

A PROSPECTIVE STUDY ON DYNAMIC INTERLOCK NAILING AND FUNCTIONAL OUTCOME IN TIBIA FRACTURES

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Abstract

Introduction: External fixation is indicated in Open fracture (Fixation with Nailing and plating are contraindicated in acute setting of open fracture). Fixation of distal tibial fracture with external methods by AO external fixator may cause improper reduction, unstable reduction which predispose for mal-alignment of high grade (range, 6%–28%) or non-union (range, 2%–17.6%) and shanz screw site infection (range, 10%– 100%).

Materials and methods: A prospective study done at Department of Orthopaedics, Rama Medical College-Hospital & Research Centre,(Kanpur) of clinical outcomes of patients from Nov 2020 to June 2022

Results: The present study includes 30 tibia fractures surgically treated with closed dynamic interlocking intramedullary nailing has done. Majority of patients are Male ,22 patients (73%) and only 8 patients (27%) were Females.

Conclusion: Intramedullary nailing with Dynamic Interlock nailing is safe and effective procedure for Distal 1/3rd tibia fractures as it is less invasive which avoids major soft tissue complication, decreased operative time and shortens the length of the patient's stay in the hospital

Keywords: Distal 1/3rd tibial fracture; Dynamic Interlocking Nailing.

Introduction

Tibial Diaphyseal Fractures is one of the most common long bone fractures encountered^{1,2}. Distal third region accounts to about 37% of all tibia shaft fracture^{1,3,4}. Because the shaft of the tibia is subcutaneous throughout its length and may have a diminished blood supply, severe complications and major disability are common outcomes.⁵

The various factors that affect the end result outcome are as following-

1. Fracture pattern and type,
2. Trauma to soft tissue associated with fracture,
3. The modality and method of fracture management and accuracy of reduction, Forces which are responsible for lower third fractures of tibia bone.
 1. Axial compression forces with high grade and high velocity,
 2. Torsion and bending due to direct trauma forces

3. Low energy rotation forces.

Distal tibia fracture has certain features which make this fracture more prone to end up in complications. These are:

1. Distal tibia is weight bearing part,
2. Its inherent instability,
3. Bone is subcutaneous in whole extent with minimal soft tissue cover,
4. Often comminuted,
5. Blood supply in distal third is poor.
6. Fracture is often associated with breach of soft tissue,

Salvage procedure have high failure rates.

To preserve ankle function, surgeon has to follow some important considerations which involves,

1. Maintain normal axial biomechanics of knee and ankle joint,
2. Maintain the joint articular surface congruity,
3. Maintain a near normal arc of motion of the Ankle joint.

Un-displaced and minimally displaced fractures can be managed by non- operative methods with following considerations,

1. Mild acceptable malunion with negligible shortening,
2. Mild and negligible limb discrepancy of the affected leg,
3. Minimal restriction of arc of motion of the affected joint

External fixation is indicated in Open fracture (Fixation with Nailing and plating are contraindicated in acute setting of open fracture). Fixation of distal tibial fracture with external methods by AO external fixator may cause improper reduction, unstable reduction which predispose for mal-alignment of high grade (range, 6%–28%) or non-union (range, 2%–17.6%) and shanz screw site infection (range, 10%– 100%). Open reduction and plating are a popular method that can result in good fixation. The technique is used widely, but it usually requires a relatively extensive wound exposure and soft-tissue dissection and is often associated with delayed healing, infection, and hardware problems^{6,7}. Recently, minimally invasive percutaneous medial locked plating has been described in the literature with promising results^{8,9}. However, this method is technically demanding, and it is often difficult to achieve anatomic reduction of the fracture site and if fixation of the fibula is required; an additional incision must be made on the lateral side. However, this method is technically demanding, and it is often difficult to achieve anatomic reduction of the fracture site and if fixation of the fibula is required; an additional incision must be made on the lateral side. Locked intramedullary (IM) nailing is the treatment of choice for closed fractures of the distal tibial shaft. The nail does not fit properly into the distal fragment of the tibia. This places additional stress on the distal locking bolts and may lead to breakage and mal-alignment^{10,11}. So now the low multidirectional locked IM nails represent an effective approach to the treatment of complex tibial fractures such as distal tibial metadiaphyseal fractures^{12,13}. The low multidirectional locked nailing may represent a superior surgical option, since it offers advantages in terms of mean operating time, hospital stay, full weight-bearing time and union time^{14,15}

