaneous vessels and according to size and site of defect. The defects were divided into proximal 1/3rd, middle 1/3rd, distal 1/3rd or proximal 2/3rd, middle 2/3rd and

distal 2/3rd of tibia. The type of harvested Fasciocutaneous flaps were proximally based medial flap, distally based medial flap, proximally based lateral flap, distally based lateral flap, retrograde distally based lateral flap, cross leg transverse flap, Sural flap and random pattern flap. Two legs having extensive defects were covered with fasciocutaneous flaps with the addition of soleus muscle flaps. Most of these flap surgeries were performed independently by senior orthopaedic surgeons and few by plastic surgeon. After surgery first dressing was changed after five days and stitches were removed after two weeks. All patients were assessed for their basic data, mode of injury, site of injury, type of flap, acceptance of flap and complications of flaps. All the data was entered on proforma. Data was analyzed on SPSS version 16.0.

Results

Average age of patients was 31.8 years, ranging from 8 to 65 years and maximum incidence was in 16 to 45 years (80.48%). The male patients were 32 and female 9, with male female ratio 3.55: 1. Average delay in hospitalization was 3 days ranging from 0 to 15 days, average time lapse in hospitalization and in flap surgery was 13.8 days (ranging from 5 – 22 days) and average hospital stay was 30.6 days (ranging from 15–66 days). According to mode of injury 17 patients (40.47%) were injured by motor cycle injury, 10 (23.8%) by vehicle injury, 5 (11.9%) by gunshot injury, 3 (7.14%) by farm injury, 3 (7.14%) by fall of heavy object and 3 (7.14%) patients were pedestrian. According to the site of injury proximal tibia was injured in 7 (16.66%), middle tibia in 12 (28.57%), distal tibia in 17 (40.47%), distal 2/3 of tibia in 2 (4.76%) and middle 2/3 of tibia in 4 (9.52%). Fracture was stabilized by AO external fixator in 15 (35.71%), NA fixator in 12 (28.57%), T-clamp fixator in 13 (30.95%) and by illizrov external fixator in 2 (4.76%) cases. The type of fasciocutaneous flaps harvested were proximal lateral based 3 (7.14%) patients, proximal medial based in 4 (9.52%), distal lateral based in 17 (40.47%), distal medial based in 8 (19%), cross leg flap in 2 (4.76%), sural flap in 2 (4.76%), distal retrograde flap in 4 (9.52%) and random pattern flaps were done in 2 (4.76%) legs. Soleus muscle flap was done in addition to these flaps in two legs. Complications noted were marginal necrosis in 6 (14.28%) patients, partial flap necrosis in 1 (2.38%) which later on retracted fully and exposed full defect, complete necrosis of flap in 2

Table 1: Demographic characteristics of the Patients (N = 41).

| Characteristics | No. of Patients / (%) |
|--------------------------|-----------------------|
| Mean age | 31.8 Years |
| Mode of Injury | |
| Motor cycle | 17 (40.47%) |
| Vehicle injury | 10 (23.8%) |
| Gunshot injury | 5 (11.9%) |
| Pedestrian | 3 (7.14) |
| Fall of heavy objective | 3 (7.14%) |
| Farm injury | 3 (7.14%) |
| Site of Injury | |
| Proximal tibia | 7 (16.66%) |
| Middle tibia | 12 (28.57%) |
| Distal tibia | 17 (40.47%) |
| Distal 2/3rd | 2 (4.76%) |
| Middle 2/3 rd | 4 (9.52%) |

Table 2: Types of fixator and pattern of flaps done (N = 41).

| Characteristics | No. of Patients / (%) |
|------------------------|-----------------------|
| Type of Fixators | |
| AO fixator | 15 (35.71%) |
| N A fixator | 12 (28.57%) |
| T clamp | 13(30.95%) |
| Illizrov Ext. Fixator | 2 (4.75%) |
| Pattern of Flaps Done | |
| Proximal based lateral | 4 (9.52%) |
| Proximal based medial | 3 (7.14%) |
| Distal based lateral | 17 (40.47%) |
| Distal based medial | 8 (19%) |
| Cross leg flaps | 2 (4.17%) |
| Sural flap | 2 (4.17%) |
| Distal retrograde flap | 4 (9.52%) |
| Random pattern flap | 2 (4.76%) |
| Soleus muscle flap | 2 (4.76%) |

Table 3: Post operative complications and outcome (N = 41).

| Complications | No. of Patients / (%) |
|-----------------------|-----------------------|
| Mean of hospital stay | 30.6 Days |
| Complications | |
| Marginal Necrosis | 6 (14.28%) |
| Partial Necrosis | 1 (2.38%) |
| Complete Necrosis | 2 (4.76%) |
| Superficial Infection | 3 (7.14%) |
| Deep Infection | 5 (11.9%) |
| Final Results | |
| Good | 33 (78.57%) |
| Fair | 6 (14.28%) |
| Poor | 3 (4.76%) |

(4.76%). Superficial infection was observed in 3 (7.14%) and deep infection in 5 (11.9%) patients. The results were assessed on acceptance rate, flaps which were accepted and healed completely were assumed good, having tip or marginal necrosis were assumed fair and those having partial or complete necrosis were assumed poor. We found good results in 33 (78.57%), fair in 6 (14.28%) and poor in 3 (7.14%) patients.

