

A Comparative Study of Management of Closed & Comminuted Distal Tibial Fractures with Intramedullary Inter Locking Nail V/S MIPO

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Abstract:-

➤ Objective

This study was performed to assess and compare the functional outcomes of fractures in Group A (treated with MIPO plating) versus Group B (treated with intramedullary nailing) and To assess the complications of both procedures.

➤ Methods

A total of 40 patients will be taken for study as per inclusion criteria. The patients will be divided into two groups 20 cases each. Group A will be treated with MIPO plating and group B will be treated with intramedullary nailing. Pre-operatively anteroposterior and lateral radiographs were obtained in all cases and computed tomography scans in patients with the most complex fractures to rule out intra articular extension. Follow-up evaluations were carried out at 3, 6, and 12 weeks and 3 and 9 months postoperatively, using Olerud and Molander functional score.

➤ Results

This study shown that IMILN has better outcome as it offers advantage in terms of mean operating time, less invasive surgery, hospital stay, partial & full weight-bearing time and union time. In osteosynthesis of displaced extra-articular lower tibia meta-diaphyseal fractures OTA/AO Type 42A- C (distal) & 43-A both modalities nailing as well as plating deserve a place.

Keywords:- Distal Tibial Fractures, Minimally Invasive Plate Osteosynthesis (MIPO), IMIL (Intra Medullary Interlocking) Nail, Olerud and Molander Functional Score.

I. INTRODUCTION

Tibia is a long bone with a triangular cross-section, and it has a subcutaneous anteromedial border. The tibia is bounded by four tight fascial compartments (anterior, posterior, lateral, and deep posterior). Fractures of the distal tibia account for less than 10% of all fractures of the lower extremities. These fractures are more frequently seen in men than women and aged between 35-40 years. The management of distal tibial fractures remained challenging in orthopaedic traumatology. By virtue of its location and subcutaneous position in the leg, the tibia is exposed to the risk of injury and open fractures. High energy trauma and poor blood supply at the lower one-third shaft of the tibia pose difficulties in bringing out optimal results. Most of the controversy revolves around the treatment techniques regarding the choice of implants, as the indication for surgery is fairly clear. Fractures of the tibia traditionally have been managed with closed reduction and casting. Since the late 1950s, in which an adequate reduction was not obtained or maintained by conservative methods, open reduction and internal fixation (ORIF) was tried. During ORIF, excessive tissue dissection and devitalization are seen, which creates problems in wound healing and can lead to infection. Due to this, other less invasive methods were developed to treat fractures of the distal tibia. A briefer period of disability and early return to regular activities, with a shorter time to the union, can be attained by accurate closed intramedullary (IM) nailing compared to patients managed by locking plate. This study compare the radiographic and clinical results of patients with closed, comminuted extra-articular distal one-third tibial shaft fracture, treated with intramedullary interlocking nailing and those treated by distal tibia locking plate (MIPO) and assess the complications in both the treatment modalities.

➤ *Aims & Objectives*

- To assess and compare the functional outcomes of fractures in Group A (treated with MIPO plating) versus Group B (treated with intramedullary nailing).
- To assess the complications of both procedures

II. METHODOLOGY

- *Study design: Prospective randomized control trial. Study subjects: 40 cases will be studied.*
- *Study setting: Department of Orthopaedics, Government medical college & general hospital, Anantapur. Ethical clearance was received before the beginning of the study from Ethical Clearance Committee.*

➤ *Study Period: 18 Months Duration (Oct 2019 To March 2021) Inclusion Criteria:*

- Age of the patients: 21 to 60 years
- Closed displaced fracture of the distal tibia
- Open fractures of the distal tibia (Gustillo and Anderson grade I&II)

➤ *Exclusion Criteria:*

- Age of the patients <21 and >60 years
- Pathological fractures
- Presence of infection at the fracture site.
- Patient unfit for surgery due to various medical reasons
- Gustillo Anderson type III
- Associated fractures of talus, calcaneum
- Intra-articular fractures
- An associated proximal tibia fracture

- Segmental fracture of the tibia
- The patients who are not willing to give consent to participate in the study
- Routine investigations were done as were necessary. X rays of distal leg with ankle joint – AP & Lateral views were obtained. Stabilization was done with an above knee slab, and open reduction and internal fixation was done once the swelling had subsided.

