



International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2019; 5(2): 354-358
© 2019 IJOS
www.orthopaper.com
Received: 19-02-2019
Accepted: 23-03-2019

Dr. Jainish Patel
Senior Resident, Depart. of
Orthopaedics Dhiraj Hospital,
SBKSIMRC, Vadodara, Gujarat,
India

Dr. Vilkes Patel
Senior Resident, GMERS, Sola
Hospital, Ahmedabad, Gujarat,
India

Dr. Jeet Patel
Junior Resident, Depart. of
Orthopaedics, Dhiraj Hospital,
SBKSIMRC, Vadodara, Gujarat,
India

Dr. C Sai Sabharish Reddy
Junior Resident, Depart. of
Orthopaedics, Dhiraj Hospital,
SBKSIMRC, Vadodara, Gujarat,
India

Dr. Anurag Jain
Junior Resident, Depart. of
Orthopaedics, Dhiraj Hospital,
SBKSIMRC, Vadodara, Gujarat,
India

Dr. Cheraventh Mani
Junior Resident, Depart. of
Orthopaedics, Dhiraj Hospital,
SBKSIMRC, Vadodara, Gujarat,
India

Dr. Sarvang M Desai
Professor, Depart. of
Orthopaedics, Dhiraj Hospital,
SBKSIMRC, Vadodara,
Gujarat, India

Correspondence

Dr. Jeet Patel
Junior Resident, Depart. of
Orthopaedics, Dhiraj Hospital,
SBKSIMRC, Vadodara, Gujarat,
India

Study of interlocking nail in shaft tibia fracture

Dr. Jainish Patel, Dr. Vilkes Patel, Jeremy Oakley, Dr. C Sai Sabharish Reddy, Dr. Anurag Jain, Dr. Cheraventh Mani and Dr. Sarvang M Desai

DOI: <https://doi.org/10.22271/ortho.2019.v5.i2g.48>

Abstract

Introduction: The tibia is the most commonly fractured long bone in the body and understanding of the mode of injury, fracture pattern is necessary to decide an operative management. Tibia shaft fractures are commonly managed by interlocking nail. This study is to assess the surgical management and assess the functional outcome of tibia shaft fractures.

Materials and Method: The study consist of 50 patients with tibia shaft fracture treated with tibia interlocking nail. Clinical outcome and function results were evaluated by Alho & Ekland's criteria.

Result: In this study, we have operated a total 50 cases with tibia interlocking nail in tibial shaft fractures. The average union time was 17.68 weeks. The study yielded about 82 % of excellent result.

Conclusion: The present study shows that closed fractures of the tibia shaft treated with interlocking intramedullary tibia nailing involves minimal surgical trauma and negligible blood loss. It provides the advantages of early ambulation, lower rates of infection and non-union. A significant advantage of interlocking nail in addition to early joint mobilisation, is early weight bearing which allows earlier return to work. Hence the study concluded that closed interlocking intramedullary nail is the treatment of choice in closed tibia shaft fracture.

Keywords: interlocking nail, shaft tibia fracture

Introduction

Tibia shaft fractures are very common fractures in young bread winner members of the family. This may be often the result of a high-speed trauma due to increasing and fast-moving vehicles. Industrialization and urbanization are progressing year by year with rapid increase in traffic and so is the incidence of high energy trauma. Amongst 10-15 fracture cases, one will be a fracture shaft of tibia. Tibia is a long bone, which is a load bearing bone of the lower extremity. Fracture of the tibia can cause prolonged morbidity, extensive disability unless treatment is appropriately done. Because of its very location, it is frequently exposed to injuries. As one third surface being subcutaneous, it often suffers from open fractures. Furthermore, the blood supply to the tibia is already precarious and is guarded by the presence of hinge joints at the knee and the ankle which allow no adjustment for the rotatory deformity. Modalities of treatment vary according to the type of fracture, bone density, age group, other co-morbid conditions, often bony and soft tissue injury. Closed reduction and cast immobilization have previously been regarded as the standard treatment for low-energy tibial shaft fractures. However, during the recent decades, the use of intramedullary locking nails (IMLN) has become more popular, and many studies have shown that the outcome of treatment of a tibial shaft fracture with locked intramedullary (IM) nailing is far more superior to that of cast treatment & other methods. Intramedullary interlocking nailing is considered to be the treatment of choice, for most tibial shaft fractures. Internal fixation of tibia using intramedullary locking nails has decreased incidence of non-union, allowed shorter hospitalization time, and earlier weight bearing for the patient compared to other fixation methods. This study was conducted to assess the safety and effectiveness of interlocking nailing and success rate of the treatment in tibial shaft fracture.

