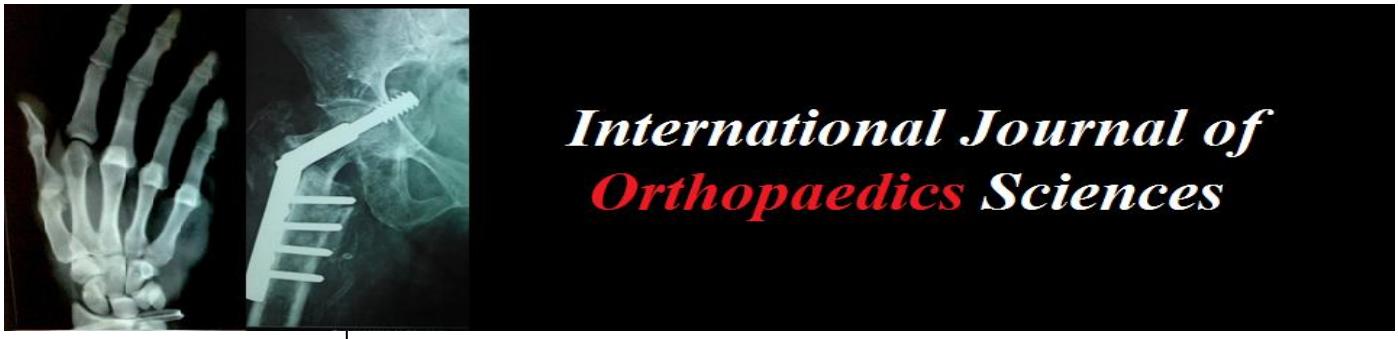

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Extra-articular distal tibia fractures: To plate or nail? A comparison

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Abstract
High energy trauma such as road traffic accidents, are a common cause of lower extremity fractures. Tibia fractures are the second most common lower extremity fractures, and distal tibia fractures deserve special attention due to the relatively lesser amount of energy necessary to cause the fracture, and the propensity for complications, such as nonunion, malunion, infections, and skin cover complications.
In this study, we compare and discuss the outcomes of two well-established modalities of surgical management of extra articular fractures of the distal tibia, intramedullary nailing, and plate fixation.

Keywords: Trauma, fractures, distal tibia, intramedullary nail, ORIF

Introduction
Road traffic accidents are the most common cause of tibia fractures. Tibia is the most common long bone involved in road traffic accidents due to its subcutaneous location. Shaft tibia fractures being the most common and distal tibia fractures being second most common location wise constituting around 10% of all tibial fractures [1, 2]. Incidence of distal tibia fractures being 0.7% [3]. Falls direct blows and sports injury being other causes of distal tibia fractures. These fractures because of its subcutaneous location, poor blood supply and decreased muscle coverage when compared to the rest of tibia, they pose a challenge to treating surgeon and complications are more often.
Some of the complications being delayed union, nonunion, wound infection, wound dehiscence, malalignment, knee pain and implant failure. The location of fracture is close to the ankle joint and is not uncommon for the fracture line to extend into the joint. These fractures are often comminuted and unstable. The degree of soft tissue injury is more in distal tibia fractures than in shaft fractures. Therefore, the aim of management in a distal tibia metaphyseal fracture is to provide a stable internal fixation with minimal additional soft tissue injury. Intramedullary nailing is the mainstay of treatment in shaft fractures of the tibia. Nowadays intramedullary nailing is being considered as mainstay for extraarticular distal tibia fractures as it preserves the extra-osseous blood supply.
Fractures of the distal tibia have been described long back. However, despite the presence of large number of publications, several controversies still exist regarding the ideal method of managing these fractures [4]. Open reduction and internal fixation by plating was done previously for distal tibia metaphyseal fractures. But it had the major drawback of opening the fracture site and elevating the periosteum. This led to major wound complications like wound infection, wound dehiscence and also fracture union problems like delayed union and nonunion as the fracture hematoma which is a scaffold for new bone formation was removed in these cases. Cadaveric studies have shown that the blood supply to distal tibia is mainly by a vascular anastomotic channel formed by anterior tibial artery and posterior tibial artery and not solely relying over the posterior tibial artery which is the nutrient artery. In fact, in one of the cadaveric studies it was found that the major blood supply to callus comes from periosteum and thus stripping of periosteum decreases the chances of bone healing [6]. Hence intramedullary interlocking nailing was extended to distal tibia. Here the problem was nails do not have any hold in the distal fragment this led to malunion.

"Poller" screws were devised to prevent this misalignment and increase the stability of fixation. Also locking of three distal locks with two mediolateral and one anteroposterior was recommended to improve the stability. Since nails are load sharing devices early weight bearing could be started.

