

# Outcome of Open Diaphyseal Tibial Fracture Managed with Intra Medullary Inter Locking Nail

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## ABSTRACT

**Objectives:** To evaluate the outcome of open tibial diaphyseal fracture managed by intra medullary inter locking nail in terms of frequency of union, range of knee motion and absence of infection.

**Study Design:** Descriptive case series

**Place and duration of study:** Department of Orthopedics, Jinnah Post Graduate Medical Centre, Karachi from June 2009 to December 2009

**Patients and Methods:** Patients with open tibial diaphyseal fracture Gustilo-Anderson I-III A type managed by intramedullary static inter locking nail were included while patients with co morbid, previous knee or ankle disease with restricted movement and Gustilo-Anderson type III B-C were excluded. Patients were evaluated clinically and radiologically for union of fracture, infection and knee range of motion on monthly interval for 6 months and documented on proforma. SPSS-15.0 was used for statistical analysis.

**Results:** 92 patients aged 18 – 60 years were selected. 71 (77.2%) were males and 21 (22.8%) females. Mean age was  $31.96 \pm 8.86$ . Gustilo-Anderson type I fracture was found in 77 (83.7%) patients, type II fracture in 11 (12%) and type III-A in 4 (4.3%) patients. Sixty-one (66.3%) patients treated within 6 hours of injury while 31 (33.7%) patients treated between 6 - 12 hours. Superficial infection was found in 11(12%) patients during initial follow up. 30 patients needed dynamization 6<sup>th</sup> week visit. On last follow up at 6 months, 3 (3.3%) patients had deep infection and 89 (96.7%) remained infection free. Three (3.3%) patients had non-union. Majority (96.7%) had range of motion 0 to 135°. Overall outcome of the patients showed 90.2% success and 9.7% failure.

**Conclusion:** Intramedullary static Interlocking Nail is the treatment of choice in open tibial diaphyseal Gustilo-Anderson Type I-III A fractures, as it provides early mobilization of the patient, decreases hospital stay, prevents complications, improving functional outcome, thus total cost of treatment is reduced.

**Key words:** Tibia , open diaphyseal fracture, static interlocking nail, non union

## INTRODUCTION

Open fracture of Tibia shaft is among the most common fractures encountered in Orthopedic practice. Numerous factors related to the patient and injury other than residual angular deformities can affect the outcome of a patient with open tibial shaft fractures. These factors include other associated injuries, extent of soft-tissue injuries and time to union, patient education, substance abuse, ability to return to work and activities, and complications during fracture treatment.<sup>1</sup>

Locked intramedullary nailing currently is the preferred treatment for most of open tibial shaft fractures.

Interlocking intramedullary nailing of the tibia greatly improves axial rotational stability and can be used for axially unstable fractures located from 7 cm below the knee joint to 4 cm above the ankle<sup>2</sup>. The best option is the one which suits reduced hospital stay, early return to work, and less chances of infection, nonunion and rotational deformities.

Functional outcome of open diaphyseal tibial fracture in terms of frequency of union, range of knee motion and frequency of infection have not been published together in any single local or foreign literature as far we know. In our study we tried to evaluate the results of interlocking nail in open tibial fracture in contest to all the 3 parameters, so that the effectiveness of all procedure may be evaluated in all aspects.

## PATIENTS AND METHODS

Adult patients with Gustilo-Anderson Type I-III A<sup>3</sup> open tibial diaphyseal traumatic fracture

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irrespective of the age and sex were selected. Children and old patients above 60 years, Gustilo-Anderson type III B,C injuries, patients with co morbid, associated injuries, restricted knee and ankle movements. Patients were counseled for the procedure, its risks and benefits. Informed consent was taken. Majority of patients were operated within 6 hours of injury for soft tissue management and others within 6 – 12 hours of injury. Intra medullary static interlocking nail were used to fix fractures in majority on next elective list subjected to wound free of infection, risk and healthy wound care. Surgical procedure was performed and followed up by co researcher with the help of other investigators. All patients received preoperative antibiotic prophylaxis, one hour before surgery. Patients were operated under spinal/ general anesthesia in supine position, with the help of image intensifier with standard protocol of static tibial inter locking nailing<sup>2</sup>. Midline entry was made after splitting patellar tendon. Guide wire was passed closely after reducing the fragments under image intensifier. Few fractures required open reduction through the open wound. Proper length 1mm smaller diameter Nail was inserted than the maximum diameter reamer used. Proximal locking and distal locking were inserted under image intensifier. Wounds were debrided, washed and closed. Post operative I/V antibiotics given, which were switched to oral after change of dressing on 2<sup>nd</sup> post operative day. Oral antibiotics continued for 5 days.