➤ *Study Procedure*

A total of 40 patients will be taken for study as per inclusion criteria. The patients will be divided into two groups 20 cases each. Group A will be treated with MIPO plating and group B will be treated with intramedullary nailing. Plating group include patients managed by distal tibia medial locking plate by minimally invasive method, and Nailing group include patients managed with closed reduction and reamed intramedullary nailing. Detailed history, general physical examination, systemic and local examination and tests will be recorded as per the proforma. All fibula fractures within 7cms of ankle joint are fixed with plating. Postoperatively, the operated limb was immobilized in plaster splint in all the cases for two weeks till soft tissue oedema was settled. Static quadriceps exercises were started with in a slab. After 2 weeks plaster splint was removed and patients were instructed strict non weight-bearing walking with crutch or walker. At the end of six weeks, radiographs were taken and weight-bearing was initiated only after signs of callus are seen on radiographs.

Patients are followed on 6th week and then every 3 monthly till 1 year. Delayed union was described as radiographic union >24 weeks. Functional outcome was done by Olerud and Molander functional evaluation score (% of normal).

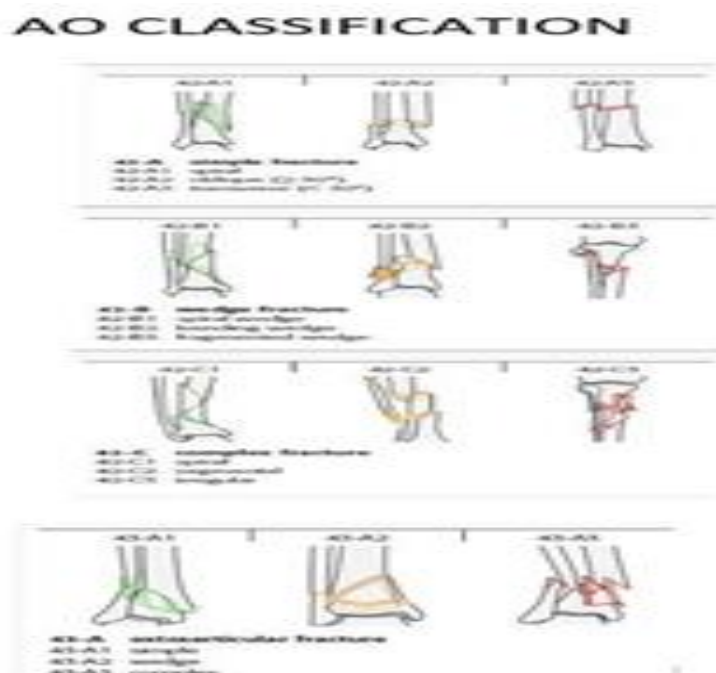


Fig 1 AO Classification

Technique- IMIL nail & MIPO

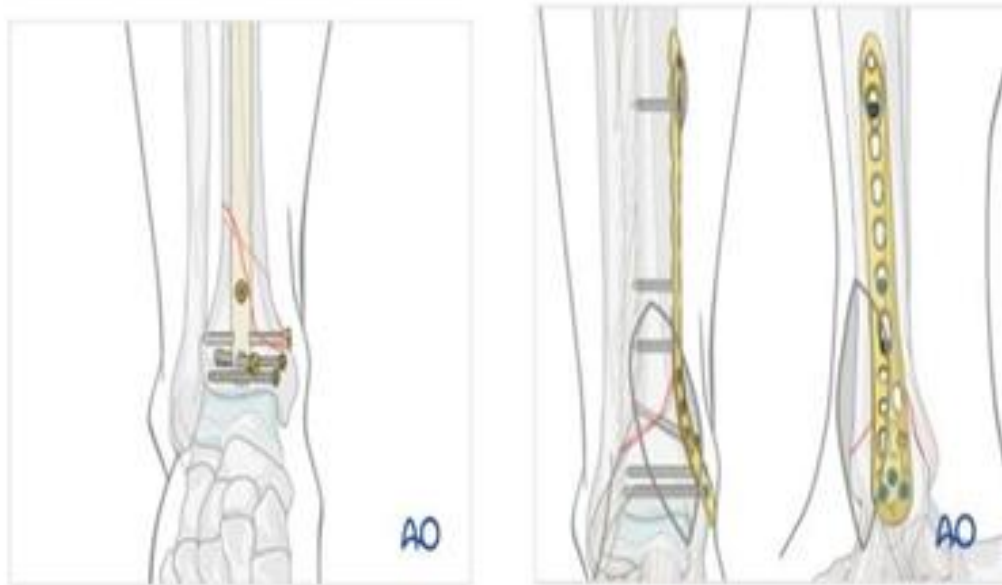


Fig 2 Technique- IMIL nail & MIPO

➤ *Post Operative Protocol*

Immediately after surgery , active knee and ankle exercises were started. Post operatively parenteral antibiotics given for 5 days. Patient discharged after sutureremoval on an average on 10 thday (decided according to wound inspection).

In cases of Fractures fixed with fibular plating, NWB for 6weeks, followed by PWB astolerated for next 2 months.

➤ *Follow Up*

Patient follow-up was done on :- At 3 weeks, 6 weeks, 12weeks, then monthly for next 3 months and finally at 9months postoperative.

Cases Illustrations

(preop xray, immediate postop xray, 6months postop xray & clinical fotos at9 months follow up respectively)

• *Case 1:*



Fig 3 Preop Xray, Immediate Postop Xray, 6months Postop Xray & Clinical Fotos at 9 Months

- Case 2:



Fig 4 Preop Xray, Immediate Postop Xray, 6months Postop Xray & Clinical Fotos at 9 Months

III. RESULTS

A total of 40 patients are included in this study, 20 patients were operated with distal tibia lockingplate (Plating group) and 20 operated with Intramedullary interlocking nail (Nailing group).

- Age distribution: Mean age of patients from the plating group was 36.42 ± 12.72 years, while the mean age of patients from IM nailing was 42.56 ± 11.93 years.
- Sex distribution: In both the study groups, the majority were males (85% in plating and 90% in Intramedullary nailing)
- Mode of injury: Commonest cause of injury was road traffic accident in 15 (75%) and 14 (70%) in plating and Intramedullary nailing group respectively.
