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## Retrospective study of management of diaphyseal fractures of tibia with intramedullary interlocking nail

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### Abstract

Most common long-bone fracture is tibial shaft fracture encountered by most of the orthopaedic surgeons. Intramedullary nailing has become the treatment of choice for displaced diaphyseal fractures of the tibia in adults. There have been multiple reports to support the superiority of intramedullary nailing to other methods of treatment with respect to return to weight bearing and work. The aim of the study is to assess diaphyseal fractures of tibia with special reference to fracture anatomy, pattern and stability, to determine fracture healing and the union rates with intra-medullary interlocking nail and to study the functional outcome of intra-medullary interlocking nail. This is a retrospective cross sectional study. The present study includes 255 fractures of isolated tibia shaft surgically treated with closed intramedullary interlocking nailing during period from July 2010 to July 2016. All the patients who satisfied inclusion criteria were included in this study. Open tibia fractures were classified according to modified Gustillo and Anderson's Classification. All enrolled patients evaluated with Johner & Wruh's criteria. Functional outcome were graded into excellent, good, fair and poor and were statically analyzed. Final assessment was done at 6 weeks, 3months, 6 months and 12 months. In our present series, 168 out 240 patients had excellent results which correspond to around 70%, 48 patients had good results around 20%, 16 patient had fair results around 7%, and 8 patients had poor results around 3%. Closed intramedullary interlocking nailing is effective mode of treatment in tibial diaphyseal fractures. Immediate post-operative partial weight bearing and subsequent full weight bearing helps in fracture union. Open injuries with severe soft tissue injury further leading to postoperative infection was the main cause for nonunion, after inter locking nailing.

**Keywords:** tibia diaphyseal fracture, intramedullary interlocking tibia nail, functional outcome

### 1. Introduction

A tibial shaft fracture occurs commonly due to trauma, commonly in middle-aged and young people. Less prevalent in children and older people. Commonest site of long bone fractures is tibial shaft because of its superficial location <sup>[1]</sup>.

Most common long-bone fracture is tibial shaft fracture encountered by most of the orthopaedic surgeons. Around 26 tibial diaphyseal fractures per 100,000 of the population per year seen in average population. Females are less commonly affected than males, as the male incidence is about 41 per 100,000 per year and incidence of females is about 12 in 100,000 per year. The average age seen in tibial shaft fracture population is about 37 years; in females 54years and in males 31 years <sup>[2]</sup>.

Intramedullary nailing has become the treatment of choice for displaced diaphyseal fractures of the tibia in adults <sup>[3]</sup>. A commonly cited complication of this injury treated by this method is anterior knee pain <sup>[4]</sup>. This has been associated with the approach for nail insertion, and the influence of entry point has also been extensively investigated.<sup>5</sup> Research has also suggested that patients have a significant rate of both subjective and objective complications at 3-year follow-up.

There have been multiple reports to support the superiority of intramedullary nailing to other methods of treatment with respect to return to weight bearing and work <sup>[6]</sup>. However, one series indicated that at the limit of their follow-up (22 months), 18% of patients had not yet returned to their previous occupation whereas 29.5% had not yet returned to their previous level of recreation <sup>[7]</sup>. Further, it has been shown that even a very small amount of residual angulation in the united fracture alters load through the knee and ankle joints <sup>[8]</sup>.

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The evidence in the literature on the effects of tibial angular malunion in lower extremity outcomes is conflicting; however, this alteration in force could cause a predisposition to osteoarthritis [9]. The aim of the study is to assess diaphyseal fractures of tibia with special reference to fracture anatomy, pattern and stability, to determine fracture healing and the union rates with intra-medullary interlocking nail and to study the functional outcome of intra-medullary interlocking nail.

### Materials & Methods

This is a retrospective cross sectional study. Patients of either gender belonging to adult age group between 18-60 years presented with fracture shaft tibia to orthopedic department of R L Jalappa hospital Kolar admitted from July 2010 to July 2016 were evaluated. All the patients who satisfied inclusion criteria were included in this study. Open tibia fractures were classified according to modified Gustillo and Anderson's Classification [10, 11]

Main Outcome Measurements: All enrolled patients evaluated with Johner & Wruh's criteria [12]. Final assessment in our series will be done at 6 weeks, 3months, 6 months and 12 months taking into account of the following objective and subjective symptoms of gait, pain, deformity, range of motion of knee, ankle and sub-talar joints, shortening, neurovascular disturbances, ability to do strenuous activities, radiological union and presence or absence of non-union. Functional outcome were graded into excellent, good, fair and poor and were statically analyzed.

### Inclusion Criteria

- Patients diagnosed with diaphyseal fractures of tibia with or without fibular shaft fracture.
- Skeletally mature patients of either gender belonging to the age group 18-60 years.
- Closed and open type I, II Gustillo Anderson type of fractures.

### Exclusion Criteria

- Proximal tibial fractures extending to an articular surface.
- Tibial fractures with neurovascular injuries.
- Pathological tibia fractures.
- Open III Gustillo Anderson type of fractures.
- Patients with ipsilateral femur fracture.
- Skeletally immature patients.