Static and range of motion exercises were carried out with the help of trained physiotherapist, starting from second postoperative day for the operated limb and patient was allowed to sit on bedside next morning. Patient was discharged on minimum 4<sup>th</sup> post operative day with advice of non weight bearing ambulation with crutches for 2 weeks. Touch-toe weight bearing was allowed using a walker or two crutches after stitch removal on 14<sup>th</sup> day. Progressive weight bearing was allowed after the signs of union and appearance of callus on radiographs. Patients were followed at monthly intervals up to six months. At each follow-up clinical and radiological evaluation for union, range of motion of knee and infection was performed and recorded in Performa. Union was evaluated clinically by pain and tenders at fracture site, and signs of callus formation on roentgenogram. Infection was documented by presence or absence of signs of infection.

#### **Data Analysis Procedure:**

Statistical program for social science (SPSS) version 15 was used to analyze the data. The mean and standard deviation were computed for quantitative variable like Age and hospital stay. Frequency and percentage was computed for qualitative variable like sex, mode of injury (RTA) and limb involvement (Left, Right or both), type of fracture (Gustilo- Anderson I – III A). Outcome including infection (None, Superficial, Deep), Union (None, radiological, clinical) and Range of motion were measured.

#### **RESULTS**

92 patients aged 18 – 60 years, with Gustilo-Anderson Type I-III A open tibial diaphysal fracture were selected. 71 (77.2%) were males and 21 (22.8%) were females with male to female ratio 3.4: 1. The average age of the patients was 31.96 ± 8.86 (ranging from 18 to 60) years. Most of the patients (53.3%) were found in the age group of 18-30 years followed by 27 (29.3%) patients in 31-40 years, 11 (12%) in 41-50 years and 5 (5.4%) in the age group of 51-60 years. 63 (68.5%) were found with right limb involvement and 29 (31.5%) with left limb involvement. Sixty-one (66.3%) patients presented within 6 hours after the road traffic accident while 31 (33.7%) patients presented after 6 hours. Gustilo-Anderson type I fracture was found in 77 (83.7%) patients, type II fracture in 11 (12%) and type III-A in 4 (4.3%) patients. Superficial infection was found in 11(12%) patients at 2<sup>nd</sup> weeks follow up but at 3 months infection was completely cured. At 6 months follow up 3 (3.3%) had deep infection and 89 (96.7%) did not show infection.

Three (3.3%) patients had non-union at 6 months follow up while 89 (96.7%). Range of motion at 6 months follow up in majority (96.6%) of the patients was 0 to 135<sup>0</sup> followed by 3.4% who had range of motion 0-125<sup>0</sup> while none of the patient had range of motion 0-90<sup>0</sup>. Overall outcome showed 90.2% success and 9.7% failure of the procedure at 6 months follow up because of non union, infection and decreased range of motion. Superficial and deep infections were high in males than females (12.7% vs. 9.5%) and (4.8% vs. 2.8%) respectively. One female (4.8%) had non union, while two males (2.8%) had non union. Range of motion was equal in males and females (97.1% and 95%) and overall successful outcome in males and females was (84.5% and 85.7%) respectively.

**Table 1:** Outcome of Patients At 6 Months Follow Up According To Gender

Follow up outcome	Gender		
	Male	Female	Total
Infection			
▪ None	69 (79.2)	20 (95.2)	89
▪ Superficial	0 (00%)	0 (00%)	0
▪ Deep	2 (2.8)	1 (4.8)	3
Union			
▪ Yes	69 (97.2)	20 (95.2)	89
▪ No	2 (2.8)	1 (4.8)	3
Range of motion			
▪ 0-90°	0 (0)	0 (0)	0
▪ 0-125°	2 (2.8)	1 (5.0)	3
▪ 0-135°	70 (97.2)	19 (95.0)	89
Overall outcome			
▪ Successful	64 (91.4)	19 (86.4)	83
▪ Failure	6 (8.6)	3 (13.6)	9

Values given in parentheses are percentages.

**Table 2:** Outcome of Patients on 6 Months Follow Up According To Age

Follow up outcome	Age groups (years)				
	18-30	31-40	41-50	51-60	Total
Infection					
▪ None	49 (100)	26 (96.3)	10 (90.9)	4 (80)	89
▪ Superficial	0 (0)	0 (0)	0 (0)	0 (0)	0
▪ Deep	0 (0)	1 (3.7)	1 (9.1)	1 (20)	3
Union					
▪ Yes	49 (100)	26 (96.3)	10 (90.9)	4 (80)	89
▪ No	0 (0)	1 (3.7)	1 (9.1)	1 (20)	3
Range of motion					
▪ 0-90°	0 (0)	0 (0)	0 (0)	0 (0)	0
▪ 0-125°	0 (0)	1 (3.8)	1 (10)	1 (25)	3
▪ 0-135°	55 (100)	25 (96.2)	9 (90)	3 (75)	89
Overall outcome					
▪ Successful	51 (100)	20 (80)	8 (72.7)	4 (80)	83
▪ Failure	0 (0)	5 (20)	3 (27.3)	1 (20)	9

Values given in parentheses are percentages.