With the advent of newer plate designs, AO came up with locking compression plates in the year 2000, this led to the advent of MIPO plates. Here mini incisions were taken to the slide the plate and under C arm guidance locking was done. Here as the fracture hematoma was not exposed and the periosteal stripping was minimal, it had better chances of union. However wound complications were present even in this.

In this study we aim to compare radiological and functional outcomes of distal metaphyseal tibia nailing versus plating.

Olerud and Molander functional scoring system and American orthopaedic foot and ankle society scoring system was used to compare the results.

Aims and objectives

1. To study the functional outcomes of patients with extra articular distal tibia fractures treated by intramedullary interlocking nailing and MIPO plating using American Orthopaedic Foot and Ankle Society Score(AOFAS) and Olerud and Molander scores.
2. To assess the radiological outcomes of patients with extra articular distal tibia fractures treated by intramedullary interlocking nailing and MIPO plating using bony union rates.
3. To assess as to when the patients treated by intramedullary interlocking nailing and MIPO plating returned to work.
4. To study the complications associated with both of these treatment modalities.

Materials and Methods

60 patients of fracture of distal end of tibia were chosen from among population attending the orthopaedic outpatient clinic as well as from the inpatients admitted at the institute. Patients with displaced but extra articular distal tibia fractures were included in the study.

Two groups were made, one of patients treated with interlocking intramedullary nailing and the other patients treated with MIPO distal tibia plating.

Patients of either sex, with ages between 20-80, having extraarticular fractures of the distal end of tibia, with no joint incongruity, no distal neurovascular compromise, no compartment syndrome and no other co morbidity were included in the study.

Inclusion Criteria

- fracture meeting AO criteria AO type 43A (AO type 43A1, 43A2, 43A3)
- age > 18 years
- presence of distal fragment of atleast 3cms in length without articular incongruity
- no neurovascular deficits in affected limb valid consented patients

Exclusion Criteria

- open fractures
- intra articular extension
- pathological fractures
- stress fractures
- paediatric patients (< 14 years of age)
- metabolic bone diseases
- who did not give valid consent
- polytrauma patients as the outcome evaluation may be difficult

After initial assessment, the consenting patients were hemodynamically stabilised and the fracture was initially immobilised using a plaster of Paris slab. Then standard anteroposterior and lateral radiographs of affected tibia with ankle and knee were done. If any suspicion of intra articular extension, CT scan was done and intra articular fractures were excluded from the study.

A detailed history of trauma, including the mechanism of injury, time course since the trauma and any history of active medications is taken in detail and any other relevant information is obtained.

Investigations were carried out after consideration of clinical presentations so as to find out the predisposing factors, precipitating factors and etiology.

Both the group of patients undergoing intramedullary interlocking nailing and distal tibia MIPO plating were treated on inpatient basis with standard postoperative intravenous antibiotics and analgesia protocol. Other medications such as calcium supplementation, cissus quadrangularis supplementation and anti-inflammatory enzyme preparations were provided in the same dosage and schedule in both the groups. Follow up duration was one year. Follow up of such patients was done at second, fourth, sixth week and then three months, six months and one year. Comparison of initial and serial radiographs was done, and at the same time range of motion, pain, deformity, disability, any evidence of post-operative wound infection or wound dehiscence were observed and functional activity of ankle was assessed by Olerud and Molander functional scoring system. A randomized prospective comparative study was conducted between July 2017 to July 2019.

Unpaired t- test was used for collected data

The present study was carried out in the orthopaedics department; in patient department. The study was conducted after obtaining ethical committee clearance as well as informed consent was taken from all patients.

Results

The study sample contained 32% females and 68% male patients, with a mean age of 46.2 years and a standard deviation of 1.04. The minimum and maximum ages in the sample were 20 and 80 years respectively. Given the generalized male preponderance and the age distribution, the sample seems to be in agreement with the population at large.

There was also an observed preponderance to the right side, seen in 59% patients of the MIPO group and 54% patients in the IMIL group. This right sided prevalence of trauma is also in agreement with existing literature. As is with the population at large, the most common mode of injury was road traffic accidents followed by falls. Only AO classification 43 A (extra articular) was included in the study Three fracture patterns were included in the study as per AO classification, AO 43.A1, 43.A2 and 43.A3 of which AO 43.A2 (metaphyseal wedge) was the most common type in our study constituting to total of 28 patients (46%) that is 20 in nailing group and 8 in plating group. This was followed by the second most common type being 43.A1 (metaphyseal simple) constituting around 33%. However, AO 43.A3 patients were more commonly managed by MIPO plating in view of the associated comminution.

