Rotational Fasciocutaneous Flap-A Rescue Technique for exposed Tibia bone.

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ABSTRACT

Objective: To determine the outcome of local rotational fasciocutaneus flap in the treatment of exposed tibia bone.

Methods: We conducted this descriptive study in Department of Orthopedic surgery Liaquat University of Medical and Health Sciences, Jamshoro in collaboration with department of plastic surgery Liaquat University of Medical and Health Sciences, Jamshoro from 3rd January 2017 to 3rd June 2020. Patients of either gender and age with open tibia fractures and skin loss meeting the inclusion criteria were enrolled in our study. All patients were operated for fracture stabilization and coverage of the skin defect with rotational fasciocutaneous flap. Flap survival was assessed and results were graded as good, fair and failure as per Ponten criteria.

Results: In this study 23 patients were included. Majority (78.26%, n=18) were males while females were 5(21.73%). Mean age was 31.8±9(range 18 to 46 years). Right tibia was involved in 14(60.8%) and left in 9(39.1) patients. Skin loss involved middle third of tibia was in 12(52.1%) patients, proximal third in 5(21.7%), distal third in 3(13%) and skin loss extended from middle to distal third in 3(13%) patients. The length of the flap varied from 9cm to 19 cm while the width varied from 3.5 cm to 9.5 cm. Flap survival results were good in 20(86.9%) patients and fair in 3(13%) patients. No flap failure was noted.

Conclusion: Tibia fracture with skin loss treated with local rotational fasciocutaneus flaps produced good and fair outcome results without any flap failure in our series. We therefore recommend local rotational fasciocutaneus flap a technique of choice for coverage of variable tibia skin loss with fractures.

Keywords: Flap, Open fracture, Outcome, Survival, Tibia.

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INTRODUCTION

Lower limb fractures with extensive skin loss and exposed tibia make management more challenging and problematic.[1,2] A healthy and intact soft tissue envelope however is mandatory for bone healing and restoration of limb functions.[3] Although various treatment options for coverage are local gastro-soleus flaps, rotational fasciocutaneous flaps, cross-leg and free flaps, each has merits and demerits.[3,4] Local rotational fasciocutaneous flap is easy in designing and construction, can cover large defects with less operative time and minimum donor site morbidity.[5]

Originally called axial flap, fasciocutaneous flap was first described by Bengt Ponten in 1981.[6] It is a semicircular skin flap that is rotated into the defect

on a fulcrum point in arc of circle till the defect is closed.[7-12] The flap however should have adequate size with a huge base and if there is tension back cut is needed near the pivot point.[13]The deep fascia is included in the flap which enhances its vascularity.[14] The flap is not preferably indicated in smokers, elderly patients with comorbid conditions like diabetes and peripheral vascular diseases as results are compromised.[15-16] Local rotational fasciocutaneous flaps are best alternative to free flaps for coverage of tibia and excellent outcome results have been reported in the literature.[17-20] The flap has its own blood supply and can be opened safely after healing for fixation of bone if needed.[21]This flap have been reported to be done by Orthopaedic surgeons rather than plastic surgeons but with comparable good outcomes.[22]

In our department tibial soft tissue defects are covered according to surgeon's preferences and various option are rotation flaps, muscle flap, pedicle flaps and free flaps. The results of this study will provide evidence for formulating guidelines regarding the optimum coverage option for managing tibial soft tissue defects. The objective of our study was to determine the outcome of local rotational fasciocutaneus flap in the treatment of exposed tibia bone.

METHODS

This descriptive study was conducted in Department of Orthopedic surgery Liaquat University of Medical and Health Sciences, Jamshoro in collaboration with department of plastic surgery Liaquat University of Medical and Health Sciences, Jamshoro from 3rd January 2017 to 3rd June 2020.Patients of either gender and age with Gustilo Anderson type IIIB tibia fractures presented to the Accidents and Emergency Department or Outpatient Department of our hospital within 2 weeks were included. Diabetic patients, smokers and polytrauma patients with injuries to other organs requiring active surgical intervention at the time of presentation were excluded from our study. The study was approved by the Ethical Committee of our hospital and informed written consent was taken from all patients for surgery and publication of study results and photographs. In the included subjects initial resuscitation was done according to ATLS protocol followed by complete history, physical examination and radiographs of the limb. A through debridement of the wound and application of an external fixator (AO external fixator ®Smeico) was done within 24 hours in Accident and Emergency Department. All such patients were operated on our immediate elective operation list for local rotation fasciocutaneus flap with the help of a plastic surgeon.