Materials and Methods

A prospective study done at Department of Orthopaedics, Rama Medical College-Hospital & Research Centre,(Kanpur) of clinical outcomes of patients from Nov 2020 to June 2022

PRE-OPERATIVE ASSESSMENT

- X-ray of the fractured leg including one joint above(knee) and one joint below(Ankle).
- Minimum two views are necessary: Antero-posterior and Lateral Views.
- Pre-Operative Nail length is measured clinically from opposite leg from tibial tuberosity to medial malleoli.
- Diameter of nail is measured using the Preoperative X-rays at the level of the isthmus

The inclusion criteria:

1. Age more than 18 years and less than 70 years
2. All extra-articular distal tibia fractures (as per AO Classification 43A1,43A2,43A3)
3. Gustilo Anderson Type 1 open fractures

The exclusion Criteria:

1. Gustillo Anderson type 2 and 3 open fractures
2. Fractures with intra-articular extension
3. Patients less than 18 years of age
4. Patients unfit for surgery
5. Patients not willing for surgery
6. Associated neuro-vascular injuries
7. Pathological fractures
8. Segmental fractures of tibia

Results

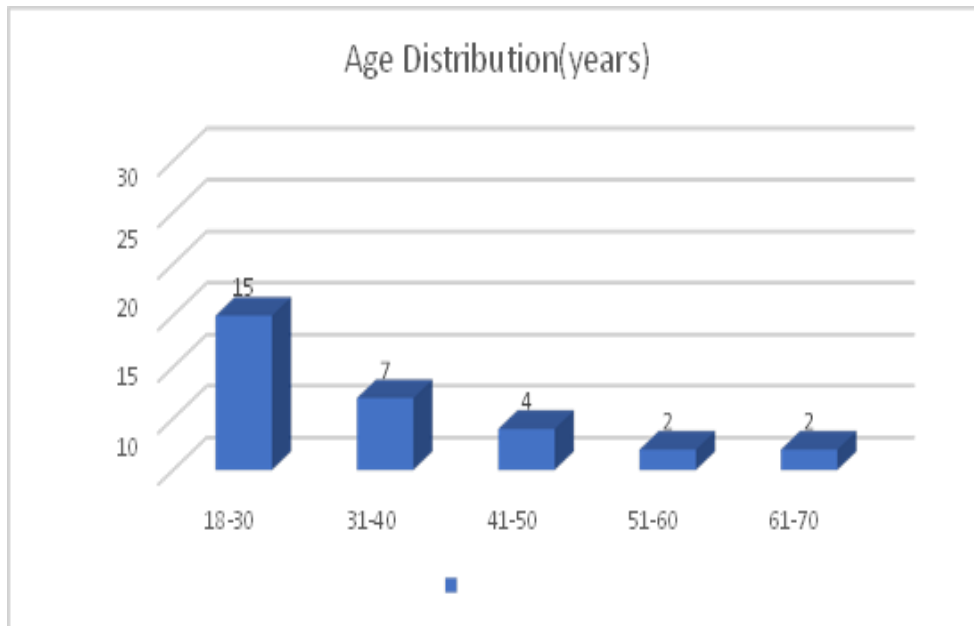
The present study includes 30 tibia fractures surgically treated with closed dynamic interlocking intramedullary nailing has done.

AGE DISTRIBUTION:

The age of the patient ranged from 18 to 70 years with the fracture being most common in 18 to 30 years, with youngest being 18years old and oldest is 70yrs old. with mean age group of 35.5 years. (Table 1 and Graph 1)

Table 1: Distribution of Patients according to age

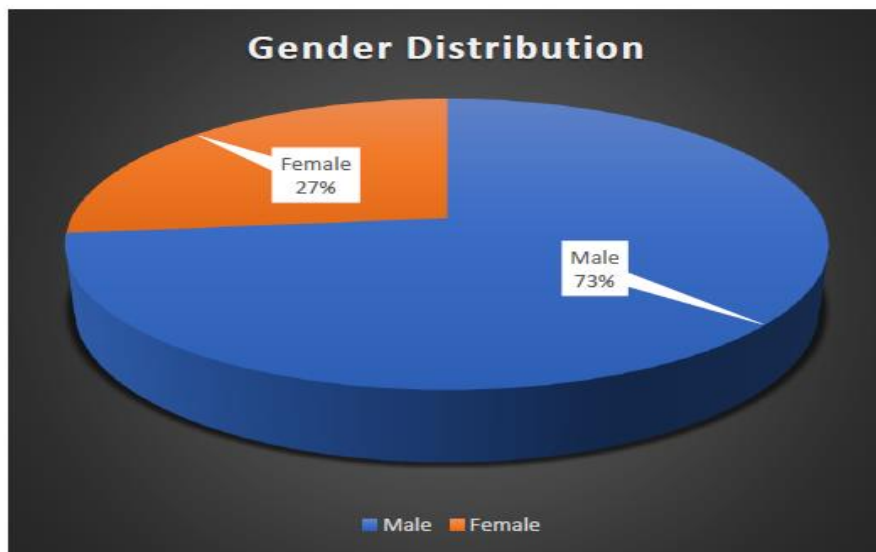
AGE (in years)	No of patient	Percentage (%)
18-30	15	50.00
31-40	7	23.33
41-50	4	13.33
51-60	2	6.67
61-70	2	6.67
Total	30	100