- Concomitant Fibula Fracture was observed in both the intervention groups approximately similar in number. i.e. 90% and 75%.
- *Both the groups did not vary significantly with regard to the age group of patients, mode of injury, sex distribution, type of fracture or associated fibula fracture.
- Mean operative time in surgery of patients from Intramedullary nailing was 76.21 ± 9.9 minutes while in patients from the plating group was 91.02 ± 10.5 minutes
- Mean hospitalization days in patients from Intramedullary nailing was 7.21 ± 2.3 days while in patients from plating group was 9.66 ± 3.2 days
- Time to full weight bear: The average duration following which patients could be allowed to bear full weight on the operated was 13.7 ± 1.12 weeks (range, 13-17 weeks) in nailing group and 17.8 ± 0.94 weeks (range 16-20 weeks) in plating group. The patients in the intramedullary interlocking nail group were able to bear weight on the operated limb in a significantly lesser time (P-value < 0.005).
- Time to union: The average duration for the radiological union in the intramedullary interlocking nail group was 20.1 ± 1.14 weeks (range 18-22 weeks) and in the plating group it was 24.1 ± 1.16 weeks (range 22-30 weeks). Thus, the union occurred significantly faster in the nailing group (P-value 0.001). Three patients from the plating group had delayed union.
- Ankle range of motion: In the present study, a significantly better ankle range of motion was noticed in the intramedullary interlocking nail group as compared to that of distal tibia plating group. Average dorsiflexion at the final follow-up (12 months) was 12.8 degrees and 9. degrees in the intramedullary interlocking nail group and the distal tibia plating group respectively (P value < 0.025). The average plantar flexion was 31.6 degrees and 24.7 degrees in the intramedullary interlocking nail group and the distal tibia plating group, respectively (P value < 0.001).
- Functional outcome assessment: The mean Olerud and Molander functional score at the end of 1 year was higher for the intramedullary interlocking nail group (82.6) as compared to that for the plating group (75.4). Both the groups had good results with a slightly better outcome in intramedullary interlocking nail group, though not significantly different.
- Five cases from Intramedullary nailing and 1 case from the plating group had significant valgus (6° - 10°). Other patients either had no varus/valgus or had acceptable 5° varus /valgus
- Complications: The only post-operative complication seen in this study was an infection at the operative site in 2 patients (10%), all in the plating group. No infection noted in nailing group.
- Secondary procedures: In this study, one patient required vacuum-assisted closure of the wound and one patient had fibula plate removal due to persistent wound problems. All two patients belong to the plating group