Data collection: Data collected retrospectively from medical records on patients who have undergone intramedullary nailing surgery satisfying inclusion and exclusion criteria by systematic random sampling technique. A total of 255 patients were selected in which 15 patients did not have follow up.

Statistical Analysis: The collected data coded in to an excel format and all quantitative measures like age, sex, type of fracture, mode of injury, time of union and complications were evaluated based on the descriptive statistics. Microsoft word 2010 was used to generate tables and graphs.

### Results

The present study includes 240 fractures of isolated tibia shaft surgically treated with closed intramedullary interlocking nailing during period from July 2010 to July 2016 in the Department of Orthopedics, R.L.J Hospital attached to Sri Devraj urs medical college and Research Centre, Kolar, Karnataka. All the patients were available for follow-up.

Period of follow-up was 12 months.

### Age/sex/fracture distribution

**Table 1:** Age/sex/fracture distribution

AGE (years)	No. of cases	Percentage
18-29	88	36.7%
30-39	88	36.7%
40-49	16	6.6%
50-59	48	20%
SEX		
Male	216	90
Females	24	10
Type Of Fracture		
Closed	168	70%
Open Type 1	32	13.3%
Open Type 2	40	16.6%

Mode Of Injury	No. Of Cases	Percentage
Rta	216	90 %
Fall	16	6.6 %
Assault	8	3.3 %
Associated Injury		
Metatarsal	8	3.3
Rib fracture	8	3.3

**Table 2:** Union in relation to type of fracture

Duration in weeks	Closed	Open type 1	Open type 2	Total
0 To 12 Weeks	0	0	0	0
13 To 16 Weeks	16	0	0	16
17 To 20weeks	128	8	0	136
> 20 Weeks	24	24	32	80
Non Union	0	0	8	8

**Table 3:** Complications

Complications	No of cases	Percentage
Infection	18	7.5%
Non union	8	3.3%
Anterior knee pain	64	26.7%
Delayed union	80	33.3%

### 1. Range of motion

One of the essential aspects of closed reduction and internal fixation with Interlocking intramedullary nailing is the ability to mobilize the joints early.

#### a. Knee motion

In 208 out of 240 patients had full range of knee motion (0 – 130°) gained at 12 weeks. In 24 patients > 80% of knee range of motion (up to 105°) was noted, in 8 patients >75% of knee range of motion (up to 95°) was noted.

#### b. Ankle motion

In 168 out 240 patients had full range of ankle motion (Dorsiflexion 0 -20°, plantar flexion 0 – 50°) gained at 12 weeks, in 72 patients > 75% range of ankle motion was noted.

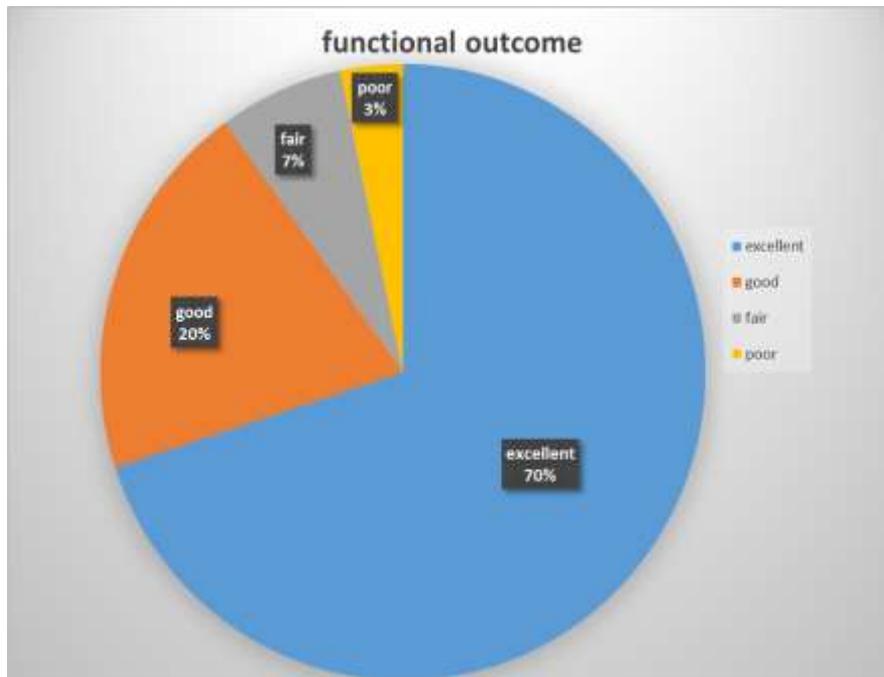
### 2. Infection

10 patients developed superficial infection. This healed with oral antibiotics, 8 patients developed deep infection and treated with antibiotics based on pus culture sensitivity. All 8 fractures had gone into nonunion in our study, 8 patients had poor results. These 8 patients were Type II open fractures treated with primary intramedullary nailing. Open fracture

had led to chance of infection which has gone into nonunion and along with fracture pattern. Because of infection patients were delayed for partial weight bearing and full weight bearing. So they developed quadriceps wasting and their knee and ankle range of movements are also restricted. In current study no failure of implant was observed.