Graph 1: Distribution of Patients according to age

GENDER DISTRIBUTION

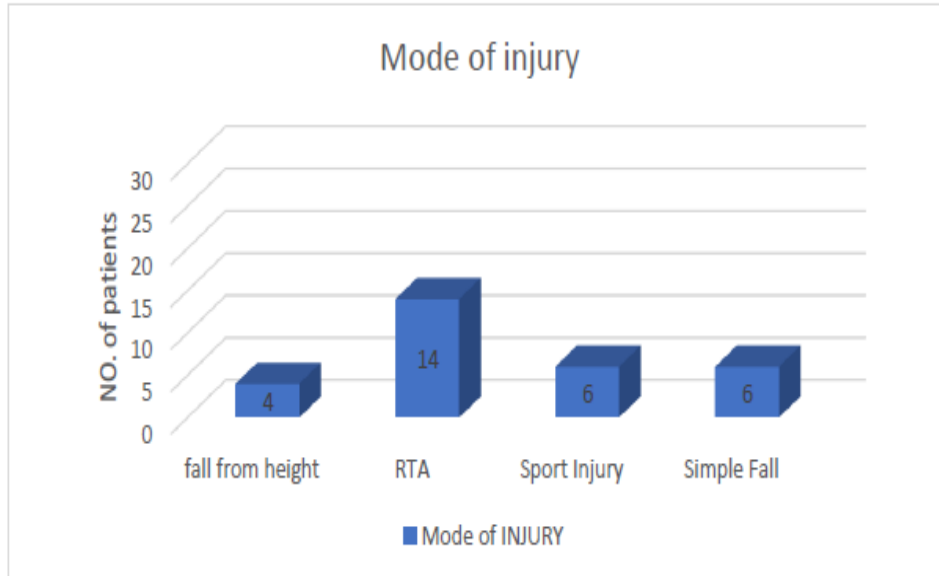
Majority of patients are Male ,22 patients (73%) and only 8 patients (27%) were Females. (Graph 2)



Graph 2: Distribution of Patients according to Gender

DISTRIBUTION ACCORDING TO MODE OF INJURY

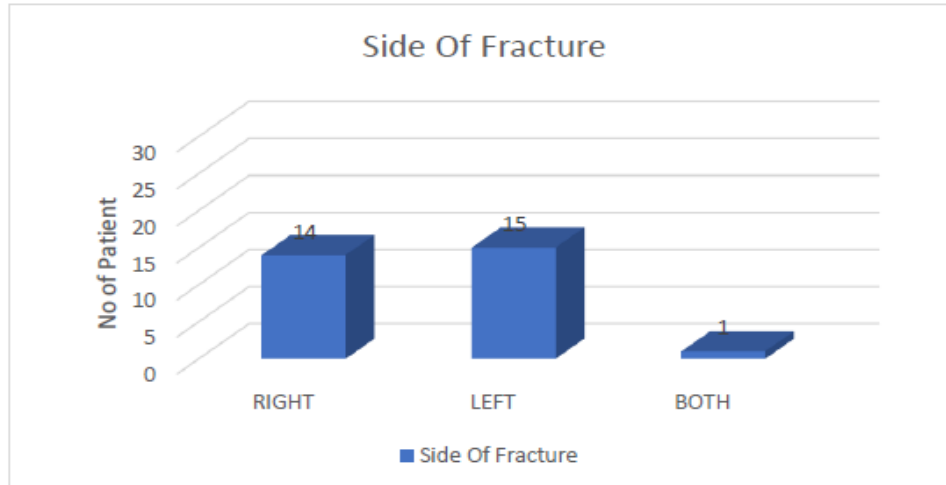
In our study, 14 (46.67%) of patients sustained injury following road traffic accidents and 6 (20%) patients sustained injury following Simple fall, 6 (20%) patients sustained injury following Sport injury, 4(13.33%) patients fall from height. (Graph 3)



