

Surgical management of fracture shaft tibia with closed interlocking intramedullary nailing – A clinical study

Rao N.¹, Ravikanth K^{2*}, Reddy T V R.³, Chandra T J.⁴

DOI: <https://doi.org/10.17511/ijoso.2020.i01.10>

¹ N V Narasimha Rao, Department of Orthopedics, GSL Medical College, Rajahmundry, Andhra Pradesh, India.


^{2*} Ravikanth K, Department of Orthopedics, GSL Medical College, Rajahmundry, Andhra Pradesh, India.

³ Tetali Venkata Rama Reddy, Department of Orthopedics, GSL Medical College, Rajahmundry, Andhra Pradesh, India.

⁴ Jaya Chandra T, Central Research Laboratory, GSL Medical College, Rajahmundry, Andhra Pradesh, India.

Introduction: The tibia being the most commonly fractured long bone. A study was conducted to analyze the efficacy of closed intramedullary nailing tibial shaft fractures. **Materials and methods:** Study was conducted in the Department of orthopedics. Individuals with closed tibial diaphyseal fractures of >18 years, open diaphyseal fractures of tibia type I, type II were included. Open diaphyseal fractures of tibia Type III A, B, C, tibial fractures with intraarticular extensions and medically ill were excluded. Under spinal anesthesia, intramedullary locking was done as per the protocol. **Results:** During the study period, 50 fractures were included. the male-female ratio was 5.25. The youngest patient was 19 years and the oldest patient was 67 years. 60% of the participants had right tibial fractures and 40% with left. Thirty-nine (78%) participants simple and 22% (11) had type I and type 11 compound fractures. The majority of fractures (58%; 29) were united within 18-20 weeks. The average healing time was 19 weeks. **Conclusion:** In this study 16.9 weeks was the average healing time and 76% patients showed excellent outcome.

Keywords: Fracture, Tibia, Participant, Report

Corresponding Author	How to Cite this Article	To Browse
Ravikanth K, Department of Orthopedics, GSL Medical College, Rajahmundry, Andhra Pradesh, India. Email: gsocentralresearchlab@gmail.com	Rao NVN, Ravikanth K, Reddy TVR, Chandra TJ. Surgical management of fracture shaft tibia with closed interlocking intramedullary nailing – A clinical study. Surgical Review Int J Surg Trauma Orthoped. 2020;6(1):53-59. Available From https://surgical.medresearch.in/index.php/ijoso/article/view/164	

Introduction

As industrialization and urbanization are progressing year by year with a rapid increase in traffic, the incidence of high energy trauma is increasing at the same speed.

The tibia being the most commonly fractured

Long bone because the exposed anatomical location of the tibia makes it vulnerable to the direct blow and high energy trauma as a result of vehicle accidents resulting in fractures [1].

Various modalities of treatment such as conservative gentle manipulation, use of short

Manuscript Received 21-01-2020	Review Round 1 30-01-2020	Review Round 2 05-02-2020	Review Round 3	Accepted 10-02-2020
Conflict of Interest No	Funding Nil	Ethical Approval Yes	Plagiarism X-checker 14%	Note



Leg or long leg cast, open reduction internal fixation with plates screws, intramedullary fixation and external fixation are available.

Among the various modalities of treatment such as conservative gentle manipulation and use of short leg or long leg cast, open reduction internal fixation with plates and screws, intramedullary fixation and external fixation. Surgeon should be capable of using all these techniques and must weigh advantages and disadvantages of each one and adapt the best possible treatment.

Immobilization in plaster cast was most commonly used in the past; improper maintenance of tibia length and presence of inaccessible wounds are drawbacks [2]. Due to the high rate of infections, open reduction and internal fixation with plates, screws had yielded a high rate of unacceptably [3,4,5].

At this juncture, inspite of the disadvantages such as bulky frames, frequent pin tract infections as well as non-unions and malunions, external fixation had become the treatment of choice by many traumatologists [6].

The intramedullary nailing locked or unlocked has become an attractive option since image intensifiers have made closed intramedullary nailing possible. In continuation, intramedullary nailing, locked or unlocked has become an attractive option for most type I, type II, type IIIA open and closed tibial shaft fractures [7].

With these, a study was conducted to analyze the efficacy of closed intramedullary nailing tibial shaft fractures.

Materials and Methods

Settings: It was a hospital-based study, conducted in the department of orthopedics, GSL Medical College, Rajahmundry.

Duration of study: The study was conducted from September 2012 to September 2014.

Sampling method: Random sampling was considered in this study.

Inclusion criteria: Individuals with closed tibial diaphyseal fractures group of >18 years, open diaphyseal fractures of tibia type I, type II as classified by Gustillo-Anderson grading.

