OUTCOME OF DISTAL TIBIA FRACTURE BY NAIL OR PLATE (MIPPO) - A COMPARATIVE STUDY

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ABSTRACT

BACKGROUND
Distal tibial fracture often present a challenge to the orthopaedic surgeon. The best option for surgical management of distal tibial fracture is still unclear, whether nail or plate.

MATERIALS AND METHODS
The study consists of 24 patients of distal tibial fracture treated either with reamed intramedullary nails or locked plating/MIPPO with open reduction method or minimally-invasive techniques.

RESULTS
24 patients included in the present study were divided into two groups as nailing group A and plating group B. Nailing group included 12 patients and plating group included 12. Age range of patients was 21-62 years. Most common mode of trauma in both groups as RTA followed by accidental fall in 2 cases. The average time for union and weightbearing was 19 weeks in group A and 20.08 weeks in group B. Complications like malalignment, more surgical time were seen in group A and surgical site infection, skin necrosis, prolonged immobilisation were seen in group B.

CONCLUSION
Both IM nailing and plating are optional methods of treatment. Intramedullary nailing in distal tibial fractures result in early mobilisation is an easier technique, more economical and has fewer complications rate. Plating is preferred in cases where fracture is very close to ankle mortise and associate with higher rate of wound complications.

KEYWORDS
Distal Tibia, Intramedullary Nail, MIPPO.


BACKGROUND
Distal tibial fracture often present a challenge to the orthopaedic surgeon. It occurs as a result of axial and rotational forces on lower extremity1-2 pilon fractures,3,4 Destot first used the term in 1911 as likening the pillar to pestle. The tibial pillar consists anatomically the distal end of the tibia including the articular surface.1,2,3,4 It’s proximal limit is 8-10 cms from the ankle mortise.

It represents 5-7% in all tibial fractures. Distal tibia has less muscle coverage in comparison to the rest of tibia. They are prone to be associated with severe soft tissue injury,1,2,5,6 They can be associated with severe skin oedema and blistering leading to postoperative complications.5,6 By convention, all tibial fractures including the distal articular surface should be classified as tibial pilon fractures except for medial and lateral malleolus fractures and trimalleolar fractures.

The treatment of this type of fracture is of current research interest. We must take into account not only the stabilisation of the fracture, but also the management of soft tissue injury. Multiple methods of treatment are available for managing these fractures.4,7 Conservative treatment and external fixation are likely cause of loss of reduction and leads to malunion. The goal of management is to provide stable fixation and early mobilisation with minimal soft tissue complications.4 Plate fixation and intramedullary nails are two well accepted and effective methods. Newer nails have become the mainstay of treating tibial fractures.8 Indications have been extended to those of proximal and distal metaphyseal regions. Various tibial nails have been designed to treat various tibial fractures, which includes universal tibial nail, proximal tibial nail and distal tibial nails. Intramedullary nail is a load sharing device, spares the extraosseous blood supply, avoids soft tissue injury and allows early ambulation.9 Intramedullary nailing of distal tibial fracture is often challenging to the orthopaedic surgeon with more technical difficulties due to anatomy at distal tibia.
Having hourglass-shaped canal that allows tight fixation of nail in the mid shaft tibia, but not in the distal tibia. Technical problems of nail are accurate reduction of fractures.9 Guidewire placement should be in the exact center of the tibial plafond and rigid locking screw fixation is needed for the better outcome.

Conventional Open Reduction and Internal Fixation (ORIF) techniques involve extensive dissection and periosteal stripping leads to vascular damage, which increases the risk of soft tissue complications. Recent studies have suggested that the circulation of distal tibia is mainly from the anastomotic network of arteries from the anterior and posterior tibial arteries, which enter tibia from medial surface.5,6,10 As a result, less-invasive methods were developed to treat distal tibial fractures, which include intramedullary nailing and MIPPO.11,12 The minimally-invasive plate osteosynthesis technique uses indirect reduction methods and allows stabilisation of distal tibial fractures, while preserving the vascularity of soft tissue envelope of distal tibia.8

OBJECTIVES
This study was conducted to set the indications for both modalities of fixation in various fracture subtypes and also to compare the functional outcomes of distal metaphyseal fractures (i.e., fracture line within 5 cms proximal to the syndesmosis) of tibia managed by both methods at 1 year follow up. Complication rates with different modalities of fixation were also studied.