Deep/superficial infection and non union was higher in older age groups. 3 cases each of infection and non union found in 31 – 60 years age. Range of motion 0 – 135° in age group 18-30 years was 100 % and 96.1% in 31-40 years. However, proportion of overall successful outcome was also higher in younger age groups i.e. 93.9% in age group 18-30 years. Deep and superficial infections were higher in patients presenting > 6 hours than those presenting within 6 hours after the injury (22.6% vs. 6.6%) and (6.5% vs. 1.6%) respectively. Non-union was high in patients with delayed presentation i.e. > 6 hours than those

presenting within 6 hours after the injury (6.5% vs. 1.6%). Good range of motion (0-135°) was observed in patients presenting within 6 hours than delayed presentation (100% vs. 89.7%). Proportion of successful outcome was also high in patients presenting within 6 hours than delayed ones (96.7% vs. 61.3%). Deep infection was found in 4 cases (25%) type-III-A fractures. Superficial infection was high in fracture type III-A than type I & II (27.3% vs. 9.1% vs.25%) respectively. One case of non-union was observed in each fracture type (1.3% type-I, 9.1% type-II and 25% type-III-A). Proportion of a good range of motion (0-135°) was

higher in type-I fracture (98.7%) followed by type-II (90%). Proportion of successful outcome was higher in fracture type-I followed by type-II and type-III-A respectively (87%, 81.8% and 50%). 30

patients required dynamization on 8 and 12 weeks follow up because of evidence of decreased union on clinical and radiological follow up.

**Table 3:** Outcome of Patients on 6 Months Follow Up According To Time Duration of Injury

Follow up outcome	Time duration of injury		
	≤ 6 hours	> 6 hours	Total
Infection			
▪ None	60 (98.3)	29 (93.1)	89
▪ Superficial	0 (0)	0 (0)	0
▪ Deep	1 (1.6)	2 (6.9)	3
Union			
▪ Yes	60 (98.4)	29 (93.5)	89
▪ No	1 (1.6)	2 (6.5)	3
Range of motion			
▪ 0-90°	0 (0)	0 (0)	0
▪ 0-125°	0 (0)	3 (10.3)	3
▪ 0-135°	63 (100)	26 (89.7)	89
Overall outcome			
▪ Successful	69 (97.2)	19 (73.1)	89
▪ Failure	2 (2.8)	7 (26.9)	9

Values given in parentheses are percentages.

## DISCUSSION

There are similarities in our and western studies, having more road traffic accidents compared to gunshot injuries<sup>4</sup>. Most of our patients were young, leading active life, fond of motor bikes and cars, the major cause of road accidents. Public transport vehicles are also responsible for many road traffic injuries and pedestrians are frequent victims in this city of Karachi, Pakistan<sup>5,6</sup>. A local study reported that a total of 36% ran while crossing and were 1.8 times more likely to cause traffic to swerve than those who walk. The reflection of the causes can also be seen in our study. Males are affected more common than females in our study, the reason being their nature of work. In our study 77% males are affected while remaining are females. Another local study reports that most common mechanism of injury was road traffic accident (44%), rate of superficial wound infection was 10.8% and deep infection 4.6%. Non-union occurred in 23.1% (15 cases) of tibial fractures treated with IM nailing.<sup>7</sup> The infection rate in the present study (3.26%) are consistent with the local study but frequency of non-union cases is high. However, in another study, proportion of non-union was 4.3%.<sup>8</sup> In an Indian study comprising of 40 prospective cases of open fracture of tibia grade-I, II, IIIA and III-B in a road traffic accident, functional results were

