



## Open reduction and internal fixation of intramedullary interlocking nail of tibia with fibula plating in lower 1/3rd tibia fibula fracture

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### Abstract

*Thirty cases of fractures of distal 1/3rd tibia fibula operated. Out of them, 25 cases were treated with distal tibia interlock nailing & fibula plating & rest 5 cases were treated with only distal tibia interlock nailing. Thirty tibial fractures closed (24) & compound (6) were treated with an average follow up of 2 months. Average operation time was 2 to 2 1/2 hour. Using DCP / recon / 1/3rd tubular plate was done. Static locking was done for all cases. Closed reduction was done in all closed and puncture compound fractures. Open reduction was done in 1 case. All these cases were operated within 7-10 days post trauma. Most of the fractures were caused by road traffic accident. Male to female ratio was 9:1 Postoperatively, full weight bearing for non-communitated fractures was started at 9 wks and for communitated fractures at 14 wks. Average time of union was 18 wks for non-communitated fractures and 24 wks for segmental, communitated & compound fractures. Dynamisation was done in 4 cases. It was done at the end of 10-12 weeks when the fracture showed some amount of callus or was axially stable Malunion occurred in the form of vulgus malalignment in 5 cases. Delayed union occurred in 1 case of compound fracture for which bone grafting was done. it can be said that closed tibia interlock nailing and open fibula plating is definitely one of the best treatment modality available to orthopaedic for fracture distal 1/3rd tibia fibula as it effectively maintains the length, alignment and rotational stability and allows rehabilitation concurrent with fracture healing. It brings the patient to the preinjury state quickly and safely.*

**Keywords:** *Tibia, Fibula, Interlocking nail, fracture, internal fixation.*

### Introduction

Distal tibial fractures are major source of morbidity and mortality in patients with lower extremity injury. It is one of the Common fracture encountered in subcutaneous bone and higher incidence of compound fracture. Poor / slow union - poor vascular supply. Tendency and redisplacement of

fracture in plaster cast once swelling subsides. Maximum acceptable displacement of fibula has ranged from 0 to 5mm. Displacement greater than this have to be fixed to maintain ankle mortice<sup>[1]</sup>. Small wire fixators allow early ankle joint mobility but this treatment method in complicated by pin track infection, septic arthritis, delayed union and malalignment<sup>[2]</sup>. ORIF provides stability but

requires extensive soft tissue dissection and further devascularisation of tibia. In addition subcutaneous location of plates may lead to symptomatic hardware requiring removal<sup>[3]</sup>.

It is safe to treat tibial fractures conservatively with reduction and plaster cast. However, it is not suitable for all cases as it does not always maintain rotational alignment and axial alignment. Interest in internal fixation has been centered around the use of AODCP and this has been well documented. But the use of AODCP has been documented in treatment of closed and minor compound fractures only. Under these circumstances load sharing devices such as intramedullary nails rather than load bearing devices such as plates significantly reduce the numbers of mechanical and biological failures<sup>[4]</sup>. It also spares extra osseous blood supply and avoids extensive soft tissue dissection. Various intramedullary devices have been used to stabilize the fracture, but to control shortening and rotation in comminuted fracture is the major challenge. AODCP causes compression at fracture site while putting the screws only. Intramedullary interlock nail causes axial compression at fracture site during surgery and post operatively after dynamisation. The increase in high velocity trauma with more exacting demand of functional recovery and the need to decrease morbidity has resulted in different methods of internal fixation<sup>[5]</sup>.

This study conducted to know the role of intramedullary tibia interlocking nail with open reduction and internal fixation with fibula plating in lower 1/3rd fracture tibia fibula, with aim to return the patient to his pre injury state as quickly and safely as possible. Inclusion criteria for this review were skeletal maturity, a factor involving distal 5cm of the tibia & treatment with an intramedullary nail of a fracture pattern that allowed placement of at least 2 interlocking screws through the nail.

