

# International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958 P-ISSN: 2706-6630 IJOS 2021; 7(1): 468-471 © 2021 IJOS <u>www.orthopaper.com</u> Received: 05-11-2020 Accepted: 14-12-2020

#### Dr. Tarun Bali

Associate Professor, Department of Orthopedics, East Point College of Medical Science & Research Centre, Bangalore, Karnataka, India

**Corresponding Author: Dr. Tarun Bali** Associate Professor, Department of Orthopedics, East Point

of Orthopedics, East Point College of Medical Science & Research Centre, Bangalore, Karnataka, India

# Study to evaluate the outcome of soft tissue reconstruction in case of open tibia fractures

# Dr. Tarun Bali

# DOI: https://doi.org/10.22271/ortho.2021.v7.i1h.2527

#### Abstract

Aim: to evaluate the outcome of soft tissue reconstruction in case of open tibia fractures.

**Materials and Methods:** This is prospective study of minimum 30 patients admitted to East point College of Medical Sciences and Research Centre. Thorough local examination of injured limb was done and fracture graded according to Gustilos grading of fracture. Post debridement grading and radiological evaluation of fracture was recorded. Wound management was decided as per the condition of the patient and wound contamination-acute (<1 week), subacute (1-6 weeks), chronic (>6 weeks). Fracture management included external fixation, IM fixation, plate fixation (Internal fixation), limited internal fixation-pin/K-wire/Screws, and pin plaster. Type of coverage was planned-Split thickness skin grafting; fasciocutaneous flap, Muscle flap and SSG.

**Results:** Majority of the patients were found in age group between 21-30 years and least was in the age group of below 10 years. It was observed that majority of patients in our study were male (86.66%). RTA was the main mode of injury with 27 cases (90%). Out of 15 patients, 4 had head injury (13.33%), 5 had blunt abdomen trauma (16.66%), 4 patients had both head injury and blunt abdomen trauma (13.33%) and 2 patients had urinary bladder rupture (6.66%). Oblique fracture was found in 15 patients (50%), spiral in 10 cases (33.33%) and comminuted fracture in 5 cases (16.66%). Majority of patients underwent external fixation i.e. 17 cases (56.66%) followed by Internal fixation i.e.11 cases (36.66%). In this study excellent results were observed in 23 cases (76.66%), good in 5 cases (16.66%) and poor in 2 cases (6.66%).

**Conclusion:** Early soft tissue coverage in the acute phase (1-6 days) should be the priority in order to prevent bacterial colonisation especially hospital acquired; wound desiccation, sequestration of the exposed bone. External fixation should be contemplated in highly comminuted fractures with severe contamination and when wound closure is not possible.

Keywords: External fixation, tibia fracture, comminuted fracture, soft tissue reconstruction

#### Introduction

Although numerous studies demonstrate the efficacy of early soft tissue reconstruction in Type III open tibial injuries, the soft tissue coverage is typically separated from the tibial reconstruction in many units <sup>[1, 6]</sup>, because most orthopaedic surgeons have limited experience in microsurgery.<sup>7</sup> In many cases, Type III open tibial shaft fractures lead to massive bone loss that requires significant strategies to obtain bone union <sup>[8, 10]</sup>. Some surgeons recommend primary flap cover after debridement and stabilization of open fractures. Gopal S *et al.* <sup>[8]</sup> analyzed 80 open tibial diaphyseal fractures that were treated with early stabilization and flap cover. Their overall limb salvage rate was 95% and the rate of flap failure was 3.5%. They emphasized that internal fixation was preferable to external fixation and that their results were much better in those patients that had flap cover as part of the primary operative procedure. This may be a useful technique if it is logistically feasible and if the surgeon can guarantee that there is no residual contamination after debridement. In this study 30 cases of type IIIB open tibia fractures have been studied where the results were obtained after fracture fixation with different techniques and soft tissue coverage.

#### **Materials and Methods**

This is prospective study of minimum 30 patients admitted to East point College of Medical Sciences and Research Centre, satisfying both the inclusion and exclusion criteria as stated below, after obtaining ethical committee approval.

## **Inclusion Criteria**

- All patients below 60yrs of age
- All patients who have sustained tibial fractures falling into IIIB Gustilo's Classification of open fractures.