Exclusion criteria: Open diaphyseal fractures of tibia Type III A, B, C, tibial fractures with

Intraarticular extensions and medically ill who were unfit for surgery

Sample size: All the individuals who satisfy the inclusion criteria during the study period were included in the study.

Ethical approval: Study protocol was approved by the institutional ethical committee.

On admission, the general condition of the patient was assessed by considering hypovolemia, associated orthopedic or systemic injuries and resuscitative. All patients received analgesia in the form of intramuscular and antibiotics through intravenous for open fractures. A thorough clinical examination was performed including detailed history relating to age, sex, occupation, mode of injury, past and associated medical illness.

The limb was immobilized in the form of above-knee plaster of Paris posterior slab. Limb elevation over a pillow was given to all patients. All the routine blood investigations were performed as per the institutional protocol. Radiographs such as anteroposterior and lateral views of the entire long bone including the joints proximal and distal to it were taken.

Preoperatively the length of the nail is calculated by measuring from just above the tibial tuberosity to the prominent part of the medial malleolus. The medullary canal is measured at the isthmus on X-ray for nail diameter. Accordingly, a stock of interlocking nails 2 cm above and below the measured length and 1 mm above and below the required diameter was kept.

Nails in diameters of 8, 9 and 10mm with length from 280 – 360 mm with increments of 20 mm were used for tibia interlocking. For locking, there are 2 holes on either side, at the proximal and distal ends of the nail. Locking screws are self-tapping, 4.5mm available from 25 – 95mm in 5 mm increments.

In all the cases spinal anesthesia, combined spinal and epidural anesthesia was used in some cases. All pts were positioned supine on the radiolucent table. The injured leg was positioned freely, with the knee flexed 90° over the edge of the operating table. And the remaining surgical procedure was done as per the standard protocol as per the Johner and Wruh's Criteria [8].

Statistics such as mean, average, percentages were used in this study.

Results

During the study period, 50 fractures of tibial shaft surgically treated with closed intramedullary interlocking nailing were included.

Out of the 50 study participants, 84% (42) were male and 16% (8) were female and the male-female ratio was 5.25 (Table 1).

Table-1: Gender wise distribution of the study participants.

Gender	Number	%
Male	42	84
Female	8	16
Total	50	100

The youngest patient was 19 years and the oldest patient was 67 years. Age-wise, 24% (12) patients were included in <25 years age group, 10% (5) in 25-34 years group, 26% (13) in 35-44 years group, 12% (6) in 45-54 years group, 24% (11) in 55-64 years group and 6% (3) in 65-74 years group (Table 2).

Table-2: Age-wise distribution of the study participants.

Age	Number	%
< 25	12	24
25-34	5	10
35-44	13	26
45-54	6	12
55-64	11	24
65-74	3	6
Total	50	100

When the side of fracture was considered in this study, 60% (30) of the participants had right tibial fractures and 40% (20) with left and the right-left fracture ratio was 1.5. Thirty-nine (78%) participants simple and 22% (11) had type I and type II compound fractures.

In this report, a motor vehicle accident was identified to be the common cause for the fracture (94%;47) followed by fall (6%; 3) and the ratio was 15.6. In the present study, the majority of fractures (58%; 29) were united within 18-20 weeks followed by 12-17 weeks (30%; 15) and 21-24 weeks (12%; 6) (Table 3).

Table-3: Fracture union among the study participants after the nailing.

Time in weeks	Number	%
12-17	15	30

18-20	29	58
21-24	6	12
Total	50	100

Table-4: Functional outcome of study participants after the surgical intervention.

Functional outcome	Number	%
Excellent	38	76
Good	11	22
Fair	1	2
Poor	0	0
Total	50	100

The average healing time was 19 weeks. In this report, 76% (38) had excellent functional outcome followed by good (22%; 11) and fair (2%; 1) (Table 4).

Discussion

Treatment of diaphyseal fractures of tibia evolved for many years. There are several methods of treatments and there are many modifications in each treatment method. Closed reduction and cast application which was practiced for many years based on Sarmiento functional cast bracing.

But its main disadvantage was the development of fracture disease. Pins and cast application was another method. Its disadvantage was chances of loss of alignment, rotation, so more chances of malunion. Chances of fracture disease are also more.

An external fixator application is another treatment option. It has the disadvantage of the development of pin tract infection. Most of the time it is used as temporary fixation. Plate and screws fixation for fracture tibia is another method used. It gives rigid fixation. But chances of infection are very high because periosteum stripping is more, soft tissue damage is more.

Intramedullary nailing has many advantages. Closed reduction, reaming, inter-locking all have advantages. Closed reduction is also called as indirect reduction, it preserves fracture site hematoma. Fracture unites by indirect healing. Chances of infection are very less in this method as soft tissue around fracture is undisturbed.