Material and Method

The study was conducted at Dhiraj Hospital, Piparia, Vadodara. The cases which were

selected had sustained fracture shaft of tibia. All the cases were included in study after getting an informed consent. This is a prospective analysis carried out from December 2015 to September 2017. The study consists of a total of 50 patients with shaft tibia fractures. Study was conducted after getting approval from the ethics committee.

Inclusion criteria

1. Patient aged under 18 years and above.
2. All patients with shaft tibia fracture & treated with interlocking nail
3. Closed Fracture
4. Compound fractures type 1 and type 2, according to Gustilo Anderson classification.

Exclusion criteria

1. Patients treated conservatively.
2. Intra articular fracture of tibia.
3. Patients under 16 years.
4. Compound fractures of Tibia, type 3A, Type 3B, Type 3C, according to Gustilo Anderson classification.
5. Pathological fracture.

Aims and Objectives

1. To analyse the benefits and complications of interlocking intramedullary nailing for treating tibial shaft fractures in adults.
2. To study and evaluate the results of interlocking intramedullary nailing in shaft fractures of tibia.
3. To study the period of union and union rate on radiological evidence.
4. To study the range of movements at knee and ankle joint.
5. To study the complications of interlocking intramedullary nailing in fractures of tibia.

Follow up and evaluation

The patient is usually followed up at 4 weeks, 8 weeks, 16 weeks and 6 months. Radiographs are taken at every visit and patient is assessed clinically for fracture union. In every follow up, patient's were assessed clinically for knee/leg pain, walking ability, abnormal gait/ limp, limb length discrepancy (shortening), any deformity, range of movements at knee and ankle joint, muscle strength and ability to squat and sit cross-legged. The results are analysed on the basis of Alho and Ekeland's criteria⁷.

Observation and Result

The present study consists of 50 patients of shaft tibial fracture treated by closed reduction and internal fixation with interlocking nail at Dhiraj General Hospital between December 2015 to September 2017. The following were the observations made and the data was analysed as follows:

In the present study, age varied from 18 to 55 above years. Out of all, 90% of the patients belong to the age group of 18 to 45 years. We observed that out of 50 cases included in the study, 43 patients (86 %) were male and only 7 patients (14%) were female. Road traffic accident (96%) is the most common injury in our study. Fall from stairs (4%) is second most common injury. We found that right side (68%) is more common as compared to left side this may be due to right sided vehicle driving and oncoming traffic on the left side, so right lower limb is most likely to get exposed in road traffic accidents. Most of the patients had closed tibia shaft fractures (80%), open grade I had 10% and open grade II had 10% patients. Most of the patients had transverse type of fracture