Discussion

Coverage of soft tissue defects in type 111 – B open tibial fractures is currently a most frequently done procedure due to high incidence of high energy trauma affecting this location.¹⁵ To manage these complex injuries an orthopaedic surgeon must have to be skilled to manage not only the fracture fixations but also the management of wound, its coverage and their complications.⁵

British orthopaedic association and British association of plastic surgeons has emphasized on combined treatment by orthopaedic and plastic surgeons team to manage severe open tibial fractures, but majority of their district general hospitals are still running without plastic surgeons.¹⁶ Many of our teaching hospitals don't have plastic surgeons available, if are available many of them don't have the microsurgical instrument facilities in their theaters and remain overburdened in their work. Their availability always remains a problem.

So an orthopaedic surgeon equipped with theoretical and practical knowledge of local vascular anatomy to harvest an adequate procedure for soft tissue coverage of these injuries which he should be able to manage with less technical demanding, simple to do and without any special instrumentation.¹ Which constitute a reliable and versatile technique, facilitating the integral treatment of these injuries.⁵ By this logical approach only few complicated cases can be referred to specialized centers by decreasing the working burden on centers as well on patient's economy.¹ The fasciocutaneous flaps are reliable and having major advantage to be relatively simple to execute.¹⁷ These flaps can be used locally in ipsilateral limb or distally as a cross leg transverse flap depending upon site and size of leg defect.¹⁸ The improved knowledge of blood supply of these flaps allows the design of a safer, longer and more useful flap.¹⁹

In our series results shows full acceptance of fasciocutaneous flap in 33 (78.57%) cases, marginal necrosis in 6(14.28%) and complete necrosis of flaps in 3 (7.14%), with deep infection in 5 (11.9%) and superficial infection in 3 (7.14%) cases. Comparing with others Debarma S. et al,²⁰ reported 76.5% survival rate of fasciocutaneous flaps and 23.33% deep infection in their serial. Naique SB,¹⁶ and his colleagues reported 35 cases of fasciocutaneous flaps in his serial of type 111 – b open tibial fractures with full acceptance in 80%, minor tip necrosis in 8.57% and flap failure in 11.42% of cases. Raghvendra N et al performed 23 ipsilateral perforator based fasciocutaneous flaps in their serial with successful rate 92.3%, partial necrosis in 7.69% and infection in 19.2% cases. Chitoria and Mishra,²¹ reported 20 cases in their serial with 95% successful rates, 5% partial flap loss and 10% wound infection. Iqbal MZ,²² and his colleagues reported 20 cases of type 111 – B open tibial fractures with 90% full acceptance of flap, 10% marginal necrosis and 20% wound infection in their study. Ponten B,¹³ in his serial of 23 cases of fasciocutaneous flaps reported 73.9% complete healing of their flaps, marginal necrosis and partial or complete necrosis in 13% each.

In our study two sural flaps were harvested over distal 1/3 rd of leg. Cross leg transverse flaps were applied on two cases having extensive defect in middle 2/3rd of tibia. Soleus muscle flap was rotated in two patients having extensive loss of soft tissue in middle 2/3rd of leg in addition to fasciocutaneous flaps and SSG. There were 6 flaps that developed marginal necrosis, one sural flap and one cross leg flap develo-

ped marginal necrosis. In one case patient was heavy smoker. All healed well after dressings, no any additional procedure was required for them. Out of three poor results one patient having partially necrosed flap, he started walking to toilet on the next day of surgery, his stitches were cut through flap was detached from bed and recipient skin and flap was partially necroses. In second case exposed fractured bone was not properly shaved by chiesel. Third patient with complete flap necrosis had head injury; he remained initially under treatment of neurosurgery department, where his leg wound became severely infected. After multiple debridements and antibiotics, wound is covered with distal based lateral flap, soleus muscle flap and SSG. His fasciocutaneous flap became necrosed completely with severe infection. All three were treated by revised flaps.

Patients having superficial infections were treated by change of antibiotics and multiple dressings. In our serial 5 (11.9%) cases developed deep infection, patients who were referred from peripheral hospitals very late and have got infected wounds were the victims. One patient who have got farm injury reported after 10 days of injury was getting treatment from bone setter have severely infected wound, got discharging sinus after healing of flap. Two patients reported after 15 days of injury having severely contaminated wounds developed discharging sinus after flap healing. Fourth patient has got gunshot injury went in infected non union, having multiple sequestrum pieces. Fifth patient sustained head injury remained under treatment of neurosurgery department for many days; his open tibial fracture was neglected over there. His flap became necroses along with severe infection, which was later on revised and ultimately patient went in infected non union after healing of flap. Both non unions were treated by illizrov external fixator and sequestromy and in two others by removal of small tiny sand stones from their wounds.