- Age Distribution ($P>0.05$)- Not Significant)

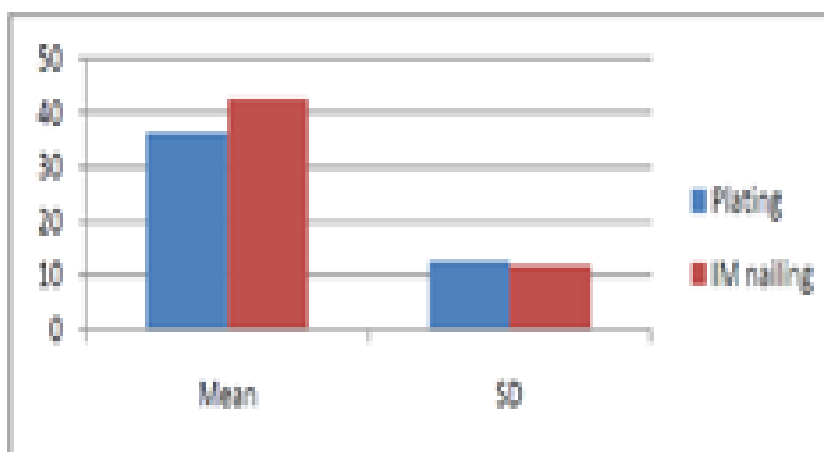


Fig 5 Age Distribution

Table 1 Age Distribution

Author	Plating	IM nailing
Mayank Mahendra etal ⁵	41.90±15.27	41.04-14.07
Baral Retal ⁶	46.11-16.116	37.38-12.18
Present study	36.42 12.72	42.56 11.93

- Mode of Injury (($p>0.05$)- not significant)

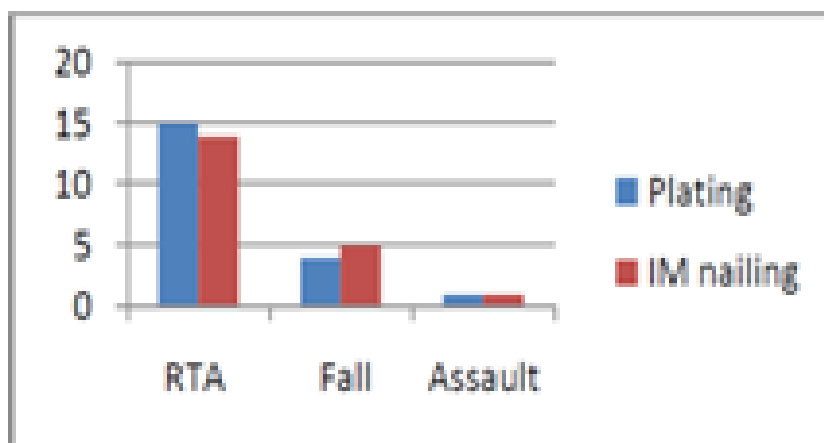


Fig 6 Mode of Injury

Table 2 Mode of Injury

Author	RTA
Pawar E Detal	60%
Hologunda Letal	73%
Mayank Mahendra etal	67%
Present Study	73%