Graph 3: Distribution according to Mode of injury

DISTRIBUTION ACCORDING TO THE SIDE OF INJURY

There were 14(46.67%) patients with right distal tibia fracture, 15(50%) patients with left distal tibia fractures and 1 (3.33%) patient with both side fracture. (Graph 4)



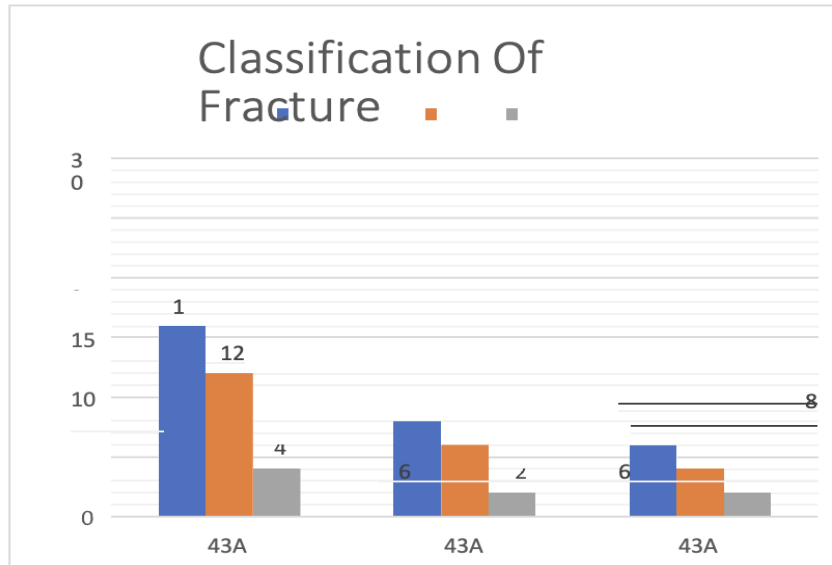
Graph 4: Distribution according to the side of injury

DISTRIBUTION OF PATIENT ACCORDING TO CLASSIFICATION OF FRACTURE (ACCORDING TO AO/OTA CLASSIFICATION)

In our study involving 30 cases of distal tibia fracture ,16 patients had 43A1 type of fracture with 12 Males and 4 Females,8 patients had 43A2 type of fracture with 6 males and 2 females,6 patients had 43A3 type of fracture with 4 males and 2 females. (Table 2 and Graph 5)

Table 2: Classification of Fracture (According to AO/OTA Classification)

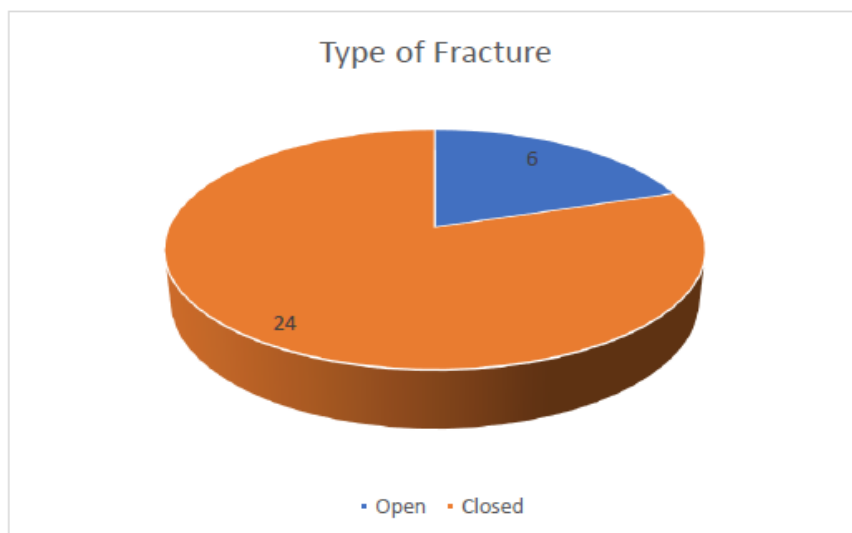
Site of Fracture	No of Patient	Male	Female
Distal tibia Fracture	30	22	8
43A1	16	12	4
43A2	8	6	2
43A3	6	4	2



Graph 5: Classification of Fracture (According to AO/OTA Classification)