### 3. Functional results

Detailed analysis of function results of patients were done at end 6 months on the basis of following criteria by Johner and Wruh's. In our present series, 168 out 240 patients had excellent results which correspond to around 70%, 48 patients had good results around 20%, 16 patient had fair results around 7%, and 8 patients had poor results around 3%.



**Graph 1:** Functional results (Johner and Wruh's criteria)

### Discussion

In current series 240 cases of fracture of shaft of the tibia were treated by closed interlocking intramedullary nailing. They were followed up for an average of 12 months. The purpose of this study was to evaluate the end results of treatment in these patients. These cases were of different age groups, occurred in both sexes, and the fracture were of different types and at different levels.

The average age of all cases in this series was 34.7 years. The fracture is more common in the age group of 18- 39 years. The average age in a different studies as shown in table.

**Table 4:** Comparison of age in different studies: There were 216 male and 24 female patients showing male predominance of 90 % in our Series of 240 cases. Active young individuals were the major sufferers.

Sl No.	Studies	Average Age ( years)
1	Lawrence <i>et al</i> <sup>[13]</sup>	34.9
2	Kelly. A <i>et al</i> <sup>[14]</sup>	34.4
3	Ferguson <i>et al</i> <sup>[15]</sup>	33
4	Bonnevialle <i>et al</i> <sup>[16]</sup>	28
5	Present study	34.7

**Table 5:** comparison of sex ratio in different studies: Working men with outdoor activities are majority.

Studies	Male	Female
Lawrence <i>et al</i> <sup>[13]</sup>	56%	44%
Kelly <i>et al</i> <sup>[14]</sup>	77%	23%
M. Ferguson <i>et al</i> <sup>[15]</sup>	78%	22%
Bonnevialle <i>et al</i> <sup>[16]</sup>	73%	27%
Mohan <i>et al</i> <sup>[17]</sup>	80%	20%
Present study	90%	10%

**Table 6:** comparison of mode of injury in different studies: Road traffic accidents about 90% are cause for tibial fractures in present series. High velocity, road traffic accident is the major cause of injury.

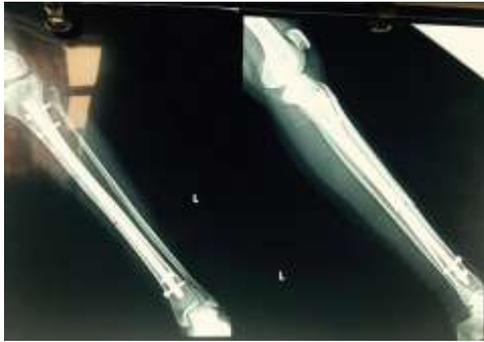
Studies	RTA	FALL
M. Ferguson <i>et al</i> <sup>[15]</sup>	45%	33%
Bonnevialle <i>et al</i> <sup>[16]</sup>	66%	5.2 %
Present study	90%	6.6%

In present series, 232 out of 240 cases have united with average of 19.2 weeks (16 weeks to 32 weeks), In Mohan *et al* <sup>[17]</sup> average period of union was 36 weeks, In M. Ferguson *et al* <sup>[15]</sup> average period of union was 35.8 weeks.

### Case Illustrations X Ray Pictures



Pre-Operative X Ray



Immediate Post-Operative X Ray

**Follow Up X Rays**



6 Months Follow Up



1 Year Follow Up

**Clinical Photos**



Full Range Of Knee and Ankle Movements at End of 6 Months

**Conclusions**

Active young individuals were the main sufferers in leg fractures, working men with outdoor activities are majority in tibia shaft fractures. High velocity road traffic accidents is the major cause of these fractures among which mid diaphysis fractures are common site.

Closed intramedullary interlocking nailing is effective mode of treatment in closed tibial fractures, closed tibial shaft fractures with Undisplaced or mini displaced fractures have united well, more displaced factures have gone into delayed union.

Immediate post-operative partial weight bearing and subsequent full weight bearing helps in fracture union

Open injuries with severe soft tissue injury further leading to postoperative infection was the main cause for nonunion, after inter locking nailing. Proximal end of nail prominence above cortex is the major cause for anterior knee pain.

Overall functional results are good with closed intramedullary interlocking nailing for tibial diaphyseal fractures. Intramedullary interlocking nails are the current choice of treatment for isolated tibial shaft fractures which are Undisplaced or minimally displaced fractures as it shows better union rates and early mobilization.

**Limitations**

The infection and non-union rates in our study varied as this was a retrospective study and there were several operating surgeons were involved. Long term results of surgical management of tibial shaft fractures with closed intramedullary nailing could not be assessed because of limited duration of study and follow up was done for an average period of 12 months only, further studies are needed to evaluate long term functional outcomes.

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