accounting to 24 patients (48%). 14 (28%) patients had spiral type of fracture, 8 patients (16%) had oblique type of fracture, 2 patients (4%) had wedge type of fracture and 2 patients (4%) had severe comminuted fracture. 48 patients (96%) had hospital stay of 14 days or less and 2 cases had hospital stay more than 15 days due to additional surgery for wound coverage (fascio cutaneous rotational flap). In this study, 45 patients (90%) were treated by reamed tibia nail & 5 patients (10%) were treated by unreamed tibia nail. 2 (4%) patients had superficial skin infection, 1 patient (2%) had deep infection & 2 (4%) patients had pulmonary embolism (open grade II tibia shaft fracture). No compartment syndrome and deep venous thrombosis occurred in our patients. Both patients were recovered. Majority of the fractures united within 20 weeks (45 patients, 90%), average time of fracture union was 17.68 weeks. 45 patients had radiological & clinical union present between 12 to 20 weeks, 2 patients had union between 21 to 24 weeks, one had delayed union & 2 patients had non-union. All the patients had minimum followed up of 6 months. Among all the patients, 42% of them (21 patients) followed up for more than 12 months, 30% of them (15 patients) followed up for 10-12 months and 28% of them (14 patients) were followed up for 6-9 months with an average duration of follow-up of 11.38 months. In this study, 48 patients (96%) had full extension of knee but 2 patients had 10-degree extension lag. 41 patients (82%) had more than 120-degree knee flexion, 6 patients had 120-degree knee flexion and 3 patients had 90-degree knee flexion. About 45 patients (90%) were walking without pain, 3 patients were walking with mild pain and 2 patients were walking with a limp due to 1 cm limb shortening. Upon final follow up, 47 patients could squat easily and 3 patients couldn't squat, 47 patients (94%) can cross leg sitting easily and 3 patients (6%) had difficulty in cross leg sitting. 32 patients (62%) had returned to his/her workplace (occupation) within 4 – 6 months after surgery and 16 patients (32%) had returned to workplace after more than 6 months and two patients could not return to their workplace due to non-union of fracture. We have taken constant Alho and Ekeland's Criteria to find out the result of study. According to that we graded them as excellent, good, fair and poor. We had excellent result in 82% cases, good in 10%, fair in 4% and poor in 4% of the patients.

Discussion

In our study, injuries are encountered in young males below 45 years (90%), who are the central pillar of the family. Fractures of the tibia are the commonest among the major long bone fractures. Very often, they are open owing to the subcutaneous location of the tibia. The commonest cause of tibia fractures are high velocity road traffic accidents. In our series, 96% of the fracture groups were due to high velocity road traffic accidents. In these accidents, a tremendous amount of energy is dissipated to the surrounding soft tissue thus causing severe damage.

In our study fractures were common in 18 to 45 year with average age being 33.64 years. In Yograj Rathwa *et al.*^[6] study, patient's average age was 27 years (age group 18 to 30) and most common age group was 17 to 44 years in Rahul Katta study^[13]. In Radhakrishna A.M. *et al.* study^[4], the most common age group was 18-39 years. From this it is infer that tibia shaft fractures occur in young and active patients.

In our study there were 43 male patients (86%) and 7 female patients (14%). In Yograj *et al.*^[6] series also commonly males were affected (42 patients, 84%) than females (8 patients,

16%). In Rahul Katta [13] series also commonly males were affected accounting to 88 male (73.33%) compared to females of 32 patients (26.66 %). Radhakrishnan A.M. *et al.* study [4] showed similar results (21 male 70% and 9 female patients 30%). Male predominance can be drawn from this inference. 48 patients (96%) suffered tibia fractures due to road traffic accident in our study, only 2 patients (4%) suffered tibia fractures due to fall from stairs. However, Yograj Rathwa *et al.* study [6], 33 patients (66%) suffered tibia fractures due to road traffic accident and 13 patients (26%) due to fall on floor/stairs. In Rahul Katta study [13], 88 patients had road traffic accident and 18 patients (15%) had fracture due to fall on floor/stairs. Radhakrishna A.M. *et al.* study [4], 26 patients (86.67%) had road traffic accident and 4 patients had fall from stairs. Increased incidence of road traffic accident for transportation has increased in recent times in our country and relatively the expansion of highway and security has not improved in relation with it.

In our study, majority of tibia shaft fracture were closed type (40 cases, 80%), followed by equal predominance of open grade I and open grade II injuries 5 cases (10%) each. In Yograj Rathwa *et al.* study [6], majority 36 cases were closed tibia shaft fracture and 14 cases were open grade I, II, IIIA tibia shaft fracture. In Rahul Katta study, majority 95 cases were closed tibia shaft fracture and 25 cases were open grade I, II tibia shaft fracture. In Radhakrishna A.M. *et al.* study [4], 21 cases (70%) were closed tibia shaft fracture and 9 cases (29.97%) were open fracture grade I and II.