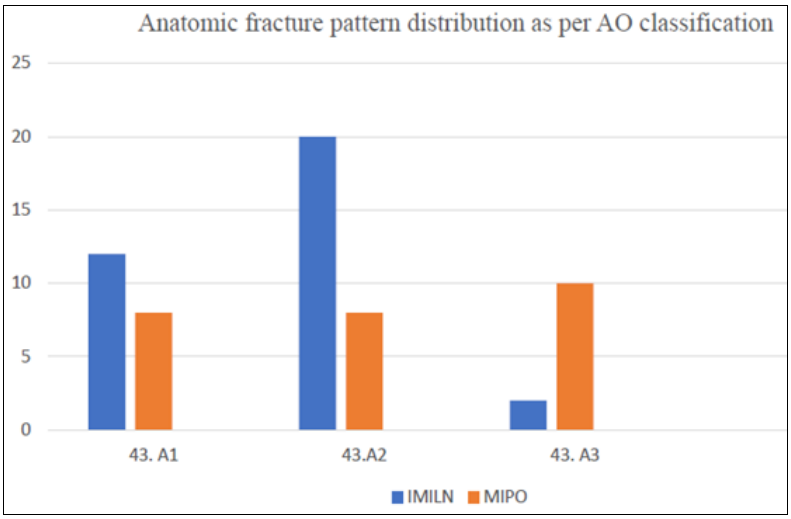

Table 1: Statistical distribution of anatomic fracture patterns as per the AO classification.

85% patients were also seen to have a concurrent fibula fracture, which was relatively more frequent in the IMILN group.

In our study all the fibula fractures were fixed and CRIF with nailing was preferred as it reduces further tissue damage and brings about the alignment.

There was an average delay of 4 to 5 days to surgery in about 34% of the patients, mostly due to associated soft tissue conditions.

Table 2: Average time to surgery

No. Of days	No. Of surgery
1-3	8
4-5	20
6-7	14
8-14	12
>15	6

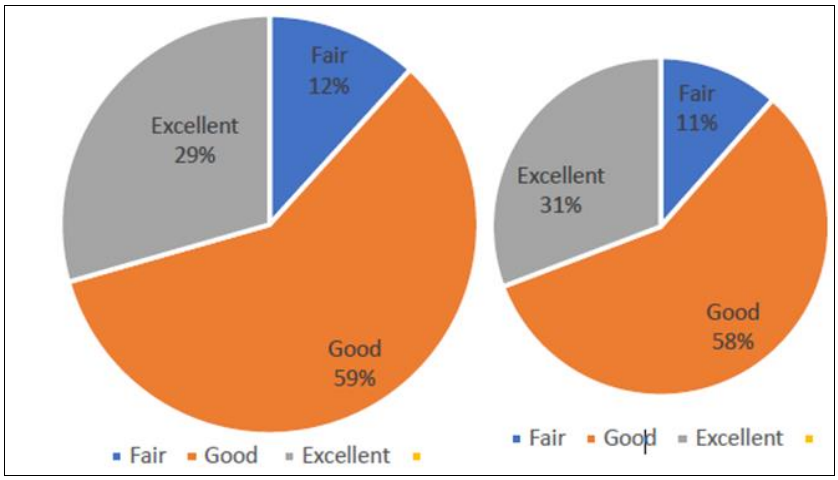

Table 2: Analysis of AOFAS scores

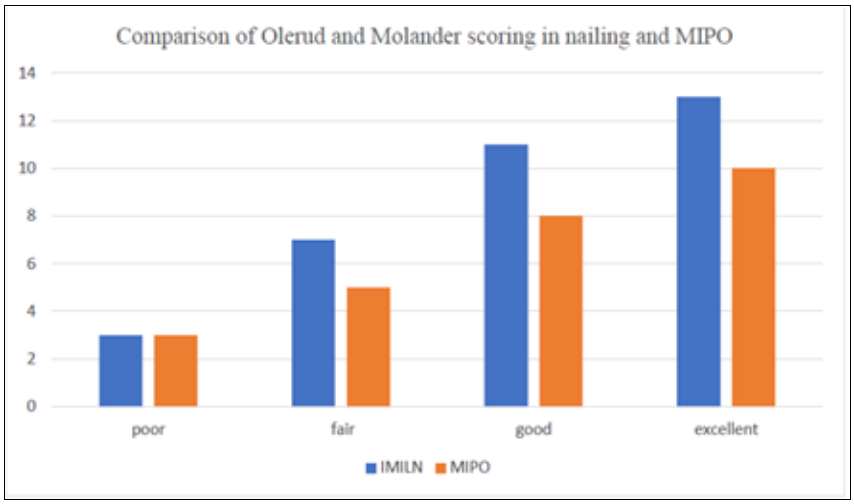

Table 3: Analysis of Olerud and Molander scoring.

The comparison of functional scoring system Olerud and Molander scoring system between intramedullary nailing and MIPO group. The above data clearly suggests that the functional outcomes between both the methods of treatment nailing and MIPO is comparable and there is no significant difference between them.

This is also supported by the literature search which gives similar results that there is no statistically significant differences between nailing and MIPO group regarding functional outcomes.

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