MATERIALS AND METHODS
This is a prospective study of 24 patients in KIMS, Hubli. The study consists of 24 patients of distal tibial fractures treated either with intramedullary nails or minimally-invasive plate osteosynthesis techniques. Biplanar radiography was evaluated to determine the nature and geometry of fracture.

There are 2 groups of patients. Group A includes patients managed by closed reduction and reamed intramedullary nailing. Group B includes minimally-invasive techniques (MIPPO) by locked plates. Both groups are matched for age, sex, fracture type, associated fractures and comorbidity conditions. Patients are followed up every 2 months till fracture union at 6 months and at 1 year. Patients are evaluated for functional and radiological criteria.

Operative Technique
Most of the cases are operated after soft tissue healing within 7 to 10 days of admission in hospital. Intravenous antibiotics are given one hour before induction anaesthesia. Majority of patients were operated under SA or epidural anaesthesia on standard operating table in supine position with the help of image intensifier.

For intramedullary nail fixation, we have used distal tibial nail with 3 locking holes in AP and mediolateral direction. Reamed intramedullary nailing done through vertical patellar tendon splitting approach, entry made into medullary canal with curved awl under image intensifier. Safe zone is selected for awl entry point, medial to lateral tibial spine on AP view and just anterior to articular surface lateral view. Guidewire is inserted exactly in the centre of the tibial plafond to avoid malalignment, medullary cavity reamed, nail introduced, two proximal locking screws used. At least two and if possible 3 distal locking screws were inserted. All the nails were statically locked.

Role of blocking screws in few cases - blocking screws are used to avoid malalignment.

In MIPPO technique group, 2 cm skin incision is made just below the medial malleolus, locking screw plate is introduced along the subcutaneous borders of tibia, fracture is manually reduced and externally held by bone holding forces. Length, alignment and rotation of the fracture fragments obtained. Position of the plate on the bone is confirmed by the image intensifier in both AP and lateral views. Once the accurate position of plate has been achieved, fixation of the fracture is done using locking screws. Distal metaphysis requires more screws than the diaphysis. Wound closed in layers. Fixation of fibula is done in all associated tibial fractures with DCP plate and screws to provide more stability to the ankle joint.

Postoperatively, below knee pop slab immobilisation done in all plating group patients. Standard antibiotics protocol was followed. Patient is mobilised after 24 hours with non-weightbearing crutch walking. Patients were reviewed after 3rd and 7th postoperative days for wound inspection. Sutures were removed in between 10-14th day.

Patients were followed up every 8 weeks till the fracture union at 6 months and at 1 year after suture removal. Soft below knee plaster is applied in all patients for first 6 weeks. Decision regarding weightbearing is allowed on individual basis depending on fracture type, fracture fixation and weight of the patient. Clinical evaluation includes range of motion of knee and ankle, pain at fracture site and ankle joint. Radiological evaluation includes union progress and alignment of ankle mortise.

RESULTS
This study was consisting of 24 cases of extra-articular fractures of distal tibia, out of which 12 are treated by interlocking nailing and 12 are treated by plating by MIPPO technique. All interlocking nails were done by reamed procedure. Plating is done by MIPPO technique. Age of the patients were ranging from 21 yrs. to 62 yrs. average age was 42.5 yrs. Of 24 patients, 19 were males and 5 were females. Majority of the cases were due to RTA in both groups and 2 of the fractures are due to fall from height. Associated injuries were present in both groups.

Surgery was done in between 2 to 9 days after admission at an average of 4 days. Average duration of surgery was 60.8 mins. for MIPPO and 64.2 mins. for intramedullary nailing. The duration of surgery was calculated as time interval between skin incisions to skin closure. The average time for union and weight bearing was 19 weeks in group A and 20.08 weeks in group B. Postoperatively, one patient has superficial infection and one patient had deep infection in plating group. Superficial infection is controlled with local
dressing and antibiotics. A patient with deep infection has undergone plate removal.