Reaming prepares the canal into uniform diameter for proper fitting of nail. Interlocking with screws maintains axial length and rotation of fracture fragments. But they also have disadvantages, closed reduction is technically demanding. It needs

C-arm guidance for reduction. Hazards of X-ray are another problem. Reaming destroys endosteal blood supply. Intramedullary nails are considered the treatment of choice for most tibial shaft fractures.

Although the case for this technique has been strengthened by the introduction of locking screws to maintain fracture length, alignment and rotation, there are concerns about nail use in distal segment fractures because of several technical limitations that make fracture reduction and stable fixation difficult [9].

Moderate quality evidence suggests that there is no clear difference in the rate of major re-operations and complications between reamed and unreamed intramedullary nailing [10]. An Indian study by DD Tanna et al. reported that an interlocking tibial nailing without any image intensifier, in 56 patients, using hollow tubular nails with no slit and anteroposterior holes for the locking screws [11].

The average age in this study population was 42 years and fractures were more common in the age group of 35 –

44 years in this study. Tibial shaft diaphyseal fractures were seen in the younger age group because this age group people were physically active and usually these were only involved in outdoor activities. The average age group who underwent fractures was reported to be 35 years and 32.4 years respectively by Arne Ekeland et al. [12] and Court Brown et al. [13].

Gender wise, the male female ratio in this study was 5.25; 84% (42) were male and 16% (8) were female participants. Usually male were involved more in outdoor activity. Similar findings were reported in the literature [11, 13, 14]. Court Brown et al. reported 81.3% male incidence 18.7% female [13]. Hooper et al. [14] reported 82% male incidence Gatson et al. reported 81% [15].

In this study 78% cases had closed fractures and 22% were open type 1 and 11 tibial fractures. In a report by Lawrence B. Bone et al. closed type were noted at a rate of 78% [16]. In this study, cause of fractures was identified to be road accidents in 94% cases. It was reported to be 90% by Lawrence B. Bone et al. [16] and 59% by Hooper et al. [14].

In this study, fractures were operated after 2 to 12 days after injury. The cause of delay for surgery were presence of open injuries, head injury and associated systemic illness like diabetes, hypertension and anemia. The commonest nail

Used was intramedullary nails of 340mm X 9mm followed by 320 X 9 and 360 X 9 mm nails. This is in contrast to the western literature where most of the nails used were larger diameter [17]. The mean duration of surgery in this study was 90 minutes, ranged 60 – 180 minutes. Postoperatively, in this report, no complications like fat embolism, compartment syndrome, neurological or vascular injury were identified.

Depending upon the type of fracture and stable fixation of fracture, partial weight bearing was started by the 4th week in this study. Full weight bearing at 10th week in 19 (70.3%) patients and at 12th week in 8 patients (29.6%) and the average time of full weight bearing was 10.6 weeks in this study. The full weight bearing was reported to be 8.5 weeks by Gupta et al. [18].

The final assessment in this study was done at 6 months using the Johner and Wruh's criteria [54]. Functional outcome was excellent in 76% (38) patients, 22% (11 patients) had good, 2% (1 patient) had fair functional outcome.

In another study it was reported 62.50% excellent, 31.8% good, 4.5% fair and 1.2% poor results [19]. Whereas Arne Ekel et al. reported 64.4% excellent, 28.8% good and 4.4% as fair [12].

Postoperatively, in our series, no complications like fat embolism, compartment syndrome, neurological or vascular injury occurred. Superficial infections occurred in one patient at the site of surgical incision over Knee and both the superficial infections healed by dressings and antibiotics.

In majority of our patients, active hip, knee, ankle movements and quadriceps exercises were started on the first postoperative day in 29 patients, in one patient with polytrauma it was delayed. Majority of patients were mobilized with the walker from the third postoperative day, without bearing weight on the operated leg.

Full weight bearing in the present study was started at 10th week in 19 patients (70.3%) and at 12th week in 8 patients (29.6%). The appearance of bridging callus was used to assess and allow the patient full weight bearing. The average time of full weight bearing was 10.6 weeks. In a study full weight bearing was mentioned at 8.5 weeks [20].

Limitations

Small sample size is the limitation of this study.

Conclusion

Road traffic accidents were the common cause for tibia fractures and common among male aged 35 – 44 years. Nail sized 340mm X 9mm was commonly used for fixation and 16.9 weeks was the average healing time. Thirty-eight (76%) patients showed excellent outcome.

What does this study add to the existing knowledge?

Road traffic accidents were the common cause for fractures and outcome was excellent with interlocking intramedullary nailing.