# Exclusion Criteria

- Open tibia fractures in patients above 60yrs of age
- Soft tissue loss secondary to pathological fractures of tibia: osteomyelitis and tumours

# Patients who have

- Peripheral Vascular Disease
- Comorbidities- Diabetes mellitus
- Carcinomatous condition with cachexia
- Generalised atherosclerosis
- Serious medical illness

#### Method of collecting data

Once the patient was received in casualty after resuscitation measures the details of the cases regarding name, age, sex, occupation and address were recorded. Patients and the accompanying attendees were interviewed to determine mode of injury, time elapsed since injury. Thorough local examination of injured limb was done and fracture graded according to Gustilos grading of fracture. Patient was then posted for debridement of the wound. Post debridement grading and radiological evaluation of fracture was recorded. Wound management was decided as per the condition of the patient and wound contamination-acute (<1 week), subacute (1-6 weeks), chronic (>6 weeks). Fracture management included external fixation, IM fixation, plate fixation (Internal fixation), limited internal fixation-pin/K-wire/Screws, pin plaster. Type of coverage was planned-Split thickness skin grafting; fasciocutaneous flap, Muscle flap and SSG.

#### **Post-op monitoring**

Posts operatively patient were antibiotics were instituted as per wound culture and sensitivity. If external fixator was used then the patient was examined for pin tract infection, pin loosening, loss of fixation on 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> day, 1 week, 2 weeks. If intramedullary fixation was used then patient was examined for infection, loosening and the loss of fixation 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> day, 1 week, 2 weeks.

In case of SSG wound was examined on  $1^{st}$  and  $5^{th}$  day, 1 week and at 2 weeks. In case of flap on day  $1^{st}$ ,  $3^{rd}$  and  $5^{th}$  day, 1 week and at 2 weeks. Patients were started on knee and ankle exercises as per the stability of fixation and the soft tissue cover. Patients were discharged at around  $14^{th}$  to  $20^{th}$  post-operative day.

## Follow up

The discharged patients were advised to report for follow up every month till adequate soft tissue coverage and the fracture union.

At every visit patient was examined clinically for wound coverage, knee and ankle movements and the radiograph was obtained to see for fracture union. Any complications noted were recorded.

# Observations

Table 1	l: Age a	and Gende	er wise	distribution	of the	study po	nulation
I abit I	L. Ingu i	ina ocna	1 11100	uisuiouuon	or the	study pt	pulation

Age (Years)	Number	%age				
0-10	Nil	0				
11-20	3	10				
21-30	10	33.33				
31-40	8	26.66				
41-50	4	13.33				
51-60	5	16.66				
Gender						
Male	26	86.66				
Female	4	13.33				

Table 2:	Mode and	associated	injuries	in the	study	population

Mode of Injury	Number	%age				
RTA	27	90				
Assault	3	10				
Fall	0	0				
Farmland	0	0				
Industrial	0	0				
Other	0	0				
Associated Injuries						
Head injury	4	13.33%				
Blunt abdomen trauma	5	16.66%				
Both	4	13.33%				
Urological injury	2	6.66%				

<b>Table 5:</b> type of fracture and wound manageme	racture and wound management	and	fracture	of	type	e 3:	able	Ί
---	------------------------------	-----	----------	----	------	------	------	---

Type of fracture	Number	%age			
Oblique	15	50%			
Spiral	10	33.33%			
Comminuted	5	16.66%			
Wound Management					
Acute	9	30.0%			
Sub-acute	9	30.0%			
Chronic	12	40.0%			

Type of Fixation	Number	%age				
Internal fixation	11	36.66				
External fixation	17	56.66				
None	2	6.66				
Type of coverage						
SSG	8	26.66				
Fasciocutaneous flap	13	43.33				
Muscle flap+SSG	9	30				

Table 4:	Type	of	fixation	and	coverage
----------	------	----	----------	-----	----------

# Table 5: Outcome

Scoring criteria	Grade	Result	No. of cases	Percentage
Primary soft tissue cover+ Bone union+ No major complications	А	Excellent	23	76.66
Primary soft tissue cover/cases requiring secondary procedure +Bone union + major complications (but finally both soft tissue and bone healing)	В	Good	5	16.66
Primary soft tissue cover/cases requiring secondary procedure +Bone non-union + major complications requiring amputation/repeated surgeries	С	Poor	2	6.66

