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## Outcome of distal tibia fractures treated with tibial interlocking nail and minimal invasive plating: A prospective study

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### Abstract

**Introduction:** The best modality of management of distal tibial fractures (extra articular) remains controversial and challenging. Various studies have shown varying results with different modalities of treatment, however our study is to compare functional and radiological outcomes between patients treated with tip locking nail and compression plate using MIPPO Technique. The mechanism of injury and the prognosis of these fractures are different from pilon fractures, but their proximity to the ankle makes the surgical treatment more complicated than the tibial midshaft fractures.

**Material and methods:** A total of 120 patients between the age of 25-50 years were treated randomly with nailing (Group A) and percutaneous plating (Group B) between the year May 2014- March 2017. At one year follow up, outcome was analysed based on union rate, operating time, complications (Infections, Nonunion, delayed union, malunion) and functional score by AOFAS (American orthopedic foot and ankle score). 53 patients included in group A and 55 patients in group B. 12 patients did not follow up.

**Result:** Out of 108 patients randomly, average operating time in nailing is 44.21 mins and plating is 40.14 mins. 1 patient in group B developed superficial infection which healed well on long term follow up. In 30 patients, fibula fracture was first fixed using 3.5mm one third tubular plate and cortical screws due to ankle joint/syndesmotic instability. Mean radiological union time in nailing group was 20.1 weeks. (18-22 weeks) and plating group was 17.5 weeks (16-18 weeks). 4 cases in nailing developed malunion with angulation less than 5 degree which was acceptable and 2 cases developed varus deformity with angulation more than 5 degree. No cases of implant failure was noted. No evidence of nonunion was noted in both groups. Functional outcomes based on AOFAS score was IM nailing 90.8 and 96.2 for plating which was statistically significant between the 2 groups. In addition to pain which was included in AOFAS score 10 patients treated with IM nailing had anterior knee pain.

**Conclusion:** Based on the above study, we concluded that treating distal tibia fractures (extraarticular) with locking compression plate using MIPPO technique is superior than tip locking nail as there is better anatomical reduction/alignment leading to quicker radiological union and better functional outcome according to AOFAS.

**Keywords:** Tibial interlock nail, Mipppo, non union, distal tibia fracture

### Introduction

The best modality of management of distal tibial fractures (extra articular) remains controversial and challenging. Various studies have shown varying results with different modalities of treatment, however our study is to compare functional and radiological outcomes between patients treated with tip locking nail and compression plate using MIPPO Technique. The mechanism of injury and the prognosis of these fractures are different from pilon fractures, but their proximity to the ankle makes the surgical treatment more complicated than the tibial midshaft fractures. Conservative treatment of these fractures quite often results in number of complications including nonunion, malunion and ankle stiffness [11-13]. External fixation can be used as either a temporary or definitive method of treatment, especially in fractures with severe soft tissue injury [14-18], but malunion and delayed union continue to be the main problems with this method [19, 20].

Open reduction and internal fixation results in extensive dissection and associated wound complications and infections as distal tibia is only covered by a thin, soft tissue envelope which has a precarious circulation. MIPPO technique provides good, though slightly delayed bone healing and decreases incidence of nonunion and need for bone grafting. This technique should be used where locked nailing cannot be done like small distal metaphyseal fragments, vertical splits, markedly comminuted fractures and in fractures with intra-articular extension [3]. Minimally invasive technique can address the above issues amalgamating all biological benefits of closed reduction and fixation. 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 [4]. Guo *et al* study showed closed intramedullary nailing has the advantage of shorter operating and radiation time and easier removal of implant [2]. Studies have shown patients treated with fibular fixation had significantly smaller proportion of valgus angular deviation when compared to patients treated without fibular fixation [1]. Locked plates provided more stable fixation than intramedullary nails in vertical loading but were less effective in cantilever bending. An intact fibula in the presence of distal tibia fracture improved the fracture fixation stability for both treatment methods. In fracture patterns in which fibula cannot be effectively stabilized, locked plates offer improved mechanical stability when compared with locked intramedullary nails [5]. Thus, based on above studies different views and controversies are noted and definitive surgical modality of treatment of distal tibial fractures, is not established which makes me to take up this study.

### Patients and methods

A total of 120 patients between the age of 25-50 years were treated randomly with nailing (Group A) and percutaneous plating (Group B) between the year May 2014- March 2017 at one year follow up based on union rate, operating time, complications (Infections, Nonunion, delayed union, malunion) and functionally by AOFAS (American orthopedic foot and ankle score). 53 patients included in group A and 55 patients in group B. 12 patients did not follow up. Ethics committee approval from our hospital was obtained and informed consent was taken. The inclusion criteria was based on AO-Muller's classification 43-A (extraarticular), aged 25 to 50 (mean age 38 years) years, all closed fractures and Gustilo-Anderson's grade 1 compound fractures and upto 1 week old fractures. Exclusion criteria included fractures with intra-articular extension, pathological fractures, Gustilo-Anderson's grade 3 and 3 open compound fractures and aged less than 25 and greater than 50 years. All patients underwent routine investigations for anesthetic clearance, temporally immobilized with Plaster of Paris slab, analgesics and antibiotics with routine radiographs in AP and lateral view and where operated within a week of trauma.