In group B patient who had undergone interlocking nailing, three patients developed anterior knee pain, two patients developed valgus deformity, one patient had varus deformity, one had knee stiffness, one had ankle pain and one person has delayed union. In patients who undergone plating by MIPPO technique, three patients developed ankle stiffness, one patient had delayed union, four patients had ankle pain and one person developed varus deformity. All the patients having delayed union underwent subsequent union without any secondary operative procedure. All the patients having delayed union underwent subsequent union without any secondary operative procedure. Most of the patients were discharged by removing sutures after 10 days of surgery. Follow up was done for a year. Time of healing defined as the time formation of circumferential bridging callus across the fracture. The average time of healing was 20.08 weeks in plating and 19 weeks in nailing.

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**Table 1. Shown in Study Outcome of Procedure**

**Figure 1. a) Preop X-Ray; b) Immediate Postop X-Ray Managed with IMIL Nail; c) X-Ray after 12 Months of Followup Showing Union**
DISCUSSION
Both groups are compared with regards to age, sex and fracture types. Mean age of cases was 40 years in group A and 42 years in group B. Most common mode of injury was RTA in both groups of patients followed by fall from height. This is similar to study conducted by Mohammed et al.

Associated fibular fractures are seen both groups of patients, which was fixed in all cases with DCP and screws. Kumar et al reported that intact fibula or fibular plate fixation provides rotational stability and minimises varus or valgus angulations in distal tibia fractures treated with either nail or plate.

There was one case of varus deformity in plating group, two cases of valgus deformity and one case of varus deformity in nailing group. In nailing group, high percentage of malunion cases seen compared to plating group, this is because of the hourglass shape of medullary canal in distal fragment compared to narrow medullary canal of proximal fragment. In cases of mid shaft tibial fractures, the distal fragment reduces itself when nail is inserted. But, this does not happen with distal tibial fractures, which results in varus/valgus angulation at fracture site. The average duration of surgery is prolonged in nailing group than plating group.
Nailing group has early and better ankle range of movements than plating group. In our study, more infection rate seen with plating group. Radiological union was marginally quicker in nailing group than plating group. 

Im GI et al⁵¹ have shown that locked intramedullary nails have an advantage in the duration of operation, restoration of motion and reduced wound problems and anatomic plate and screw can restore alignment better than intramedullary nails.

Vallier et al⁵² found that high primary union rates were noted after surgical treatment of distal tibia shaft fractures with both non-locked plate and reamed intramedullary nails. Rates of infection, nonunion and secondary procedures were similar. Intramedullary nailing was associated with more alignment versus plating.

Guo JJ et al⁵³ found that reduction and fixation with plate was good, but risk of infection, delayed union and nonunion are high in plating group compared to nailing group.

Gao et al⁵⁴ studied 32 adult patients with very short metaphyseal fragments in fractures of distal tibia treated with polyaxial locking system. The polyaxial locking system shows results of 87.5% functional outcome with American Orthopaedic Foot and Ankle Society Score, which offers more fixation versatility maybe a reasonable treatment option for distal tibia fractures with very short metaphyseal segment.

Hazarika et al⁵⁵, a series of 20 patients of distal tibia fractures treated using locking-compression plates through MIPPO technique. This approach aims to pressure bone biology and minimise surgical soft tissue trauma. This provides 85.5% of good to excellent results. Fractures were classified according to the AO system and performed as scored stage surgery after sterilisation with external fixator primarily.

In our study, we had excellent and good results of around 86% in nailing group and 75% in plating by MIPPO technique. Fair outcome of 8% and 16% in nailing and plating group, respectively. 8% of poor results are seen in plating group.

CONCLUSION
Both IM nailing and plating are optional methods of treatment. Intramedullary nailing in distal tibial fractures result in early mobilisation is an easier technique, more economical and has fewer complications. Plating is preferred in cases where fracture is very close to ankle mortise and associated with lesser rate malalignment and higher rate of wound complications and stiffness of ankle joint.

REFERENCES