- Mean Surgery Time (($p<0.05$)- significant)

Table 3 Mean Surgery Time

Author	IL group	Plating group
Li Y et al	60 minutes	70 minutes
Guo et al	81.2 minutes	97.9 minutes
Mayank Mahendra et al	79.00 5.59 minutes	94.50±10.11 minutes
Present study	76.21 ± 9.9 minutes	91.02 10.5 minutes

- Mean Duration of Hospitalization ($p < 0.05$)- significant)

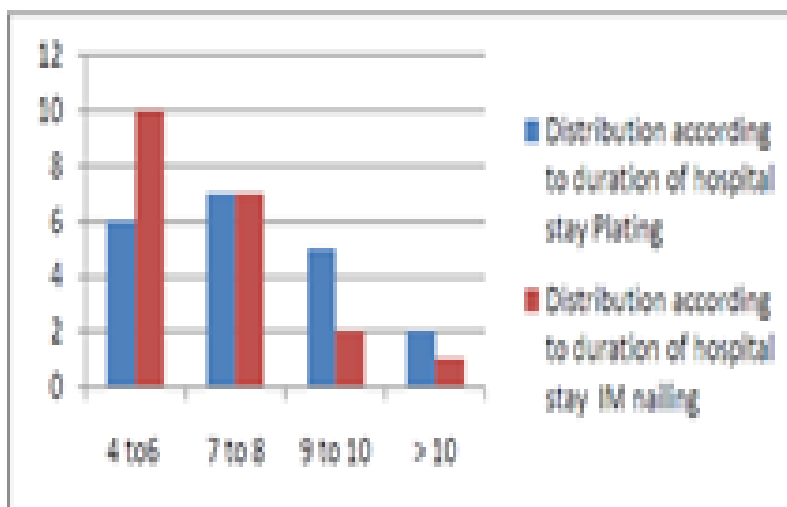


Fig 7 Mean Duration of Hospitalization

Table 4 Mean Duration of Hospitalization

Author	Plating group	IL group
Mayank Mahendra et als	9.86±3.2 days	7.01 ± 2.3 days
Li Y et al	8.9 +/- 3.1 days.	5.8 +/- 2.1 days
Present study	9.66 ± 3.2 days	7.21 ± 2.3 days

- Duration of Bone Union ($p < 0.05$)- significant)

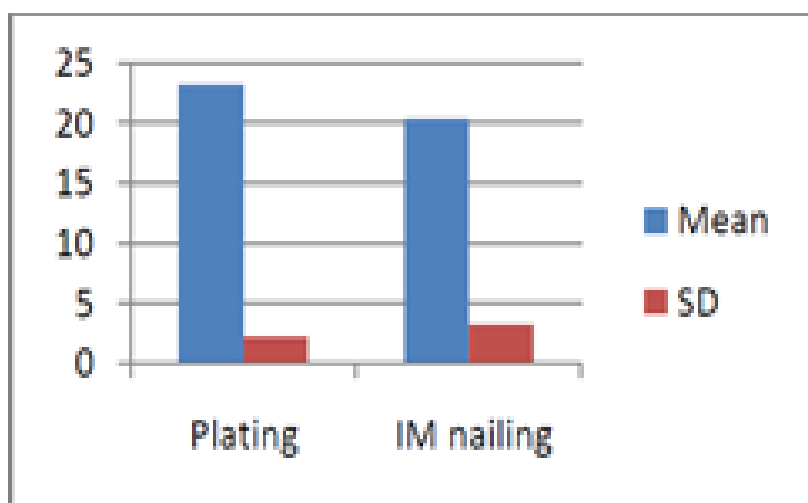


Fig 8 Duration of Bone Union

Table 5 Duration of Bone Union

Author	Interlocking (weeks)	Plating (weeks)
Mayank Mahendra et al ⁵	20.33± 3.27 weeks	23.21±2.2 6 weeks
Li Y et al ⁵	21.3+/-3.5	23.1+/- 3.6
Vaza J V et al ⁵	23.45 weeks	26 weeks
Pawar E D et al ⁷	17.43 weeks	21.40 weeks
Mihir R Solanki et al ¹³	19.1 weeks	23.8 weeks
Kasper W et al ¹⁴	19 weeks	21 weeks
Present study	20.1±1.14 Weeks	24.1 ± 1.16 Weeks