In our study, predominant fracture pattern was transverse in 24 cases (48%), 14(28%) patients had spiral type of fracture, 8 patients (16%) had oblique type of fracture, 2 patients (4%) had wedge type of fracture and 2 patients (4%) had severe comminuted fracture. In Yograj *et al.* study, predominant fracture pattern was transverse (19 cases, 38%), followed by oblique (14 cases, 28%), spiral (5 cases, 10%) and comminuted (12 cases, 24%). In Radhakrishna *et al.* study [4] 43% of cases were comminuted fractures while transverse fractures only made upto 23% cases. Oblique and transverse fractures made 30% fractures (09 patients). In Rahul Katta study [13] 51% (61 patients) were non-comminuted, 51 patients (42%) were mild to moderate comminuted and 8 patients (7%) were severe grade comminuted.

In our study, only 1 patient had severe comminuted fracture pattern that showed delayed union because severe comminuted fracture has multiple loose fragments that caused impairment in union.

For the level of tibia shaft fracture based on location, majority of fractures were shaft tibia (23 patients, 46%), distal third shaft (19 patients, 38%) and proximal third shaft (8 patients, 16%). In Yograj Rathwa *et al.* study [6], majority of the fractures occurred at distal third of tibia (32 cases, 64%) followed by middle third (11 cases, 22%) and proximal third

of tibia (7 cases, 14%). In Rahul Katta study [13], majority of the fractures occurred at middle third (62 cases, 52%) followed by distal third of tibia (41 cases, 34%) and proximal third of tibia (17 cases, 14%). In Radhakrishna A.M. *et al.* study [4], majority of the fractures occurred at middle third shaft of tibia (18 cases, 59.94%) followed by lower third fracture (7 cases, 23.31%) and proximal third of tibia shaft (5 cases, 16.65%).

We had 19 patients (38%) who presented with distal 3rd tibia shaft fractures which are more prone to non-union because of poor vascularity in distal tibia region. Although we managed such patients with early weight bearing using proper intra-op fracture fixation technique, we have encountered one patient with fracture non-union. The patient was advised for further intervention & bone grafting.

In our study 15 patients had associated injuries with tibia shaft fracture in which 5 patients had femur shaft and trochanter fracture were treated with intramedullary nailing. 5 patients had malleolar fracture treated with C.C screw and tension band wiring, 2 patients had patella fracture treated with tension band wiring. In Rahul Katta study [13] 15 patients had associated injuries with tibia shaft fracture. In Yograj *et al.* study [6] 15 patients had associated injuries sustained during trauma which could have directly or indirectly influenced the functional outcome of the patients and also increase surgery time period while doing fixation of associated injury.

44 (88%) patients had fibula fracture and 6 patients had no fibula fracture in our study conducted. In Yograj *et al.* study [6] most of the cases were associated with fibula fracture 80%.

In tibia shaft fracture with intact fibula, we had difficulty in intra-op close reduction and to maintain length and takes long time in surgery which may influence on fracture union, in our study we had one case of tibia shaft fracture with intact fibula had delayed union.

In our study mostly 47(94%) patients were treated with tibia interlocking nail within 7 days of interval between injury and surgery and 3 patients had delayed surgery because of late presentation of patients to us. In Rahul Katta study [13] most of the patients (83%) nailing was done within 1-7 days of injury. Delay of upto 7 days was either due to associated injury and other medical causes. 3 patients reported after almost a month of injury. In Yograj *et al.* study [3] average time period from injury to surgery was only 3 days. In old tibia shaft fracture during surgery it was difficult to achieve good reduction because of fibrosis around fracture which influenced surgery time with a requirement for open reduction.

In this study all the patients were followed up regularly at 4 weeks, 8 weeks, 16 weeks and 6 months or even later. Average duration of follow up of this study was 11.38 Months with minimum follow up of 6 months and maximum follow up of 18 months.