## Material and Methods

### Pre-operative Management

Patient's general condition & pre-operative x-ray was carefully evaluated. Measurements of nails to be inserted was done. In Wound was cleaned with

taking proper antiseptic care with ether, hydrogen peroxide. A lot of wash with ringer lactate/normal saline was given. If bone was protruding through the wound it was carefully washed taking care bone is not reduced. Now sterile dressing was applied and above knee slab was given. Patient was taken for debridement at the earliest (within 6 hr). Wound was properly debrided, if required wound was extended. Nailing was done at the same time. During nailing procedure all used instruments, gloves are changed and new drapings are applied.

### Operative technique

Position of the patient- Supine position on an ordinary table that can be broken at the level of the knee. The leg was held hanging at the edge of the table keeping the knee flexed. Spinal anesthesia was usually employed. After suitable anesthesia adequate antiseptic preparation, draping and antibiotic cover, operative procedure was started. Now, a 6 cm long midline incision over the patellar ligament extending up to the level of knee joint was taken. Tibia was exposed only in distal 2.5cm incision. Knee joint was not exposed. Retract the patellar tendon laterally about 20 mm, if required few fibers of patellar tendon can be detached from tibia tuberosity but it was never required. Now an entry point was made on tibia. It was sited 1-1.5 cm below the joint line and behind or slightly medial to the patellar tendon with an curved awl. On an average, insertion canal and axis of the tibia medullary canal forms an angle of about 110° in sagittal plane. We confirm entry portal on AP and lot view to ensure nail would be in mid plane of the tibia. Now with a hand reamer (femoral) metaphyseal bone was perforated. The long axis of the reamer should remain as such parallel to the long axis of the tibia. Now the limb was kept flexed about 90° by allowing it to hang at the edge of table. The purpose is not to ream but to perforate. Now a long beaded guide wire of 3 mm was mounted over T-handle and was introduced through the entry site. Now the surgeon held the reduction and the guide wire was negotiated through the fracture site by the assistant and position of the guide wire in the distal fragment was confirmed on image intensifier. The

guide wire should be central in both anteroposterior and lateral x-ray, if not the guide wire was withdrawn and reintroduced. If it was central, guide wire was jammed into the distal metaphyseal cancellous bone by hammering. Now, serial reaming with 0.5 mm increments in size was done as surgeon holds the reduction. Beaded guide wire was replaced with plane guide wire with use of exchange tube. Now, the appropriate size nail attached to the jig was introduced into the medullary canal over the guide wire. Nail passes in the proximal fragment with relative ease. Nail was introduced upto the fracture level. Now the surgeon held the reduction taking care of the rotational alignment and the assistant hammered the jig to introduce the nail taking care of rotational plane of the nail. If the nail was going in distal fragment easily it was changed to a larger size. Guide wire was removed when terminal part of the nail was left to introduce. Now after the nail was introduced into distal fragment its position was checked on IITV, whether it was central or not and the distance between tip of the nail and articular surface of the tibia was noted. If not central nail was withdrawn and reintroduced and engaged in subchondral bone.

#### **Plating of fibula by dynamic compression plate**

The distal fourth of fibula is subcutaneous on its lateral aspect and was exposed by a longitudinal incision through skin, fascia and periosteum. Incision was slightly extended. Proximally (3-4cm) along post aspect and fibula and bone exposed. Do not strip the periosteum circumferentially but just enough for application of plate. Now reduce the fracture by traction and angulation. Place the compression plate on postero-lateral surface of the bone so that it will be covered by the muscles. The length of plate should allow at least six cortices of fixation above and below the fracture. 3.5mm plate was used mainly. Using two self retaining bone holding forceps, hold the fracture reduced and the plate in position. Be sure the plate cover over the fracture and the fracture is reduced as anatomically as possible. Contour the plate to fit using the special device designed for their purpose so that the plate

does not bend between the holes. Compression of the fracture occurs because of oblique geometry of its special screw holes. As the screw is tightened, the head is glided by the contour of the screw hole as it glides toward the centre of the plate, with resultant impaction or compression occurring at fracture. Wound was given and wound closed. Patient placed in posterior plaster splint. In case of recon or 1/3rd tubular plate was applied on lateral. Aspect with reduction & proper holes above and below. Neutral screws were put. In case of comminution, hole was left without screw.

