

# Closed Intramedullary Interlocking Nailing for Tibial Diaphyseal Fractures: A Prospective Study

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## ABSTRACT

**Background:** Tibial diaphyseal fracture is the most common type of long bone fracture. The most common cause of fracture shaft of tibia is motor vehicle accident followed by fall. This study was conducted to evaluate the results and advantage of intramedullary interlocking nailing for the management of tibial shaft fractures.

**Materials and Methods:** A prospective study had been conducted from September 2013 to April 2015. 56 patients of closed or grade I open fracture shaft of tibia, which underwent fixation by interlocking nail were included in this study. Patient evaluated completely in the form of history, clinical and radiological evaluation.

**Results:** All the fractures united with union time ranging from 12 weeks to 28 weeks. In majority cases mode of injury was motor vehicle accident. None of the patients developed complications like hardware breakdown, patellar tendinitis, deep infection and non-union.

**Conclusion:** Closed interlocking intramedullary nailing in management of tibial diaphyseal fractures has proved to be a

onetime procedure leading to union in almost all the cases. We also conclude that this procedure allows earliest possible weight bearing leading to earlier fracture union with less morbidity, less complication rate, less hospital stay, earliest resumption of daily activities/occupation and maximum number of excellent results.

**Keywords:** Tibia, Intramedullary, Interlocking, Nailing.

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## INTRODUCTION

The most common type of long bone fracture is tibial shaft fracture. Severe complications and major disabilities are the common outcome of this fracture because of its subcutaneous location and poor blood supply. Various non-operative and operative modalities for the treatment are evolved but which one is better remain unsolved. Previously fracture tibia was treated by closed reduction and immobilization in plaster cast results in high rate of nonunion and mal-union with addition of joint stiffness.

Gerhard Kuntscher of Germany (1940) developed a nail and sparked a new interest in the world of intramedullary nailing.<sup>1</sup> Plate osteosynthesis for fracture of the distal tibia is often associated with delayed healing, infection and hardware failure.<sup>2,3</sup> Tibial diaphyseal fractures treated with plate osteosynthesis had encountered higher rates of complications because of which intramedullary interlocking nailing procedure is widely referred for the treatment of tibia fractures.<sup>4</sup> Locked intramedullary nailing is the management of choice for closed fracture of tibial shaft.<sup>5</sup>

Interlocking nailing facilitate management of complicated fractures like comminuted, proximal, distal and segmental fracture by giving stable anatomical alignment and rotational stability. In interlocking nailing procedure the stability is provided by threaded locking bolts

inserted through prefabricated holes in proximal and distal nail end. Closed interlocking nailing is advantageous to open method as it causes minimal trauma and infection. It was observed that preservation of soft tissue envelope and blood supply surrounding the fracture by using indirect technique would promote fracture healing regardless of type of fracture fixation.<sup>6</sup> It has been noted that concurrent fibula fixation in intramedullary interlocking nail will prevent mal-alignment but sometimes it affect the fracture union rate and may result in non-union.<sup>7</sup> So in our study we never fixed fibula in both tibia-fibula fracture cases.

This study is based on closed intramedullary interlocking nailing procedure to find out its result and advantage based on clinico-radiological and functional outcomes. This method of fracture fixation allows for quicker and appropriate fracture healing without displacing fracture hematoma to ensure early return to functional activities along with decreasing complications like infection, malunion and non-union.

## MATERIALS AND METHODS

A prospective study of 56 patients with fixation of tibial diaphyseal fractures with closed intramedullary interlocking nail, was

conducted from September 2013 to April 2015 with follow up at 2 weeks, 4 weeks, 8 weeks, 12 weeks, 20 weeks and 6 months. 56 consecutive patients with fracture shaft of tibia were managed with closed intramedullary interlocking nailing.

**Inclusion Criteria**

1. Adults both male & female of  $\geq 18$  years (no upper age limit).
2. Close and open fractures type 1 according to Gustilo Anderson classification.
3. Patient with intact neurovascular status.
4. Patient with normal knee and ankle movements of the contra lateral limb (for comparison of outcome).

