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## Comparative study between intramedullary nailing and plating for extra articular distal tibia fractures

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**Background:** Distal third tibial fractures remain challenging due to peculiar soft tissue features and myriad treatment options. Tibia is not only the most common long bone of body to get fractured but also offers many challenges to Orthopaedic surgeons in managing its fractures. The surgical treatment itself has controversies such as difficulty in achieving and retaining good reduction by nailing methods, propensity to infection and nonunion due to dissecting the fracture site during the procedure of inserting the plate. There are various options available for the surgical management of distal 1/3<sup>rd</sup> tibial shaft fractures and each of these treatment options is associated with certain challenges.

**Method:** We studied the 60 patients of distal 1/3<sup>rd</sup> tibial shaft fractures operated with closed reduction and internal fixation with reamed intramedullary interlocking nailing or open reduction internal fixation with plating. The patient selection was done by randomisation. Radiological outcomes and clinical outcomes using Olerud-Molander score were assessed at 6 weeks, 3 months, 6 months and 1 year intervals

**Result:** Mean for surgery duration in minutes was 68 and 75 in patients who underwent interlocking nailing and plate osteosynthesis respectively. Mean time of union was found to be 14.2 weeks in patients treated with interlocking nail and 18.1 in patients treated with plate osteosynthesis. We found out that 20% patients had good & 80% patients had excellent outcome treated with interlocking nail according to Olerud-Molander Score in comparison with patients who underwent plate osteosynthesis had good outcome in 36.7% patients and excellent outcome in 63.34% of patients. Complications were seen mostly in plate osteosynthesis group of patients that included superficial infection and hardware impingement in 2 patients each and wound dehiscence was seen in 1 patient. Hardware impingement was seen in one case on patient who underwent interlocking nail.

**Conclusion:** Our results have shown that both closed intramedullary nailing and locking plating can be used safely to treat fractures of the tibia. Closed nailing has the advantage of shortened operating time, decreased wound problems, early union of the fracture, decreased implant related problems & overall reduced morbidity, therefore we prefer closed intramedullary interlocking nailing in treatment of extra-articular distal tibia fractures.

**Keywords:** Nailing, plating, tibia fractures & extra articular

### Introduction

Distal third tibial fractures remain challenging due to peculiar soft tissue features and myriad treatment options. The surgical treatment itself has controversies such as difficulty in achieving and retaining good reduction by nailing methods, propensity to infection and nonunion due to dissecting the fracture site during the procedure of inserting the plate<sup>[1, 2]</sup>. Distal tibia fractures without articular connection are general consequence of road traffic accidents or other high-energy injuries. These fractures vary from pilon fractures in conditions of the mechanism of injury, management & prediction of the displaced bones<sup>[3]</sup>. The proximity of these fractures to the ankle joint make it more complicated than those seen with diaphyseal or middle-third injuries<sup>[4]</sup>. Therefore, the treatment of distal tibia fractures remains problematic<sup>[5]</sup>. Intramedullary (IM) nailing, minimally invasive techniques, open reduction and internal fixation (ORIF), hybrid or ring external fixation and a two-staged protocol with primarily external transfixation and later conversion to ORIF are the various options for the cure of distal tibia fractures. However, each treatment modality has associated benefits and complications. Skin and soft tissue curing complications, delayed union, nonunion are fairly widespread. It is mainly due to the anatomical situation of this area, which has a poor blood supply and thin soft

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tissue exposure. Another cause is that those fractures are often caused by high-energy injuries, frequently are open, with a massive contusion of skin, muscles and blood vessels [6].

The two approaches nailing and plating have some theoretical disadvantages. There have been some controlled clinical trials that directly compared the 2 methods. These trials also failed to show consistent results [7].

Several previous randomized controlled trials have reported the outcomes of nailing versus plating treatment modalities. The boundaries of observational studies were overcome in these RCTs by decreasing the bias through randomization. Though, all of the RCTs had low numbers of patients. In 2013, Xue *et al.* [8] performed a meta-analysis and systematic review comparing nailing versus plating for the treatment of distal tibial metaphyseal fracture. Higher functional score & lower risk of infection were found in the nailing group. Still, different categories of functional score were compounded, & no subgroup analysis was made as both RCT and retrospective studies were included. Lately, some additional studies were reported, which will make the evidence more precise & reliable. As no consensus has been reached concerning the management of these fractures, the most favorable treatment option for extra-articular distal tibia fractures remains controversial.

### Material & method

This was a prospective study conducted in Department of Orthopaedics in Sri Aurobindo Medical College and Post Graduate Institute, Indore between July 2017 and June 2018. Ethical committee clearance was obtained and patient was included in study after informed and written consent. The study consisted of 60 consecutive patients with distal tibia fracture managed surgically with either Intramedullary interlocking nailing (IMIL) or Open reduction and internal fixation (ORIF) with plating.