- *Range of Movements*

Table 6 Range of Movements

Author	Average dorsiflexion (In degrees)		Average plantar flexion in degrees)	
	Interlocking	Plating	Interlocking	Plating
Mihir R Solan ki et al ¹³	12.6	9.6	32.4	25.0
Present study	12.8	9.7	31.6	24.7

- *Olerud & Molander Scoring ((p<0.05)- significant)*

Table 7 Olerud & Molander Scoring

Author	Nailing Group	Plating Group
Mihir R Solanki et al ¹³	88%	72%
GI et al ¹⁵	88.5%	88.2%
Present Study	86%	71%

Table 8 Olerud and Molander functional evaluation Score

Functional evaluation	Nailing Group	Plating Group
Excellent (99-100)	6	4
Good	12	11
Fair	2	5
Poor	0	0

- *Duration Of Fwb ((p<0.05)- significant)*

Table 9 Duration of Fwb

Author	Interlocking (weeks)	Plating (weeks)
Present study	13.7 ± 1.12	17.8 ± 0.94
Mayank Mahendra et al ⁵	14.13 ± 2.22	17.2 ± 2.1
DV Prasad et al ¹¹	10.09 ± 1.41	13.38 ± 1.24

- *Postop Complications (p>0.05)*

Table 10 Postop Complications

Author	Total Number of Complications
Krishan A et al ¹⁶	2
Ego KA et al ¹⁷	2
Present Study	2

IV. DISCUSSION

Distal tibia fractures are the most common significant lower extremity injuries. A high percentage of good results were obtained with accurate open reduction or closed reduction techniques with stable internal fixation by using AO principles and methods for fixation of distal tibia fractures. Since soft tissue and periosteum are commonly damaged in distal tibial fractures, large incisions could further increase this damage.

Though plate fixation achieves rigid fixation and has been widely used in past years, the technique requires extensive wound exposure and soft tissue dissection, which limits its clinical application.

With the advantage of minimally invasive, symmetric and dynamic fracture fixation, IM nailing is a better choice for the management of distal tibial fractures. The fact that extraosseous soft tissue could not provide sufficient blood supply, is one of the major factors which supposed to cause

delayed union or nonunion in the fractured bones. IM nailing treatment could benefit the distal tibial fracture for it preserves the integrity of the surrounding soft tissue and vascular supply, and thus promotes the biological bone healing. For this account, in the management of distal tibial fractures, IM nailing might possess the advantages of saving operative time, decreased blood loss as well as reducing the incidence of infections.

Biomechanically, even reamed IM nailing could not match well to the lenient medullary canal of the tibia metaphysis, and the lack of adequate purchase of locking screws is apt to result in the failure to gain or maintain the tibial alignment. This may contribute to the higher incidence of malunion with IM nailing than with plate.

In the management of distal tibial metaphyseal fracture, IM nailing is linked to many complications such as malreduction and malunion. Moreover, IM nailing is convinced to have a remarkable higher incidence of

malunion than percutaneous locked plate. Consistent with these results, our analysis showed that IM nailing achieved a significant higher incidence of malunion than plate.

V. CONCLUSION

Distal tibia fractures are a common consequence of RTA and injuries due to fall. Its management continues to be a problem still. IMIL Nailing has advantage of shortened operating time, early weight bearing (both partial and full), decreased wound problems, early fracture union, decreased implant related problems and overall reduced morbidity.

In osteosynthesis of displaced extra-articular lower tibia meta-diaphyseal fractures OTA/AO Type 42A- C (distal) & 43-A both modalities nailing as well as plating deserve a place.

However, in My study IMILN showed better outcome as it offers advantage in terms of mean operating time, less invasive surgery, hospital stay, partial & full weight-bearing time and union time.

➤ Declaration of Conflicting Interest

The authors declare that there is no conflict of interest

➤ Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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