### Operative technique

Main objective of our surgical treatment is to maintain proper alignment of the fracture ends, stable fixation and addressing the associated syndesmotic injury. Tip locking IM nailing: patients on standard radiolucent table with paramedial incision over proximal tibia (patella tendon sparing approach) entry point made between articular surface of the table and tibial tuberosity. The entry point should be strictly aligned with medullary canal in diaphyseal region to avoid varus and valgus malalignment of the fractures. Guide wire was passed

after reduction entering its position in the centre of distal tibia metaphysis. The positions was improved using a poller screw. Proximal locking was done both dynamic and static and distally locked with screw in places within 2 cm from the articular surface of the tibia (two mediolateral and one anteroposterior).

**For plating:** Patient on radiolucent table, LCP was applied on the antero-medial aspect of distal tibia and adequate length was maintained so that at least 4-6 cortices are obtained on either side of the fracture site all done under C-arm guidance. Vertical union are the medial malleolus of about 4 cm and creating a subcutaneous tunnel. Using artery forceps LCP was passed through this tunnel across the fracture site, proximally holding a sleeve. Plate is flushed to the bone and reduction achieved using bone holding forceps and temporary fixed with k-wires, both proximally and distally. Under c-arm assistance, a similar sized LCP was held over the skin surface which helped to localize the hole in the inserted pate. At least 4 to 6 screws were used proximally and distally to the fracture site. Associated fibular fractures of 30 patients were fixed using 3.5mm one third tubular plate, if it was associated with ankle joint instability/ syndesmotic instability. Talar shift caused by an external rotation force was considered to be a sign of syndesmotic instability and also to maintain the length in comminuted tibia fractures. Intraoperatively, all patients received prophylactic IV antibiotic half an hour before surgery. Post operatively both groups of patients were immobilized with below knee slab and limb elevation. Touch down weight bearing was started after one week. Suture removal was done after 10-12 days depending upon healing. Knee mobilization was started after suture removal. Full weight bearing was withheld until complete fracture union occurred with no pain at the fracture site. All patients were assessed serially for 1 year functionally with AOFAS, which included pain, maximum walking distance, gait abnormality, hind-foot motion, ankle-hind foot stability, functional activity limitations/support requirements, walking surfaces, sagittal motions and alignment.

**Statistical Analysis:** The two group were compared based on union rate operating time, complications (infections, malunion, delayed union, nonunion) and functionally by AOFAS. The Chi-square and Fisher two sided exact test was used to compare non parametric means and unpaired independent t test was used to compare parametric means. The level of significance  $p < 0.05$ . Whole analysis was prepared in SPSS (version 16) software.

### Results

Out of 108 patients randomly treated with tip locking nail and LCP using MIPPO technique between the age 25 to 50 years, mean age being 38 years. Average operating time in nailing is 44.21 mins and plating is 40.14 mins (time interval between skin incision to skin closure). One patient in group B developed superficial infection which healed well on long term follow up. 30 patients fibula fracture was first fixed using 3.5mm one third tubular plate and cortical screws due to ankle joint/syndesmotic instability. Mean radiological union time in nailing group was 20.1 weeks. (18-22 weeks) and plating group was 17.5 weeks (16-18 weeks). 4 cases in nailing developed malunion with angulation less than 5 degree which was acceptable and 2 cases developed varus deformity with angulation more than 5 degree. No cases of implant failure was noted. No evidence of nonunion was

noted in both groups. Functional outcomes based on AOFAS score was IM nailing 90.8 and 96.2 for plating which was statistically significant between the 2 groups. In addition to

pain which was included in AOFAS score 10 patients treated with IM nailing had anterior knee pain.



Variables	Group A (Nailing)	Group B (Plating)
Operating time(in mins)	44.21	40.14
Infection		
Superficial	1	0
Deep	0	0
Union (in weeks)	20.1	17.5
Malunion		
Acceptable(<5*)	4	0
Varus deformity	2	0
Non Union	0	0
AOFAS score	90.8	96.2
Anterior knee pain	10	0
Implant failure	0	0