Table 1: Final result of tibia shaft fracture treated with tibia interlocking nail; comparison with other study

| Authors | No. of Patients | Union (weeks) | Infection (%) | Non-union (%) | Malunion (%) |
|-------------------------------|-----------------|---------------|---------------|---------------|--------------|
| In Our Study | 50 | 17.68 | 6 | 4 | 0 |
| Court-Brown <i>et al.</i> | 25 | 15.4 | 0 | 0 | 0 |
| Blachut <i>et al.</i> | 73 | 18 | 2 | 4 | 4 |
| Yograj Rathwa <i>et al.</i> | 50 | 20 | 0 | 2 | 8 |
| Rahul Katta | 120 | 17 | 9.3 | 0.9 | 1.5 |
| Radhakrishna AM <i>et al.</i> | 30 | 20.13 | 3.33 | 0 | 0 |

In our study union was 17.68 weeks while Court – Brown *et al.* [5] reported at 15.4 weeks, Blachut *et al.* reported at 18 weeks, Yograj Rathwa [6] reported at 20 weeks, Rahul Katta [13]

reported at 17 weeks and Radhakrishna A.M. *et al.* [5] reported 20.13 weeks. In our study tibia shaft fracture (47 patients, 94%) had united fracture by the end of 24 weeks; 1 patient

had delayed union which united at 36 weeks. Average duration of radiological union is almost 17.68 weeks. So, this study is comparable to other studies in the literature. In Yograj Rathwa *et al.* study [6], out of 50 patients, 49 had union. The time to union ranged from four to nine months, with an average of 22 weeks. 41 fractures healed before 24

weeks, and 8 fractures healed between 24 – 30 weeks. In Rahul Katta study [13], out of 120 patients, 118 had union. The average time to union was 17 weeks. In Radhakrishna A.M. *et al.* study [4], majority of the fractures united within 20 weeks (16 patients), with the average time of union was 20.13 weeks.

Table 2: Comparison of final result with other operative study of tibia shaft fracture treated with tibia interlocking nail

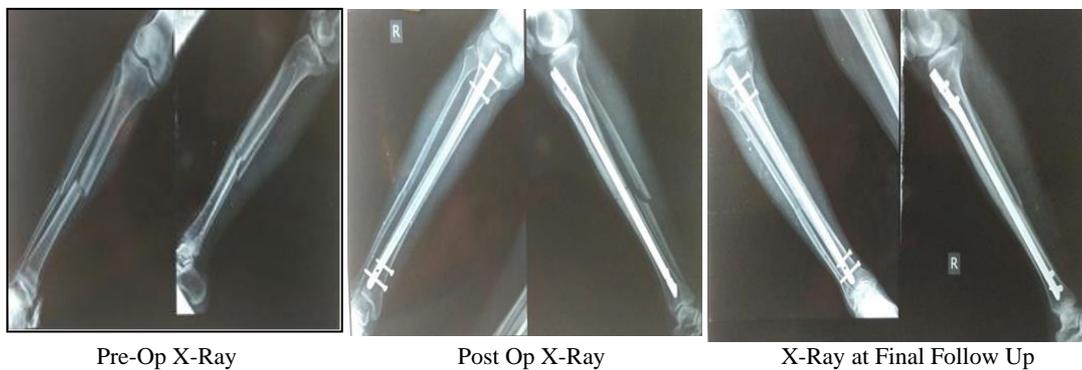
| Study | Total patients | Excellent (%) | Good (%) | Fair (%) | Poor (%) |
|--------------------------------------|----------------|---------------|----------|----------|----------|
| Our study (2018) | 50 | 82 | 10 | 4 | 4 |
| Yograj Rathwa <i>et al.</i> (2017) | 50 | 80 | 14 | 4 | 2 |
| Rahul Katta (2012) | 120 | 85 | 12 | 2 | 1 |
| Radhakrishna AM <i>et al.</i> (2014) | 30 | 76.67 | 16.66 | 6.67 | - |

In our study total 50 patients were included out of which 41(82%) patients had excellent result. 5(10%) patients had good results. 2 (4%) patients each had fair and poor results.

of Ratlam, Madhya Pradesh came to Dhiraj Hospital with h/o road traffic accident, diagnosed with mid shaft tibial fracture. Patient was operated with right side interlocking nail and had excellent result.