DISTRIBUTION OF PATIENT ACCORDING TO OPEN OR CLOSED FRACTURE:

6 cases (20%) of open fracture were operated with 4 males and 2 females and remaining 24 cases (80%) are closed fracture. All open fractures are Gustillo-Anderson type 1 fracture. (Graph 6)



Graph 6: Classification of patient according to open /closed fracture

Discussion

The management of unstable distal tibial fracture remains challenging. The optimal treatment of unstable distal tibial fracture without articular involvement remains controversial. A variety of treatment methods have been suggested for distal tibial fractures. The intramedullary

nailing and plate fixation represent two viable approaches to internal fixation of extra-articular fractures of the distal tibia. It is still a matter of debate whether tibia diaphyseal fractures should be treated by plate or nail. The open reduction and plating results in extensive soft tissue dissection and may be associated with wound complications. Distal tibia has less vascular and soft tissue support than any other part of the tibia therefore infection, delayed union or non-union have been a more common complication after open reduction and internal plate fixation⁶.

Bonnevialle *et al.*¹⁶ proposed nailing for distal leg fractures presenting 2 - 6 cm of cancellous bone above the subchondral bone. In our study, we considered fractures within 5.5cm of the tibial plafond as distal tibia metaphyseal fracture and fracture without articular extension are taken for our study. As described by Kempf *et al*¹⁷ in his study, IMIL nailing can be considered the “gold standard” for the treatment of tibial mid shaft fractures, but there are concerns about their use in distal tibia fractures. This is because of technical difficulties with distal nail fixation, and the discrepancy between the diaphyseal and metaphyseal diameter of the IM canal, mal alignment of the distal tibia may develop after nailing. There is a risk of nail propagation into the ankle joint. In our study, we have done dynamic interlock nailing for distal tibia fractures. Dogra *et al*¹⁸ conducted a retrospective study on Fifteen with distal tibial fractures treated with a reamed intramedullary nail, which had approximately 1 cm removed just distal to the lowermost locking screw. We used Distal tip tibia nails in which the distal locking screws holes are 0.5,1,1.5 cm proximal to tip of nail In our study, A total of 30 patients were included after careful consideration of inclusion and exclusion criteria with majority of patients are male (73%) and only 27% were females, which is comparable with study conducted given in Table 3. In our study, the age of the patient ranged from 18 to 70 years with the fracture being most common in 18 to 30 years, with youngest being 18years old and oldest is 70yrs old. with mean age group of 35.5 years

Table 3: Comparing Demographic data in present study with other study

Study	No. of Patients	Age(years)	Gender Distribution	
			Male	Female
Our study	30	35.5	22	8
Swyang <i>et al</i> ¹⁹	13	48.2±19	8	5
Satish R gawali <i>et al</i> ²⁰	60	35	40	20
Mugundhan Sengodan ²¹	20	35	16	4

In our study, 14 (46.67%) of patients sustained injury following road traffic accidents and 6 (20%) patients sustained injury following Simple fall, 6 (20%) patients sustained injury following Sport injury, 4(13.33%) patients fall from height.

Table 4: Comparing Mode of injury in present study with other study

Study	Mode of injury
Our study	RTA (14), SI (6), SF (6), FFH (4)
Swyang <i>et al</i> ¹⁹	RTA
Satish R gawali <i>et al</i> ²⁰	RTA

Conclusion

The present study was conducted to evaluate functional outcome of Dynamic interlock nailing for Distal 1/3rd tibial fractures in adults. The injuries were more common in Men, with age group between 18-30 years and RTA is the most common mode of injury in majority of patient. Majority of fracture were closed fracture and belongs to 43A1 group of AO/OTA c. Out of 23 cases of fibula fracture 7 had fibula fracture within 7 cm of ankle mortise, in these cases fibula fixation with help of rush nail prior to fixation of tibia helps in restoring the height of the lateral column and helps in reduction and maintain reduction of the tibia anatomically. The over-all functional outcome of Dynamic interlocking intramedullary tibia nailing evaluated using the Johner and Wruhs' criteria shows excellent outcome in almost 70% of patient and good in 23 % of patient. Intramedullary nailing with Dynamic Interlock nailing is safe and effective procedure for Distal 1/3rd tibia fractures as it is less invasive which avoids major soft tissue complication, decreased operative time and shortens the length of the patient's stay in the hospital. Dynamic interlocking potentially increases the fatigue life of the implant. It also increases the compression forces at the fracture site. Which resulted in early union and excellent outcome. we recommend Dynamic interlock nailing in distal third tibia fractures.

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