**Exclusion Criteria**

1. Age less than 18 years.
2. Open fractures of tibia type II, IIIA, IIIB, IIIC according to Gustilo Anderson classification.
3. Pathological fractures.
4. Patient with associated neurovascular deficit.
5. Patient with deformed or injured contra lateral limb, restricted knee or ankle joint movements of the contra lateral limb.

After admission of the patient precise history was taken from patient and relative to reveal the mode of injury and extent of trauma, detailed clinical examination including neurovascular examination done and relevant x-rays including the affected legs with knee and ankle joints antero-posterior and lateral views were taken. Initial management consists of closed reduction and splinting with proper wound care in case of compound fractures. Routine blood investigations and pre anaesthetic work up was

done. Depending upon level of fracture, type of fracture and length of the limb, proper size interlocking nail was selected and elective surgery done; all patients were operated under spinal anaesthesia and in supine position. Patellar tendon splitting approach was used in all patients; tourniquet was used to minimize blood loss. The knee is flexed more than  $90^\circ$ , keeping the knee flexed, with the help of a curved awl, entry portal made to the medullary canal. Entry portal made at 1-1.5 cm below the joint line, slight medial to the centre of tibial tuberosity, reduction of fracture was achieved by manual traction, guide wire passed into proximal fragment then pushed across fracture into distal fragment under image intensifier, reaming of medullary cavity was done with cannulated reamers then proper sized nail mounted on jig and inserted over guide wire and checked the position of nail with image intensifier. Locking bolts inserted into nail with the help of image intensifier either in static or dynamic mode depending upon type of fracture. Incision was closed in layers, dressing done and crepe bandage applied. Radiological evaluation was done with standard anterior-posterior and lateral views of leg with knee and ankle joints. Hip, knee and ankle mobilization started on second day. Intravenous antibiotics were given for 5 days after that switched on oral antibiotics for a week. Discharge was given after suture removal usually on 14<sup>th</sup> post-operative day. Patients were called for 4 weekly follow up for radiological and clinical evaluation. Partial weight bearing starting with toe touch weight bearing started as soon as the patient became pain free and later full weight bearing as the patient tolerated.



Fig 1: Pre-op AP and lateral view



Fig 2: Post-op AP and lateral view



Fig 3: After 4 weeks post-op



Fig 4: After 4 months post-op



Fig 5: After 6 months post-op AP view

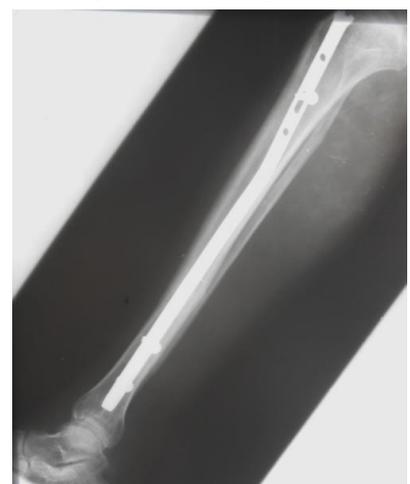


Fig 6: After 6 months post op lateral view



Fig 7: Full flexion at knee joint



Fig 8: Full extension at knee joint



Fig 9: Planter flexion at ankle joint



Fig 10: Dorsiflexion at ankle joint



Fig 11: Sitting cross legged



Fig 12: Squatting

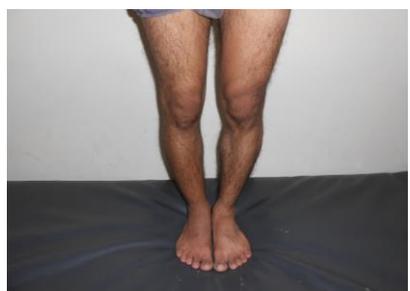


Fig 13: Full weight bearing on both limbs



Fig 14: Full weight bearing on single affected limb



Fig 15: Sitting with both limbs parallel

## RESULTS

Age distribution in our study ranged from 18 to 48 years (mean age 29.93 years) with predominance of male 48 (85.71%) cases. Mode of the trauma was motor vehicle accident in most of the cases 52 (92.85%). In this study half patients were closed and remaining half fractures were grade I open. [Table 1]