#### Discussion

Open tibia fractures especially type IIIB has plagued orthopaedic surgeons since times immorable. Their management protocol has evolved over years from amputation of the limb in the early era to the era of limb reconstruction involving neurovascular repair, soft tissue cover and efficient methods of skeletal fixation. Timing of soft tissue reconstruction has been controversial. Some surgeons favour staged procedure based upon the need for second look debridement. Others favour early coverage after skeletal stabilization to prevent nosocomial infection and secondary necrosis of expanded tissue. Godina (1986) <sup>[11]</sup> and other pioneers changed the concept of primary repair and reconstruction of damaged tissue by advancing the phase of reconstruction from a delayed elective procedure to the day of injury <sup>[11]</sup>. Age of the patients is ranging from 18 years to 60 years with an average of 34.73 years and 48 patients are male (80%) and 12 patients female (20%).

Study	Average Age	Male	Female
Schandelmaier et al. (1997) <sup>[12]</sup>	36yrs (18-78)	85.36%	14.64%
Court-Brown et al. (1995) <sup>[13]</sup>	43.2yrs (18-70)	83%	17%
Keating et al. (1997) <sup>[14]</sup>	36yrs (16-88)	88%	12%
Edwards et al. (1988) <sup>[15]</sup>	37.3 (11-65)	89.4%	10.6%
Our study	34.73(18-60)	80%	20%

In the present study mode of injury was road traffic accident in 44 patients (73.33%) and assault in 16 patients (26.66%). 15 patients had associated injuries.

Out of 15 patients, 4 had head injury (6.67%), 5 had blunt

blunt abdomen trauma (6.67%) and 2 patients had urinary bladder rupture (3.33%).

abdomen trauma (8.33%), 4 patients had both head injury and

Stude	Mode o	f Injury	Associated
Study	RTA	Others	injuries
Schandelmaier et al. (1997) <sup>[12]</sup>	90.2%	8.8%	47.33%
Court-Brown <i>et al.</i> (1995) <sup>[13]</sup>	72.2%	27.8%	34.6%
Keating et al. (1997) <sup>[14]</sup>	67.5%	32.5%	36.66%
Edwards et al. (1988) <sup>[15]</sup>	85%	15%	26%
Our study	73.33%	26.66%	25%

In our study 30 patients sustained oblique fractures (50%), 20 patients had spiral fractures (33.33%) and 10 patients had comminuted fractures (16.66%).

Soft tissue wound management was acute (less than 1 week) in 22 patients (36.66%), sub-acute (1-6 weeks) in 18 patients (30%) and chronic in 20 patients (33.33%).

Study	Type of Fracture		Tissue coverage		
Study	Spiral/Communited fracture	Oblique	1-6 weeks (Acute+sub-acute)	> 6 weeks (Chronic)	
Schandelmaier et al. (1997) <sup>[12]</sup>	47%	53%	63%	37%	
Court-Brown et al. (1995) <sup>[13]</sup>	46%	54%	70%	35%	
Keating et al. (1997) <sup>[14]</sup>	46.9%	53.1%	67.3%	32.7%	
Edwards et al. (1988) <sup>[15]</sup>	46.4%	53.65	56%	44%	
Our study	50%	50%	66.66%	33.33%	

In the present investigation for skeletal stabilization internal fixation was done in 29 patients (48.33%), external fixation in 29 patients (48.33%) and none in 2 patients (3.34%). This was found in agreement with the results reported by Schandelmaier *et al.* <sup>[12]</sup>, Court-Brown *et al.* <sup>[13]</sup>.

Split thickness skin grafting was performed for 12 patients

(20%), fasciocutaneous flap for 27 patients (45%) and muscle flap & split thickness skin graft for 21 patients (35%). This was found comparable with the findings observed by Keating *et al.* <sup>[14]</sup> and Edwards *et al.* <sup>[15]</sup>, nearly 48% patients required fasciocutaneous flap, and muscle flap was done in 10-30% cases and SSG in 22-42% cases.

In our study cases managed with soft tissue cover on acute and sub-acute basis in group external fixation showed 3 patients with pin complications and 1 case with deep infection. In intramedullary nailing group 1 patient showed knee stiffness and deep infection in 1 case. In cases managed on chronic basis in the external fixation group 1 case showed non-union and 3 cases of pin complications and 2 cases of deep infection. In intramedulary nailing group 2 cases showed non-union and 2 cases of knee stiffness. In acute and subacutely managed wound complication rate was 22.22%. In chronically managed wound the complication rate of 41.6% was observed. In the study conducted by Gustilo RB *et al.* <sup>[9]</sup> and Byrd HS *et al.* <sup>[16]</sup> complication rates in chronically managed wounds was similar to our study. The differences were observed in the acute and sub-acutely managed wounds.