#### **Locking**

Proximal locking is done with Jig. From medial to lateral side. Proper placement and size of bolt is confirmed under IITV. Incisions were closed. Distal Locking: Patient's leg was located between the source of image intensifier & one k wire. Leg was positioned so that locking hole appears as perfect circle on the screen. Now the K wire was hammered in the centre of the circular hole. It will go through the locking hole. By this method K wire was passed into both holes. Now K wire was removed. Skin incision was taken over the marked point. Now taking care of the point marked & its direction bone was drill with 3.2 mm drill bit. It will drill the proximal cortex then go through the locking hole and then the distal cortex. With depth gauze length of cortical screw was measured and at the same time with the depth gauze you can check whether you are in proper hole or not. Distal hole was locked first in anteroposter direct. Incisions were closed. A final intraoperative x-ray anteroposterior and lateral, was taken which will show all the four locking screw and fracture reduction of tibia and plate with fracture reduction of the fibula. Extremity was immobilized in above knee slab.

#### **Post operative management**

Limb was protected in above knee plaster slab and kept elevated for 48 hours. Intravenous antibiotic in closed fracture was given for 48 hrs. Static quadriceps exercises started on 1st post operative day. Dynamic quadriceps and ankle exercises was started on 3rd day. In compound fracture antibiotic was given for five days and would debrided as

required. Wound was covered at earliest with split skin graft or flap coverage. Sutures were removed at 2 weeks. Case was reviewed at every 3 weeks for 3-4 months and later monthly till the end of one year.

**Weight bearing**

If x-ray shows radiological union then patient is asked to partial weight bear on affected leg while walking and subsequently full weight bearing. If x-ray shows less amount of callus, patellar tendon bearing cast is given and patient is asked to walk with full weight bearing. If patient was of heavy built, full weight bearing was delayed.

**Results**

A study of 30 cases of interlock nailing for tibia & plating for fibula. This study includes 27 males and 3 females. Thirty tibial fracture closed (24) & compound (6) were treated with an average follow up of 1yr 2 months. Average operation time was 2 to 2 1/2 hour. Using DCP / recon / 1/3rd tubular plate was done. Static locking was done for all cases. Closed reduction was done in all closed and puncture compound fractures. Open reduction was done in 1 case. All these cases were operated within 7-10 days post trauma.

**Table 1:** Age wise distribution

Age in years	No. of patients	% of patients
10-20	1	3.3%
20-30	10	33%
30-40	7	23.2%
40-50	6	20%
50-60	4	13.4%
60 and above	2	6.6%

**Table 2:** Mode of injury

Mode	No. of patients	% of patients
Motor-Vehicular accident	15	50%
Direct trauma	9	30%
Fall from height	4	13.4%
Sport	2	6.6%

**Table 3:** Type of fracture

Compound / Closed	No. of patients	% of patients
Closed	15	50%
Compound		
Grade I	12	40%
Grade II	3	10%

**Table 4:** Pattern of fracture

Pattern of fracture	No. of patients	% of patient
Transverse	9	30%
Oblique	9	30%
Spiral	2	6.6%
Comminuted	10	33.3%

Fibular plating was done in 25 cases in fracture lower third Tibia-fibula. This helps in maintaining the length and prevents valgus angulation of distal fragments.

**Table 5:** Plates Used

Plates Used	No. of patients	% of patient
DCP	17	57%
1/3rd Tubular	6	20%
Recon	2	6.6%
No plate	5	16.5%

**Table 6:** Associated injury

Associated injury	No. of patients	% of patient
Additional extremity fracture	7	27%
Ipsilateral lower limb	4	13.4%
Multiple foot fracture	2	6.6%
TMT fracture dislocation	1	3.3%
Femur fracture	1	3.3%
Contra. lower limb fracture	2	6.6%
Upper limb fracture	1	3.3%

Dynamisation was done in 4 cases. It was done at the end of 10-12 weeks when the fracture showed some amount of callus or was axially stable. The longer fragment was dynamised. Following dynamisation shortening (1 cm - 1 case); Angulation 60, Valgus - 1 case : Patellar tendinitis - 1 case were noticed.