## Discussion

Distal tibia fracture management though remains controversial and challenging were tip locking nailing or by LCP been an established technique for management of these fractures. Tip locking nailing which is less invasive method spares the extraosseous blood supply, allows load sharing and avoids extensive soft tissue dissection. The system has two mediolateral and one anteroposterior locking option distally for better stabilization of distal fragment. These design modifications ensure that angular stability is retained and ankle stable locking reflects a potential to maintain fixation stability [6]. LCP using MIPPO technique reduce iatrogenic tissue injury and damage to bone vascularity by preserving the osteogenic fracture hematoma were plate is tunneled subperiosteally along the medial aspect of the tibia and fixed with locking screws when compared to conventional open reduction and internal fixation which requires extensive dissection leading to devitalization of tissues and increased risk of infection which creates environment less favorable for union. In our study of 108 patients, 4 cases in nailing group developed acceptable malunion and 2 cases developed varus deformity with no evidence of non-union. Mean radiological union time was lower in plating group when compared to nailing group. Yang *et al* compared both methods in patients with type 43-A fractures. They found that the time of union was shorter in IMN group, but with increase in post operative valgus by a mean of 3.7 degree [7]. Janssen *et al* suggested that in distal tibial fractures control of alignment was difficult with an IMN [8]. Vallier *et al* reviewed 111 patients treated with either IMN or a plate over a period of 4 years. Delayed union, malunion and secondary procedures were more common after nailing [9]. In a prospective study by Im and Tae nailing showed an advantage in operating time, movement and wound problems, but anatomical plates produced better alignment [10]. Published reports show that non union occurs in 0 to 8% of the closed fractures 3 to 17% of open fractures.

In addition to pain over ankle, 10 patients developed anterior knee pain. The occurrence of anterior knee pain is frequently associated with tibial nailing with the incidence reported to be between 32 and 57%. Age of the patient had no effect on the time of union in our study.

## Conclusion

Based on the above study, we concluded that treating distal tibia fractures (extraarticular) with locking compression plate using MIPPO technique is superior than tip locking nail as there is better anatomical reduction/alignment leading to quicker radiological union and better functional outcome according to AOFAS.

## References

1. Labronici *et al*. *acta ortop. Bras. sao Paulo* - treatment of distal fractures of the tibia, 2009; 17:1.
2. Guo *et al*. *JBJS A* prospective, randomized trial comparing closed intramedullary nailing with percutaneous plating in treatment of distal metaphyseal fractures of the tibia, 2010; 92-B:7.
3. Paluvadi *et al*. *journal of clinical orthopedics and trauma management of fractures of distal third tibia by minimally invasive plate osteosynthesis-A prospective series of 50 patients*, 2014; 5:129-136.
4. Li *et al*. *International orthopedics (SICOT) comparison of low, multidirectional locked nailing and plating in the treatment of distal tibial metadiaphyseal fractures*, 2012; 36:1457-1462.
5. Strauss *et al*. *J orthop trauma*. 2007; 21:172-177.
6. Gueorguiev B *et al*. *J Ortho trauma* Angular stability potentially permits fewer locking screws compared with conventional locking in intramedullary nailed distal tibia fractures: a biomechanical study, 2011; 25(6):340-346.
7. Yang *et al*. *Injury treatment of distal tibial metaphyseal fractures: plating versus shortened intramedullary nailing*,

2006.

8. Janssen *et al.* Int Orthop Treatment of distal tibial fractures: plate versus nail: a retrospective analysis of matched pairs of patients, 2007; 31:709-14.
9. Vallier HA *et al.* J Orthop trauma Radiographic and clinical comparisons of distal tibia shaft fractures (4 to 11 cm proximal to plafond): plating versus intramedullary nailing, 2008; 22:307-11.
10. Bonatus T *et al.* Clin Orthop Relat Res Nonreamed locking intramedullary nailing for open fractures of the tibia, 1997; 339:58-64.
11. Digby JM *et al.* A study of function after tibial cast bracing. Injury. 1983; 14(5):432-439.
12. Ovadia DN *et al.* fractures of tibial plafond. J Bone joint surgery Am. 1986; 68(4):543-551.
13. Ruedi *et al.* the operative treatment of intra articular fractures of lower end of tibia. Clin orthop relat res. 1979; 138:105-110.
14. Blauth *et al.* surgical options for the treatment of severe tibial pilon fractures: a study of three techniques. J orthop trauma. 2001; 15(3):153-160.
15. Dickson KF *et al.* high energy plafond fractures treated by spanning external fixator initially and followed by a second stage open reduction internal fixation of the articular surface-preliminary report. Injury. 2001; 32(4):SD92-SD98.
16. Hazarika S *et al.* Minimally invasive locking plate osteosynthesis for fractures of the distal tibia- results of 20 patients. Injury. 2006; 37(9):877-887.
17. Krackhardt *et al.* fractures of distal tibia treated with closed reduction and minimally invasive plating. Arch orthop trauma surg. 2005; 125(2):87-94.
18. Streicher G *et al.* Distal tibia fractures, 2008; 111(11):905-918.
19. Pugh KJ *et al.* Tibial pilon fractures: a comparison of treatment methods. J trauma. 1999; 47(5):937-941.
20. Ristiniemi *et al.* two ring hybrid external fixation of distal tibia fractures: a review of 47 cases. J trauma. 2007; 62(1):174-183.