Our results are comparable to all national, regional and international studies. We agreed with Booplan PR et al,²³ that the failures are often the nature of the bed and the infected state of wound at the arrival rather than the flap itself.

Conclusion

It is concluded in this study that, fasciocutaneous flaps are safe, cost effective regarding less local morbidity and high rate of acceptance with least complications.

In our local setup where resources are limited an orthopaedic surgeon with knowledge of local vessels can help in providing independent composite care of type 111 – B open fractures of tibia in improved and timely treatment in developing countries.

References

1. Kamath JK, Shetty MS, Joshna TV, Kumar A, Harshvardhar and Naik DM. Soft tissue coverage in open fractures of tibia. *Indian J. Orthop.* 2012 July – Aug.; 46 (4): 462-469.
2. O'Meara PM. Management of open fracture. *Orthop Rev.* 1992; 21: 1177-1185.
3. Tarkin IS, Siska PA, Zella BA. Soft tissue and biomechanical challenges encountered with the management of dist non unions. *Orthop Clinics North Amer* 2010; 41 (1): 19-126.
4. BM Parrett and Julian JP. Lower extremity reconstruction. *Rev. Med Clin Condes.* 2010; 21 (1): 66-75.
5. Luna AR, Saddi HF, Martinez MV and Lopez AG. Pearls and tips in coverage of tibia after high energy trauma. *Indian J Orthop.* Oct – Dec. 2008; V 45 (4): 387-394.
6. Mahmood AM, Khudair AH and Fathallah ZF. Soft tissue reconstruction in severe open leg fractures (Gustillo type 111). *Basrah J Surg,* Sept., 2008; 14: 66-76.
7. Levin LS. The reconstruction ladder. An orthoplastic approach. *Ortho Clinic North Am.* 1993; 24: 393-409.
8. Saleh Y, Waheed B, Aziz MAA and Oteify ME. A suggested algorithm for post traumatic lower limb soft tissue reconstruction. *Egypt J. Plast. Reconstr. Surg.,* January, 2007; Vol. 31, No. 1: 87-89.
9. Kuokkanen, H and Tukianen E. Soft tissue and bone reconstruction in compound fractures of the lower leg. *Scandanavian Journal of Surgery,* 2003; 92: 265-268.
10. Zook EG, Russel RC and Asaadi M. A comparative study of free and pedicle flaps for lower extremity wounds. *Ann Plast sss*
11. Stalker H, Fuckar Z, Sustic A etal. Primary versus secondary wound reconstruction in Gustillo type 111 – open tibial shaft fractures. *Croatian Medical Journal,* 2003; 44 (6): 746-755.
12. Mc Conegor IA and Morgan G Axial and random pattern flaps. *Br. J Plast. Surg.* 1973; 26: 2012-13.
13. Ponten B. The fasciocutaneous flaps , its use in soft tissue defects of lower leg. *Br. J Plast. Surg.* 1981; 34: 215-20.
14. Cormack GC and Lamberty BG. Fasciocutaneous vessels, their distribution on the trunk and limbs and their clinical application in tissue transfer. *Anat Clin* 1984; 6: 121-31.
15. Ger R. The management of open fracture of tibia with skin loss. *J Trauma.* 1970; 10: 112-20.

16. Naique S.B., Pearse M. and Nanchahal J. Management of severe open tibial fractures. The for combined orthopaedic and plastic surgical treatment in specialist centers. *J.B.J.S. Br.* 2006 March; 88 (3): 351-7.
17. Chan JKK., Harry L, Williams G. and Nanchahal J. Soft tissue reconstruction of open fractures of lower limb: muscle versus fasciocutaneous flaps. *Plast reconstr surg.* 2012 August; 130 (2): 284e-295e.
18. Chittoria R and Mishra SM. Fasciocutaneous flaps in reconstruction of lower extremity: our experience. *Khatmandu University Medical Journal*, 920040; Vol. 2, Issue 8: 344-348.
19. Fix. RJ, Luis O. and Vanconez. Fasciocutaneous flap in reconstruction of the lower extremity. *Clinics in Plastic Surgery*, July 1991; Vol. 18, No. 3.
20. Dabbarma S, Singh N.S. Singh PL. Singh SN. Singh AM. Meena RK. Fasciocutaneous flap as method of soft tissue reconstruction in open tibial fractures. *J Med Soc.* 2013; 27: 100-5.
21. Chittoria R, Mishra SM. Fasciocutaneous flaps in reconstruction of lower extremity: our experience. *KU Medical Journal*, 2004; 8 (4): 23-26.
22. Iqbal MZ. Malik MA. Azeem M. Mehboob I. Soft tissue defects in open tibial fractures and their management by fasciocutaneous flaps. *JSZMC*. Vol. 1, No. 3: 98-101.
23. Booplan PR. Nithyananth M. Titus VT., Cherian VM. Jepeganam TS. Experience of using local flaps to cover open lower limb injuries at an Indian trauma center. *J Emerg Trauma Shock*, 2011 Jul – Sep; 4 (3): 325-329.