All 60 patients were received in emergency room following which on admission of the patient, a careful history was elicited from the patient and/or attenders to reveal the mechanism of injury and the severity of the trauma. Patients are clinically assessed to evaluate their general condition & the local injury. Specific condition was assessed with the vital signs & systemic examination. Distal neurovascular status was assessed by the posterior tibial artery and dorsalis pedis artery pulsations, capillary filling, local temperature, pallor and paraesthesia. Then trauma series, relevant X-rays including the affected leg with knee and ankle joints antero-posterior and lateral views were taken. Fracture patterns were classified based on the AO/OTA classification. The limb was then immobilized in an above knee Plaster of Paris slab till definitive fixation was done.

Patients with open fractures were graded using the Gustilo Anderson classification for open fractures. Antibiotics were started immediately for all patients. Injection cefuroxime 1.5gm intravenous thrice daily and injection Amikacin 750mg intravenous once daily and Inj Metronidazole 100mg intravenous thrice daily were the antibiotics. Single dose of tetanus toxoid was given. After obtaining the necessary radiographs, Type I and II open fractures were treated by cleaning of the wound with copious amount of normal saline, and Hydrogen peroxide, followed by painting of the skin around the wound with Povidone iodine and sterile dressing was done. The limb was then immobilized in an above knee Plaster of Paris slab till definite fixation was done. In the Type III fracture, patient was taken for emergency wound debridement and Joint Spanning External Fixator was applied primarily till definitive fixation was planned.

### Inclusion criteria

1. All Skeletally mature patients (age  $\geq 18$ ) both males and females.
2. Involvement of distal 8cm of tibia.
3. All closed fractures.
4. Compound fractures Gustilo-Anderson type I and Type II fractures.

### Exclusion criteria

1. Skeletally immature patients.
2. Intra-articular fracture.
3. Compound fractures Gustilo-Anderson type III.
4. Pathological fracture.
5. Any other fracture in the same limb except for ipsilateral fibula.

All patients received treatment with Intramedullary interlocking nailing or open reduction and internal fixation with plating on random selection basis.

All patients were operated under regional anesthesia with patient supine on standard radiolucent table. The patients who underwent intramedullary interlocking nailing, Patellar splitting approach were used. Under image intensifier nailing was done using standard technique and all fractures were fixed with one proximal and two/three distal interlocking screws.

The patients who underwent plate osteosynthesis, through anteromedial or anterolateral approach reduction of fracture was achieved and fixed using plates and appropriate screws.

Dressing was done and Elastocrepe bandage was applied. Patients were shifted to post-operative ward. Post-operative x-rays were done. Postoperatively limb was elevated over pillow and ice fomentation was given. Active toe movement exercises, ankle foot pump and knee range of motion exercises were started post operatively. Non weight bearing mobilization was started on post op day 1. Weight bearing was started according to fracture pattern and after patient was able to tolerate the pain. IV 3rd generation cephalosporins for 5 days, aminoglycosides for 3 days and oral cephalosporins for 5 days were given. Dressing was done on post-operative day 2 and post-operative day 5. Suture removal was done at post-operative day 13. Patients were followed up at 6 weeks, 3 months 6 months and 1 year. At each follow up, x-rays were done and patient's Olerud-Molander score was assessed.



Fig 1: Pre op X ray

Fig 2: Immediate post op X ray



**Fig 3:** 1 month follow up x ray



**Fig 4:** 3 month follow up x ray



**Fig 9:** Pre-operative x ray



**Fig 10:** immediate post op x ray



**Fig 5:** 6 months follow up



**Fig 6:** 1 year follow up



**Fig 11:** 1 month follow up x ray



**Fig 12:** 3 months follow up x ray



**Fig 7:** Clinical images



**Fig 8:** Clinical images



**Fig 13:** 6 months follow up x ray



**Fig 14:** 1 year follow up x ray



**Fig 15**



**Fig 16**



**Fig 17**

**Fig 15, 16 & 17:** Clinical images

## Results

**Table 1:** Demographic Profile-Age Distribution

S. No.	Age in years	No.	Percentage
1	18-30	18	30.00
2	31-40	18	30.00
3	41-50	11	18.33
4	51-60	06	10.00
5	61-70	07	11.67

**Table 2:** Demographic Profile-Gender Distribution

S. No.	Gender	No.	Percentage
1	Male	42	70.00
2	Female	18	30.00

**Table 3:** Mode of injury

S. No.	Mode of injury	No.	Percentage
1	Assault	03	05.0
2	Fall from Height	12	20
3	Road Traffic Accident	38	63.33
4	Slip Fall	07	11.67

**Table 4:** Side involved

S. No.	Side involved	No.	Percentage
1	Right	23	38.33
2	Left	37	61.67

**Table 5:** Associated Fibula Fractures

S. No.	Associated Fibula Fractures	No.	Percentage
1	Yes	30	50.00
2	No	30	50.00

**Table 6:** Duration of Surgery

S. No.	Duration of Surgery [in minutes]	Nailing		Plating	
		No.	Percentage	No.	Percentage
1	60-70	21	69.94	09	30
2	71-80	06	20	18	60
3	81-90	03	10	03	10