## Conclusion

Initial debridement is important in reducing the infection rate and the other complications associated with soft tissue coverage and skeletal stabilisation. Initial wound swab at the time of admission is essential in order to recognise the flora/ growth and institute appropriate antibiotics to reduce the infection rate. Early soft tissue coverage in the acute phase (1-6 days) should be the priority in order to prevent bacterial colonisation especially hospital acquired; wound desiccation, sequestration of the exposed bone. External fixation should be contemplated in highly comminuted fractures with severe contamination and when wound closure is not possible. Short term external fixation sequentially changed over to internal fixation combines the advantage of external as well as internal fixation as well as eliminates the disadvantages and limitation. In type III open fractures internal fixation can be contemplated when presentation is early with minimal contamination and soft tissue coverage can be obtained on acute basis. Timely meticulous wound management and early soft tissue coverage leads to early sound bone healing and early restoration of the function of the limb.

#### References

- 1. Wiss D, Sherman R, Oechsel M. External skeletal fixation and rectus abdominis free-tissue transfer in the management of severe open fractures of the tibia. Orthop Clin North Am 1993;24:549-52.
- 2. Byrd HB, Cierney G, Tebbetts JB. The management of open tibial fractures with associated soft-tissue loss: external pin fixation with early flap coverage. Plast Reconstr Surg 1987;80:1-14.
- Francel TJ, Vander Kolk CA, Hoopes JE, *et al.* Mircovascular soft tissue transplantation for reconstruction of acute open tibial fractures: timing of coverage and long-term functional results. Plast Reconstr Surg 1992;89:478-87.
- 4. Sinclair JS, McNally MA, Small JO, *et al.* Primary free flap cover of open tibial fractures. Injury 1997;28:581-87.
- 5. Hertel R, Lambert SM, Muller S, *et al.* On the timing of soft-tissue reconstruction for open fractures of the lower leg. Arch Orthop Trauma Surg 1999;119:7-12.
- 6. Trabulsy PP, Kerley SM, Hoffman WY. A prospective study of early soft tissue coverage of grade IIIB tibial fractures. J Trauma 1994;36:661-68.
- Gustilo RB, Merkow RL, Templeman D. Current concepts review: the management of open fractures. J Bone Joint Surg Am 1990;72:299-304.
- 8. Gopal S, Majumder S, Batchelor AGB, *et al.* Fix and flap: the radical orthopaedic and plastic treatment of

severe open fractures of the tibia. J Bone Joint Surg Br 2000;82:959-66.

- 9. Gustilo RB, Mendoza RM, Williams DN. Problems in the management of type III severe open fractures: a new classification of type III severe open fractures. J Trauma 1984;24:742-47.
- Giannoudis PV, Papakostidis C, Roberts C. A review of the management of open fractures of the tibia and femur. J Bone Joint Surg Br 2006;88:281-89.
- Godina M. Early microsurgical reconstruction of complex trauma of the extremities. Plast Reconstr Surg 1986;78(3):285-92.
- 12. Schandelmaier P, Krettek C, Rudolf J, Kohl A, Katz BE, Tscherne H. Superior results of tibial rodding versus external fixation in grade 3B fractures. Clin Orthop Relat Res 1997;(342):164-72.
- Court-Brown CM, Wheelwright EF, Christie J, McQueen MM. External fixation for type III open tibial fractures. J Bone Joint Surg Br 1990;72(5):801-4.
- 14. Keating JF, O'Brien PI, Blachut PA, Meek RN, Broekhuyse HM. Reamed interlocking intramedullary nailing of open fractures of the tibia. Clin Orthop Relat Res 1997;(338):182-91.
- Edwards CC, Simmons SC, Browner BD, Weigel MC. Severe open tibial fractures. Results treating 202 injuries with external fixation. Clin Orthop Relat Res 1988;(230):98-115.
- Byrd HS, Spicer TE, Cierney G 3rd. Management of open tibial fractures. Plast Reconstr Surg 1985;76(5):719-30.