Early superficial infection in 2 cases and deep infections in 1 case all subsided. In one case there was osteomyelitis. It was a grade II compound fracture. It subsided following implant removal. In Compound fracture wound coverage provided within 5-7 days. One Grade II wound was covered with split skin graft. Two cases were allowed to heal by granulation. Average union time for simple closed fracture was 20 weeks. Time for union for comminuted and compound fracture was 24 weeks. Union was defined as radiological evidence of bridging cortical bone or at least 3 cortices

combined with patients ability to bear full weight on the extremity. Malunion was defined as shortening by 2cm. Angulation or rotational deformity of more than 10 degrees in any plane. There was shortening of 1 cm 2 cases. Valgus malalignment of 5o in 4 case and recurvatum of 5o in 1 case. There was 1 case of non union. Posterolateral bone grafting was done at 6-8 wks after injury.

**Table 7 :** Intra operative complication

Intraoperative	No. of patients
Error of calculation of length	3
Error of calculation of Diameter	3
Missed Holes	1
Condyle fracture	1
Comminution	4
Eccentric nail position	2

**Table 8:** Postoperative complications

Complications	No effected Simple fracture	No effected Compound fracture
Infection		
a) superficial	0	2
b) Osteomyelits	0	1
Delayed union	0	1
Patellar tendinitis	0	1
Deformity		
a) Recurvatum 5o	0	1
b) Vulgus < 10o	0	4
c) Shortening > 1 cm	1	1
Nail bending	0	1
Breakage of screw	0	1
Knee pain	1	1

**Discussion**

The current series was study of interlocking nailing and plating for distal 1/3rd tibial fractures (30 cases) & has confirmed the feasibility of interlocking system as a definite and superior mode of primary treatment in the setting of an Indian public hospital. In the current series we have used only type B nail. Similar type of studies using interlock nailing was done in distal tibial fractures with satisfactory outcome<sup>[6,7]</sup>.

Bone grafting was done in one case in this series, which was required for compound. In that bone grafting was done because the fracture was held in distraction. According to Court-Brown<sup>[8]</sup> on bone grafting is required for closed fractures and grade I compound fracture. According to A. Pagies &

collagues<sup>[9]</sup> indications of bone grafting are more than 50% comminution and cortical defect of 1/3rd of circumference of tibia at 6-8 weeks.

In this study four cases were dynamised at 10-12 weeks as fracture was held in distraction. Dynamisation lead to patellar tendinitis (1 case) & shortening of 1 cm but finally the fracture healed. A review of literate suggest that dynamisation should be done at 12 to 16 weeks if there is less than 50% comminution<sup>[9]</sup>. In another series dynamisation was delayed until fourth month (A Alho & Collagues). According to McLaren & Blokker, dynamisation is not necessary for union<sup>[10]</sup>.

In present study Mean time of union in this series was 20 weeks for non-comminuted fractures and for segmental, comminuted and compound fractures it was 24 weeks. Vulgus malalignment (14%) was seen in cases done without fibula fixation and recurvatum and shortening was seen in 1 & 2 cases each. Acceptable radiographic alignment defined as <5o of angulation in any plate was obtained in 25 cases (82.5%). The results were in comparision with other studies<sup>[6,7]</sup>.

In this study infection is noticed in 3 patients. Due to increase incidence of wound infection at the fibular fixation site, fibula nailing thought to enhance stability of distal tibia construct and it can be carried out mostly by close method and reduces risk of infection<sup>[11]</sup>.