Author's contribution

Dr. N V Narasimha Rao: Literature searching, protocol reparation

Dr. K Ravikanth: Article writing, data analysis

Dr. Tetali Venkata Rama Reddy: Patient reparation, literature searching

Dr. T Jaya Chandra: Article writing, data analysis

Reference

01. Brown PW, Urban JG. Early weight-bearing treatment of open fractures of the tibia- An end-result study of sixty-three cases. *JBJS*. 1969;51(1)59-75. [Crossref]
02. Bach AW, Hansen Jr ST. Plates versus external fixator in severe open tibia shaft fractures- A randomized study. *Clin Orthop*. 1989;241;89-94. [Crossref]
03. Reidt T, Webb JK, Allgower M. Experience with the dynamic compression plate (DCP) in 418 recent fractures of tibial shaft. *Injury*. 1976;7(4)252-257. doi: [Article:https://doi.org/10.1016/s0020-1383(75)80002-7][Crossref]
04. Ekeland A, Thoresen BO, Alho A, Strömsöe K, Follerås G, Haukebø A. Interlocking Intramedullary nailing in the treatment of tibial fractures. *Clin Ortho Rel Res*. 1988;231;208-215. [Crossref]
05. Smith JE. Results of early and delayed internal fixation for tibial shaft fractures- A review of 470 fractures. *J Bone Joint Surg*. 1974;56B(3)469-477. [Crossref]
06. Holbrook JL, Swientkowski MF, Sanders R. Treatment of open fractures of tibial shaft- Ender nailing versus external fixation- A randomized prospective comparison. *J Bone Joint Surg*. 1989;71(8)1231-1238. [Crossref]
07. Paige A Whittle, George W Wood II. Fractures of lower extremity; 10th ed In- Campbell's Operative Orthopaedics, Terry S Canale, ed. Philadelphia- Mosby, Elsevier. 2008;1;2754-2757. [Crossref]
08. Wruhs O, Johner R. Classification of tibial shaft fractures and correlation with results after rigid fixation. *Clinical Orthop*. 1983;178;7-25. [Crossref]
09. Salem KH. Unreamed intramedullary nailing in distal tibia fractures. *Int Orthop*. 2013;37(10)2009-2015. doi: [Article:https://dx.doi.org/10.1007%2Fs00264-013-1998-y][Crossref]
10. Toivanen JA, Väistö O, Kannus P, Latvala K, Honkonen SE, Järvinen MJ. Anterior knee pain after intramedullary nailing of fractures of the tibial shaft- a prospective, randomized study comparing two different nail-insertion techniques. *JBJS*. 2002;84(4)580-585. doi:[Article:https://doi.org/10.2106/00004623-2002-04000-00011][Crossref]
11. Tanna DD. Interlocking tibial nailing without an image intensifier. *J Bone Joint Surg (Br)*. 1994;76(4)670. [Crossref]
12. Nicoll EA. Fractures of the tibial shaft. *J Bone Joint Surg. Brit vol-* 1964;46(3)373-387. [Crossref]
13. Court Brown C M, Christie J, and Mc Queen MM. Closed intramedullary tibial nailing. *J Bone Joint Surg*. 1990;72(4)605-611. [Crossref]
14. Hooper GJ, Kidell PG, Pennaj ID. Conservative management or closed nailing for tibial shaft fractures randomized prospective trial. *J Bone Joint Surg*. 1991;73(1)83-85. [Crossref]

15. Gaston P, Will E, Elton RA, McQueen MM, Court-Brown CM. Tibial fractures Can their prognosis be predicted. *J Bone Joint Surg.* 1999;81(1)71-76.
doi: [Article:<https://doi.org/10.1302/0301-620x.81b1.8958>][Crossref]
16. Bone LB, Johnson KD. Treatment of tibial fractures by reaming and intramedullary nailing. *J Bone Joint Surg.* 1986;68(6)877-886.
[Crossref]
17. Gupta SKV, Prabhu B, Goud VA, Shekhar S. Comparative study of functional outcome between expert tibial nailing and conventional IMIL nailing for proximal and distal tibial fractures in adults. *Orthop Surg Traumatol.* 2018;2(1)269-278.
[Crossref]
18. Brumback RJ, Jr. Poka A, Lakatos R, Bathon GH, Burgess AR. Intramedullary nailing of femoral shaft fractures. *J Bone and Joint Surg.* 1988;70(10)1441-1452 [Crossref]
19. Bolhofner BR. Indirect reduction and composite fixation of extra articular proximal tibial fractures. *Clin Orthop.* 1995;315;75-83.
[Crossref]
20. Olreud S, Karlstrom G. Tibial fractures treated by AO Compression osteosynthesis experience from 5 years material. *Acta Orthop.* 1972;43(140)1-7.
doi:[Article:<https://doi.org/10.3109/ort.1972.43.suppl-140.01>][Crossref]