Surgical Technique

All the surgeries were performed under general or spinal anaesthesia and under tourniquet control. All the surgeries were performed by the same surgical team comprising of plastic surgeon, Orthopaedic surgeon and final year residents. A uniform standard surgical technique of harvesting standard rotation flap(SRF) was carried out in all patients. The operating recipient field was cleansed, skin edges freshened undermine and defect measured. The location of pivot point, design and size of the flap was anticipated, measured and marked. The surface of the flap was made larger than the defect to avoid tissue tension and necrosis of the distal part of the flap. For harvesting the flap an incision was given through the skin upto the subfascial plane and care was taken to avoid dissection in suprafascial plane to avoid damaging perforating vessels. The subfascial dissection was carried out in retrograde fashion from pedicle and flap was rotated and fascia sutured under the skin of recipient site. Skin edges were approximated with few fine sutures. The donor site was covered with split skin graft taken from ipsilateral thigh.(Fig case I & II) At the end of surgery a plaster of paris back slab was applied for immobilization and elevation of the lower limb. Intravenous antibiotics were continued for 5 days. The flap was monitored for hematoma or any other complication. Dressing was changed on 5th post-operative day. Patient was discharged home with special instruction for flap care. Follow up visits were scheduled in OPD weekly for first month and then monthly for minimum of 6 months. In each visit flap survival was monitored clinically and results graded as per Ponten criteria[6] as good (flap completely healed without any complication),fair(only tip of the flap was lost but the necrosis was only superficial with underlying viable fat and fascia. Granulation tissue formed rapidly and subsequently grafted successfully) and failure(flap cut through or loss of half of the flap either due to sever infection or compromised blood supply).Fracture union was assessed radiologically by noticing callus formation at the fracture site. Dynamization and removal of external fixator or secondary Orthopaedic surgeries for bone union were performed at appropriate time when needed.

The data was analyzed with SPSS version 21. Mean and standard deviation was calculated for age and union time while frequency and percentage was calculated for gender and side of injury. Data was presented in table where necessary.

RESULTS

The total number of patients in our study were 23. Male were 18(78.26%) and female 5(21.73%). The mean age of our patients was 31.8±9(range 18 to 46 years). Right tibia was involved in 14(60.8%) and left in 9(39.1) patients. The aetiology of fracture was road traffic accidents in 18(78.2%) and gun shot in 5(21.7%) patients.(table I) Skin loss involved middle third of tibia in 12(52.1%) patients, proximal third in 5(21.7%), distal third in 3(13%) and skin loss extended from middle to distal third in 3(13%) patients. The length of the flap varied from 9cm to 19 cm while the width varied from 3.5 cm to 9.5 cm. Flap survival results were good in 20(86.9%) patients and fair in 3(13%) patients. No flap failure was noted. Tibia fracture was oblique or transverse in 14(60.8%) and comminuted in 9(39.1%) patients. The average time to surgery was 5.3 days(range 1 to 13 days).The follow up period ranged from 6 to 9 months. Normal range of motion of knee and ankle was regained 19(93.3%) patients while 4(6.6%) patients had mild restricted range. All patients were ambulant without support at final follow up visit. Bone healing was noted in 16(69.5%) patients in external fixator while 7(30.4%) patients needed additional surgical procedure(interlocking nail, plating) to achieved union. The average bone healing time was 24±4 weeks(range 17 to 27 weeks).

Fig. Case I: Open tibia fracture with exposed bone and fracture stabilized with external fixator and defect covered with local rotational flap.

Fig. Case II: Open tibia fracture stabilized with external fixator and defect covered with local rotational flap.