**Table 7:** Union Time

S. No.	Union Time [in weeks]	Nailing		Plating	
		No.	Percentage	No.	Percentage
1	12-14	23	76.66	05	16.66
2	15-17	07	23.34	07	23.34
3	18-20	00	00	16	53.34
4	Above 22	00	00	02	6.66

**Table 8:** Outcome

S. No.	Outcome	Nailing		Plating	
		No.	Percentage	No.	Percentage
1	Excellent	24	80.00%	19	63.34%
2	Good	06	20.00%	11	36.66%

**Table 9:** Complications

S. No.	Complications	Nailing	Plating
		No.	No.
1	Superficial Infection	00	02
2	Wound dehiscence	00	01
3	Hardware impingement	01	02
4	None	29	25

## Discussion

Distal tibia fractures are a common consequence of road traffic accidents and injuries due to fall. Its management still continues to be a problem with several unanswered questions. These fractures generally require operative management and can be managed with closed reduction and intramedullary nailing or open reduction and internal fixation with plating or closed reduction and percutaneous plating or external fixators<sup>[9, 10]</sup>.

Intramedullary nailing has the advantage of a shorter operating time, less rate of infection and early weight bearing and easier removal of the implant. It enables closed stabilization while preserving vascularity of the fracture site and integrity of the soft-tissue envelope. Open reduction and internal plate fixation results in extensive soft tissue dissection and may be associated with wound complications and infection<sup>[11]</sup>.

Locked plate designs act as fixed-angle devices whose stability is provided by the axial and angular stability at the screw-plate interface instead of relying on the frictional force between the plate and bone, which is thought to preserve the periosteal blood supply around the fracture site<sup>[12, 13]</sup>.

In present series, 60 cases of extra articular distal tibia fractures were treated primarily over a period of two years with minimum follow up of 12 months. We evaluated our results and compared them with the result of various studies in the literature. In our study, the patients were in the range of 18-70 years, with majority of patients belonging to 15-30 and 31-40 years. Of the 60 patients, 42 were males and 18 were females. Predominant male involvement in our study was probably due to more outdoor activities and heavier labor undertaken by males as compared to females in the Indian set up. The result were comparable to that of Kumar *et al.*,<sup>[5]</sup> in their study there was also male preponderance and the patients were in also age group of 19-69 years. In our study, most common cause for these fractures was RTA followed by fall from height. Our results were comparable to other study by Kumar *et al.*,<sup>[5]</sup> in their study RTA was the most common cause followed by fall and sports injury. The mean duration of surgery in interlocking group was 68 min & the mean duration of surgery in plating group was 75 min. Our results were different than the study done by Kumar *et al.*,<sup>[5]</sup> in their study the operating time in the intramedullary nailing group was 57.14 min whereas in plating group it was 66.67min. Another similar study done by Xue *et al.*,<sup>[8]</sup> mean surgical duration was not studied. In present study, the mean union time in nailing group was 14.2 weeks and in plate osteosynthesis group of patients it was 18.1 weeks. Our result were different than the study done by Kumar *et al.*,<sup>[5]</sup> in his study the union time in the intramedullary nailing group was 18.26 weeks whereas in plating group it was 22.7 weeks. Complications were seen mostly in plate osteosynthesis group of patients that included superficial infection and hardware impingement in 2 patients each and wound dehiscence was seen in 1 patient. Hardware impingement was seen in one case on patient who underwent interlocking nail. In a study conducted by Kumar *et al.*,<sup>[5]</sup> anterior knee pain was most common complication seen in intramedullary nailing group of patients while deep and superficial infection were common complication seen in plating group so our results were different from their study.

## Conclusion

Our results have shown that both closed intramedullary nailing and locking plating can be used safely to treat fractures of the tibia. Closed nailing has the advantage of shortened operating time, early weight bearing, decreased wound problems, early

union of the fracture, decreased implant related problems & overall reduced morbidity, therefore we prefer closed intramedullary interlocking nailing in treatment of distal tibia fractures.

For fractures of the distal tibia and fibula, prior fixation of fibula helps in achieving alignment and reduction of the distal tibia fracture. Hence, we recommend prior fibular fixation whenever intramedullary nailing or locking plate fixation is used in distal tibio-fibular fractures.

Indications of IM nailing are fractures in people with thin skin or compromised soft tissue & fractures with distal bone mass allowing placing of at least two screws. Usually we prefer to use three distal screws to achieve good stability. Plating is good for fractures with risk of malalignment, fractures with simple articular involvement & fractures in which IM nailing is not amenable. IM nailing can result in malalignment, malunion & knee pain if proper reduction and surgical technique are not used. Tibia plating can achieve anatomic reduction, however it is related with the risk of wound dehiscence & infection because of the minimal soft tissue cover over the anteromedial tibia.

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