excellent in 65%, good in 25% and fair in 10% with 100% successful results as none of non-union case and only 10% delayed union cases<sup>9</sup>. However, in contrast to Indian study based on single assessment parameters, we employed three parameters for assessment of non-infectious union with 0-135° knee range of motion for assessment of overall success of intramedullary interlocking nail. Our time of union is comparable to different studies<sup>10,11</sup> in a range between 17 – 24 weeks. The radiological and clinical union was achieved in 89 (96.7%) patients. Other studies also reveal excellent results regarding union<sup>12,13</sup>. Another study reported that non union occurred in 2% cases of open fracture<sup>14</sup> compared to 3.26% of ours. Eleven patients got superficial infection while three developed deep infection. In a study conducted in Nepal, 14.5% cases of superficial infection and 9.1% cases of deep infection were reported<sup>15</sup>. 89(96.7%) of our patients got almost full range of motions of knee at the end of study period while was 3(3.3%) patient's knee range of motion was restricted. Proportion of successful outcome was also higher in group of patients who presented within 6 hours than those who were delayed (96.7% vs. 61.3%), this statement is comparable with McQueen et al<sup>16</sup> reported good functional outcome for patients who had surgery within 24 h. Our study is comparable to other

international studies. A sufficient successful outcome is achieved in the present study at follow up just after 24 weeks.

## CONCLUSION

Intramedullary Interlocking Nail is the treatment of choice in open diaphyseal tibia fractures that provides, rotational and axial stability, early mobilization of the patient and decreases hospital stay, thereby total cost of treatment is reduced.

## REFERENCES

1. Obrebsky WT, Medina M. Comparison of intramedullary nailing of distal third tibial shaft fractures: before and after Traumatologists. *Orthopaedics*; 2004. Nov;27:1180-4.
2. Whittle AP, Wood II GW. Fractures of Lower Extremity. In: Canale ST. *Campbell's Operative Orthopedics*. 10<sup>th</sup> Edition. USA. Mosby, 2003: 2725-2872
3. Gustilo RB, Anderson JT. Prevention of Infection in the Treatment of 1,025 open fractures of long bones *JBJS* 58-A: p 453-458, 1976
4. Merchant TC, Dietz FR. Long-term follow-up after fractures of the tibial and fibular shafts. *J Bone Joint Surg Am*. Apr 1989; 71: 599-606.
5. Kazmi TH, Omair A, Inam SN, Shaikh I, Jamali S. Spectrum of injuries at the emergency department of a tertiary care hospital. *J Coll Phy Surg Pak*. 2004;14:61.
6. Luby S, Hassan I, Jahangir N, Rizvi N, Farooqi M, Ubaid S, et al. Road traffic injuries in Karachi: the disproportionate role of buses and trucks. *Southeast Asian J Trop Med Public Health* 1997;28:395-8.
7. Mohammed A, Saravanan R, Zammit J, King R. Intramedullary tibial nailing in distal third tibial fractures: distal locking screws and fracture non-union. *International Orthopaedics* 2008;32:547-9.
8. Blachut PA, O'Brien, PJ, Meek RN, Broekhuysen HM. Interlocking Intramedullary Nailing with and without Reaming for the Treatment of Closed Fractures of the Tibial Shaft. A Prospective, Randomized Study. *J Bone Joint Surg* 1997; 79-A; 640-6
9. Vineet J, Aggarwal A, Methani A, Jain P, Dhaon BK. Primary Unreamed intramedullary locked nailing in open fractures of tibia. *Indian J Orthop*; 2005;39:30-2.
10. Bone LB, Johnson KD. Treatment of tibial fractures by reaming and intramedullary nailing *J Bone Joint Surg*. 1986; 68 :877-8.
11. Blachut PA, O'Brien, PJ, Meek RN, Broekhuysen HM. Interlocking Intramedullary Nailing with and without Reaming for the Treatment of Closed Fractures of the Tibial Shaft. A Prospective, Randomized Study. *J Bone Joint Surg* 1997; 79-A; 640-6
12. Freedman EL, Johnson EE. Radiographic analysis of tibial fracture malalignment following intramedullary nailing. *Clin Orthop*. 1995; 315:25-33.
13. Yokoyama K, Itoman M, Uchino M, Fakushima K, Nitta H, Kajima Y. Immediate versus delayed intramedullary nailing for open fractures of the tibial shaft: A multivariate analysis of factors affecting deep infection and fracture healing. [http:// www.ijoonline.com](http://www.ijoonline.com) on October 26, 2009.
14. Dhangiri A , Garofalo R , Francios C, Pierre-Francios L, Michael W, Elyazid M. Closed and open grade I and grade II tibial shaft fractures treated by reamed intramedullary nailing. *Med P Practice* 2006;15: 293-8.
15. Giri SK, Adhikari BR, Gurung GB, RC DR, Bajracharya AR, K Khatri. Mini-open reduction and intramedullary interlocking nailing of fracture shaft of tibia without an image intensifier. *Nepal Med Coll J* 2008; 10 (2): 123-5.
16. McQueen MM, Christie J, Court-Brown CM. Compartment pressures after intramedullary nailing of the tibia. *J Bone Joint Surg Br*. 1990; 72:395-7.