Table I: Demographic details and outcome results of our study participants

No	Age/Gender	Mode of Injury	Flap Size (Cm)	Location of Defect U:Upper M:Middle D: Distal Third	Complication	Follow-Up In Months
1	22/M	RTA	10.5x6.5	M	-	7
2	19/M	RTA	12x6.5	D	Marginal Necrosis, Restricted range of movement at ankle	9
3	35/F	RTA	19x8	M	-	6
4	39/M	RTA	11x5.5	U	-	6
5	18/M	RTA	13.5x7	M	-	6
6	44/M	RTA	9x3.5	M	Restricted range of movement at ankle & knee	8
7	33/M	RTA	18x7	MD	-	9
8	18/F	Gunshot	17x7	U	-	7
9	25/M	RTA	11x4	M	-	6
10	37/M	RTA	15x5	M	-	7
11	31/M	RTA	12x4.5	MD	Restricted range of movement at ankle	9
12	46/M	Gunshot	14x8	M	-	7
13	41/F	Gunshot	10x7.5	U	-	6
14	21/M	RTA	11x4.5	MD	-	7
15	27/M	RTA	16x6.5	M	-	6
16	38/M	RTA	10x5	M	-	6
17	40/M	Gunshot	17x9	D	Marginal Necrosis, Restricted range of movement at ankle	8
18	28/M	RTA	13x6	M	-	7
19	36/F	RTA	11.5x5.5	M	-	6
20	20/M	RTA	15x9	U	-	7
21	45/M	RTA	9.5x5	M	-	6
22	36/M	RTA	16.5x9.5	D	Tip Necrosis	8
23	33/M	Gunshot	11x8	U	-	6

DISCUSSION

We treated 23 patients with local rotational fasciocutaneous flaps. Flap survival results were good in 20(86.9%) patients and fair in 3(13%) patients. No flap failure was noted. Pontene[6] the pioneer of rotational flaps had documented good outcome in 17(73.9%),fair in 3(13%) and failure in 3(13%) patients. Ponten was of the opinion that this flap had good circulation, did not need any special equipment or expertise and it was not risky for the patients. Debbarma[21] compared the results of 15 patients treated with local fascioucutaneous flaps within 7 days of injury (group I) with 15 patients treated within 8 to 30 days(group II).He documented 80% flap survival rate in group I and 73.3% in group II.The superficial infection rate was 46% in group I and 66.7% in group II. Deep infection was 20% in group I and 26.7% in group II(*P* value< 0.05).Haroon-ur-Rashid[23] treated patients with soft tissue defects of proximal two third of tibia using distally based local fasciocutaneous flaps and achieved 100% survival of flaps. The clinical outcome was good in 19(90.5%) patients and fair in 2(9.5%) patients. Superficial infection however was noted in 2(9.5%) patients. Murtaza M and colleague[24] conducted a comparative study of 23 patients with Gustilo-Anderson type IIIB patients. Fasciocutaneous flap was used for coverage in 12(52.2%) patients and muscle flap in 11(47.8%) patients. Both types of flaps were found equally effective in covering tibial defects and had comparable survival rates. They found no significant differences between the outcome of two types of flap. Chen[25] in a review article suggested that in cases of metaphyseal tibial ankle fractures fasciocutaneous flaps were superior to muscle flaps as fasciocutaneous flaps avoided skin grafting at the ankle area and thus reducing the chances of subsequent minor injury. Iqbal and Malik[26] treated 20 patients of open tibial fractures with local fasciocutaneous flaps and documented 100% survival of flaps. Minor complications however were noted in 9(45%) patients. Pahore[27] treated covered 42 tibial soft tissue defects with fasciocutaneous flaps and noted good outcome in 33(78.5%),fair in 6(14.2%) and poor in 3(7.1%) patients.

In our study 3(13%) patients had marginal necrosis but flap survived while 4(6.6%) patients had mild restricted range of knee and ankle motion.variable complication rate of local fasciocutaneous flaps have been reported in literature.Pahore[27] reported marginal flap necrosis in 6(14.2%),partial necrosis in 3(7.1%),superficial skin infection in 3(14.2%) and deep infection in 5(11.9%). Pollak[28] compared the complication rate of 88 rotational flaps and 107 free flaps and noted that patients with sever skeletal trauma(type C injuries) treated with free flap had less complications than those treated with rotational flaps.

Limitation of our study was a descriptive design, small sample size and shorter follow-up period. Further studies are therefore recommended to confirm the usefulness of local fasciocutaneous flaps for coverage of tibial skin defects.

CONCLUSION

Tibia fracture with skin loss treated with local rotational fasciocutaneus flaps produced good and fair outcome results without any flap failure in our series. We therefore recommend local rotational fasciocutaneus flap a technique of choice for coverage of variable tibia skin loss with fractures.

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