Clinical cases

Case 1: A 41-year-old male, farmer by occupation residence



Range of movements at final follow up

Case 2

A 21-year-old male, worker by occupation residence of Khargon, Madhya Pradesh came to Dhiraj Hospital with h/o road traffic accident was diagnosed with open grade I severe

comminuted mid shaft tibia fracture. Patient was operated with right side tibia interlocking nail and had fair result (delayed union).



Pre-Op X-Ray

Post Op X-Ray

6 Months Follow Up



Final follow up (36 Weeks)



Range of movements at final follow up

is early weight bearing which allows earlier return to work. Hence we conclude that closed intramedullary interlocking nailing is choice of treatment in fracture of shaft of tibia.

References

1. Jain V, Agarwal A, Mehtani A *et al.* Primary Unreamed intramedullary locked nailing in open fracture of tibia. *Indian J Orthop.* 2005; 39:30-32.
2. Alho A, Benterud JG, Hogevoid HE *et al.*: Comparison of functional bracing and locked medullary nailing treatment of displaced tibial fractures. *Clin Orthop.* 1992; (277):243-50.
3. Ekeland A, Stromsoe K *et al.* Locked Intramedullary Nailing for displaced tibial shaft fractures. *J Bone Joint Surg,* 1990, 805-809.
4. Radhakrishna AM, Shivananda S, Santhosh Kumar G. A Clinical Study of Surgical Management of Diaphyseal Fractures of Tibia with Intramedullary Interlocking Nail". *Journal of Evolution of Medical and Dental Sciences* 2014; 3(10):2478-2491. Doi: 10.14260/jemds/2014/2161.
5. Court Brown CM, Mc Brine J. The epidemiology of tibial fractures. *Journal of Bone & Joint Surgery.* 1995; 77:417-421.
6. A study of management of tibial diaphyseal fractures with intramedullary interlocking nail: A study of 50 cases Dr. Yograj M Rathwa, Dr. Tarun V Desai, Dr. Niravkumar P Moradiya, Dr. Parth A Joshi, Dr. Poojan A Joshi DOI: 10.22271/ortho.2017.v3.i1e.47 *Int. J. Orthod. Sci.* 2017; 3(1):297-302.
7. Alho Ekeland criterias. *Clinical Orthopaedics.* 1988; 231:205.
8. Blachur PA, O'Brien PJ, Meek RN. Interlocking intramedullary nailing with and without reaming for the Treatment of closed fractures of the tibial shaft. *J Bone Joint Surg Study of Management of Tibial Diaphyseal Fractures with Interlocking Nail" DRR KATTA -2012 - mch-orth.com.* 1997; 79:640-646.
9. Anand J Thakur. *The elements of fracture fixation.* 2nd edition, Elsevier, 2007, 10-15.
10. Muller ME, *et al.* comprehensive classification of Fractures of long bones. Springer, berlin, 1990.
11. Petlier LF. *Fracture. A history and iconography of their treatment.* San franciso: norman, Intramedullary Interlocked Nailing in closed & grade I open Tibial fractures, 1990.
12. Kumar Anshuman GS, Patnaik, S. Nag *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* e-ISSN: 2279-0853, p-ISSN: 2279-0861. www.iosrjournals.org.
13. Study of management of tibial diaphyseal fractures with interlocking nail" *DRR KATTA -2012 - mch-orth.com.* 2014; 12(13):28-31.

Conclusion

The present study shows that closed fractures of the tibial shaft treated with interlocking intramedullary nailing involves minimal surgical trauma and negligible blood loss. It provides the advantages of early ambulation, almost low rates of infection, delayed union, non-union and malunion. Union rates decrease in open grade fracture types. A significant advantage of interlocking in addition to early joint movement