Intramedullary nailing can be considered the —gold standard|| for the treatment of tibial midshaft fractures and recently intramedullary nailing has become widely accepted as the operative treatment of choice for tibial metadiaphyseal fractures worldwide<sup>[13]</sup>. There is consensus in the literature on the need for double distal screw fixation so as to obtain better control of sagittal and frontal as well as horizontal movements by distributing stresses. It is also well documented that the placement of two distal screws increases the stiffness and strength of the bone-implant construct, thus leading to enhanced mechanical stability of the fixed fracture.<sup>20</sup>

Lower 1/3rd fractures of tibia fibula needs to be fixed with closed distal tibia interlock nailing and

fibula open plating for good functional results. Tibia nailing followed by fibula plating & then interlocking done achieves compression at fracture site and retains length of bone maintains rotational and axial alignment. Distal 1/3rd fibula needs to be fixed to prevent valgus mal alignment. Use of IITV for this procedure reduces the malalignment as well as operative time / closed. Dynamisation done if fracture was held in distraction lead to fracture healing and prevent penetration of ankle motion. As tibia interlocking is closed procedure, it has following advantages early union, mobilization, cut bearing, low infection, less hospital stay and therefore less cost of treatment. Immediate and thorough debridement followed by primary undreamed nailing in compound fractures led to minimal chances of infection and good healing rates. Hence it can be said that closed tibia interlock nailing and open fibula plating is definitely one of the best treatment modality available to orthopaedic for fracture distal 1/3rd tibia fibula as it effectively maintains the length, alignment and rotational stability and allows rehabilitation concurrent with fracture healing. It brings the patient to the preinjury state quickly and safely.

### References

1. Muller Allgower: Manual of internal fixation edition 2, Newyork springer 1991, 291.
2. Pugn KJ, Wolinsky PR, Mc Andrew, MP, Johnson KD. Tibial Pilon fractures : a comparison of treatment methods. J Trauma 1999; 47 :937-4
3. Teeny Son, Wiss D A. ORIF of tibial plafond fractures. Variables contributing to poor results & complication. Clinic Orthop Relat. Ru 1993; 292 : 108-17
4. Arne Ekland et al, Interlocking Intramedullary nailing in the treatment of tibial fracture a report of 45 cases CORR : 231 : 205 : 1988.
5. Kempf I; Gro0se A : locked intramedullary nailing; The application to femoral and tibial

- axis rotational lengthening and shortening osteotomies; CORR : Nov 1986 : 165.
6. Robinson CM, Mc Lauchlan GJ, Mclean IP, Court Brown Gn. Distal metaphyseal fracture of fibia c minimal involvement of ankle classification and Rx by locked intramedullary nailing JBJS 1995; 77, 789
7. Tyllianakis M, Megas P, Giannikes D, Lanbiris E, Interlocking intramedullary nailing in distal tibial fracture. Orthopaedics 2000, 23 :805 – 8
8. Court Brown : Bone grafting JBJS 1990, 72-B, 605
9. A pagies, Thomas A., Russel, Jacob Taylor; Treatment of open fracture of tibial shaft with use of interlocking nail without reaming. JBJS :1992 : 74 : A, 1162.
10. Macnab, I. & Dehaas, W. G. The role of periorbed blood supply in the healing & fractures of fibia. Clinical orthopaedics 105. 27-33, 1974
11. Rouhani A, Elmi A, Akbari Aghdam H, Panahi F, Dokht Ghafari Y. The role of fibular fixation in the treatment of tibia diaphysis distal third fractures. Orthop Traumatol Surg Res. 2012;98:868-72.
12. Vallier HA, Le TT, Bedi A. Radiographic and clinical comparisons of distal tibia shaft fractures (4–11 cm proximal to the plafond): plating versus intramedullary nailing. J Orthop Trauma. 2008;22(5):307–11.
13. Guo JJ, Tang N, Yang HL, Tang TS. A prospective, randomised trial comparing closed intramedullary nailing with percutaneous plating in the treatment of distal metaphyseal fractures of the tibia. J Bone Joint Surg Br. 2010;92(7):984–8.
14. Gorczyca JT, McKale J, Pugh K, Pienkowski D. Modified Tibial Nails for Treating Distal Tibia Fractures. J Orthop Trauma. 2002;16:18-22.