In this study most of the patients were reported and operated within 72 hours 40[71.42%]. Mode of the locking in 20[35.71%] cases was dynamic while static locking in remaining majority cases 36[64.28%]. Reaming was done in all the cases. All the fractures in our study united with union time ranging from 12

weeks to 28 weeks out of which 44 [78.57%] cases united in duration of 12 weeks to 24 weeks. Complications we found in our study were superficial infection in 4[7.14%] cases, anterior knee pain in 4 cases [7.14%], mal-alignment (rotational) in 2 cases [3.57%] stiffness in knee and ankle in 2 cases[3.57%] as shown in [table. 2] Clinical assessment was done using Alho<sup>8</sup> and Ekland<sup>9</sup> criteria. Majority of patients 52 [92.85%] had excellent and good results while remaining 4[7.14%] had fair results. None of the patient in our study developed complications like hardware breakdown, patellar tendinitis, deep infection and non-union.

Table 1: Patients characteristics

Age of the patient	Number of patients/percentage
<40	44/78%
>40 to <60	12/22%
<b>Sex</b>	
Male	48/85.71%
Female	08/14.28%
<b>Mode of trauma</b>	
Vehicular Accident	52/92.85%
Other	04/07.14%
<b>Nature of injury</b>	
Closed fracture	28/50%
Open Fracture	28/50%

**Table 2: Post-operative complications**

Post-operative complications	No. of patients/percentage
1. Infection	4/7.14%
2. Knee pain	4/7.14%
3. Mal-alignment (rotational)	2/3.57%
4. Stiffness in knee and ankle	2/3.57%

## DISCUSSION

In our study 56 patients of fracture shaft of tibia were included, out of which 48 were male and 8 were females. Age of patients varying from 18 to 48 and mean age of patients was 29.93 years with equal number of closed and grade 1 open fracture. Gerald j. Lang et al reported series of 32 tibial diaphyseal fractures treated by interlocking nail, of which 25 are male and 7 female with median age of patient 41 years ranging from 17 to 66 years with 10 closed and 22 open fractures.<sup>10</sup> In this study majority of patients were operated within 72 hours. Static locking was done in 36[64.28%] while in remaining 20[35.71%] cases dynamic locking was done. In this study reaming was done in all cases. This is comparable to study Conducted by Duwelling P J et al in which he did static locking in majority cases 47 and dynamic locking in 13 cases with non-reamed technique.<sup>11</sup> All the fractures united with union time ranging from 12 weeks to 28 weeks out of which 44[78.57%] cases united in duration of 12 weeks to 24 weeks. In Christian Krettek et al series of 32 tibial fractures treated with non-reamed interlocking nailing found healing within 23.3 weeks.<sup>12</sup> Complications we found in this study were superficial infection in 4[7.14%] cases, anterior knee pain in 4 cases [7.14%] mal-alignment (rotational) in 2 cases [3.57%] stiffness in knee and ankle in 2 cases [3.57%] Alho et al published the total infection rate of 5.3% and joint stiffness in 9.96% cases in tibial diaphyseal fracture treated by interlocking nailing.<sup>13</sup> Majority of patients 52[92.85%] had excellent and good results while remaining 4 [7.14%] had fair result. This is comparable to study conducted by Riqueime A G et al who found excellent results in 75%, 18% good and 7% poor in interlocking nailing.<sup>14</sup>

## CONCLUSION

From this prospective study we conclude that Tibial diaphyseal fractures are commonly seen in active young people and are commonly seen as a result of road traffic accidents. Closed interlocking intramedullary nailing in management of tibial diaphyseal fractures has proved to be a onetime procedure leading to union in almost all the cases. We also conclude that this procedure allows earliest possible weight bearing leading to earlier fracture union with less morbidity, less complication rate, less hospital stay, earliest resumption of daily activities/occupation and maximum number of excellent results.

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