

## Comparative Study of Minimally Invasive Plating Versus Nailing In Distal Tibia Metaphyseal Extrarticular Metaphyseal Fractures

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**Abstract:** Nailing and Plating by minimally invasive technique are two main techniques to treat distal tibia metaphyseal fracture without intrarticular extension. Which one is better is still a controversial and debatable topic due to variable results reported in literature.

**Aim:** To compare the functional and radiological outcomes in patients of distal metaphyseal fracture treated with intramedullary nailing versus anteromedial plating using locked plate by minimally invasive method.

**Methods:** A total of 40 patients were randomly allotted to either intramedullary nailing (Group A, n=20) or Plating Group (Group B, n=20) using random number generator. All patients were assessed clinically and radiologically in terms of malalignment, angulation and union on modified Klemm and Borner scoring system.

**Results:** Most common mode of injury was Road Traffic accident. Average time for union in group 1 was 22.6 months in Group A and 23 months in Group B. This difference was not significant. Malunion was more common in nailing group (15%) than MIPO group (0%). Infection rate was higher in plating group (10% vs 0%). Anterior knee pain was exclusively found in intramedullary nailing group (10%). All patients achieve satisfactory range of motion at ankle in both groups. Majority of patients in both groups had good to excellent functional outcome on modified Klemm and Borner scoring system.

**Conclusion:** Plating by minimally invasive system and Intramedullary nailing both are equally effective in treating extraarticular distal tibia metaphyseal fracture in terms of union and functional outcome using modified Klemm and Borner scoring system.

**Keywords:** Closed, Extraarticular, Locked plate, Klemm and Borner scoring system.

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### I. Introduction

Distal third of tibia fracture is prone to non-union since it is poorly surrounded by muscles which led to relatively less blood supply to this segment (comes from anterior tibial artery). Most common cause of these fractures are high velocity injury. High velocity injury results in more soft tissue injury compared to diaphyseal fractures. This is also a contributing factor towards non-union by further compromising the blood supply. Distal tibia metaphysis fracture is 10% of distal tibia fractures. (1) There are multiple options to treat these fractures like casting, intramedullary nailing, open reduction and plating and plating by minimally invasive plate osteosynthesis. Casting had various problems like prolonged immobilisation, non-union, stiffness and malunion. Classic open reduction and internal plate fixation had disadvantage of extensive soft tissue dissection and periosteal stripping leading to high rates of complications, including infection (range, 8.3%–23%) (2,3) and delayed union and nonunions (range, 8.3%–35%) (4,5,6,7,8)

MIPO (Minimal invasive plate osteosynthesis) is an attractive option to overcome the problem of open reduction and internal fixation by reducing the surgical trauma and maintaining the favourable environment several complications like but it also has complications of non-union (9,10) malunion (11) and implant failure (12) Intramedullary nailing has inherent advantage of preservation of periosteal blood supply and soft tissue envelope. But, the Intramedullary canal in distal tibia is hourglass shape which makes the fracture vulnerable to displacement while inserting the nail and, it also prevents endosteal tight fitting and compromises angular instability leading to high incidence of malunion. (13,14)

## **II. Materials And Methods**

This study was a prospective study conducted in department of orthopaedics, ESI Hospital Ludhiana, in a period of august 2014 to july 2017. All patients were made to understand in their local language and informed consent was obtained before randomizing. In our study a total of 44 patients were randomly allotted to either nailing group(Group 1) or plating group(Group 2) using random number generator. One patient from each group was lost to follow-up. so finally, 20 patients were studied in each group. Inclusion Criteria were skeletally mature persons between the age of 18-70 years, closed Extraarticular fracture involving distal metaphysis of tibia(AO types A1,A2 and A3), injury less than 3 weeks. Exclusion Criteria were skeletally immature patient, person older than 70 years, injury more than 3 weeks, open fracture, AO type B or C, malnutrition, systemic disease, peripheral vascular disease dermatological disease like psoriasis, and previous osteomyelitis, pregnant or nursing mothers, and patients on medications, such as corticosteroids, immunosuppressive agents or chemotherapy. After taking informed consent, all patients underwent detailed clinical and radiological examination along with all routine investigations. The initial radiographic evaluation includes anteroposterior(AP) and lateral radiographs of the ankle(Fig.-1). Fracture was classified with AO classification and CT was done in doubt of intraarticular extension. The preanaesthetic checkup was done.



**Fig.1-Distal Both Bone Leg Fracture(Extraarticular)**

Surgery was performed under regional anesthesia. All patients receive antibiotic prophylaxis. The part was prepped and draped. Tourniquet was inflated about double the systolic blood pressure after exsanguinating the limb. All the patient who underwent plate osteosynthesis operation were placed supine on radiolucent table. an incision is made over medial malleolus and plate is slide over medial malleolus. fracture was reduced with indirect reduction techniques and then plate was fixed with locking screws. The decision to fix the fibula was made at the surgeon's discretion. All the patient who underwent intramedullary nailing were also placed supine. patellar splitting approach was used nailing was done using standard techniques and nail was fixed 2 proximal and 2 distal screws. All patients were instructed to maintain strict elevation and performed range-of-motion exercises on knees and ankle several times per day. The suture was removed at 10-14 days. The patients

were followed up at 1month, 2 months,3 months, 6months 1 year and 2 year(Fig.-2).At each visit patients were assessed for healing of fracture by appearance of callus on anteroposterior and lateral views,malalignment and infection.Modified klemn and boring system was used to assess both functional and radiological outcomes.



**Fig.-2-Anteromedial Plating Of Distal Tibia With Fibular Plating And Lag Screw Fixation**

### III. Results

Union was defined as healing of at least 3 of 4 cortices on biplanar plain radiograph. Delayed union was defined as a lack of any bridging callus on plain radiograph within 3 months. Nonunion was defined as a lack of any healing on plain radiograph within 9 months and painless mobility at the fracture site. Malunion was defined as more than 5° of angular deformity or shortening of more than 1 cm.(15) There was no significant difference in preoperative evaluation between the two groups(age, sex ).Most common mode o injury in both group was road traffic accident. The fracture was united at 22.6 months in the Group 1 patients treated with nailing and at 23 months.3 patients(15%) in Group 1 had angular deformity >5 degrees.while only one patient had malunion in Group2.none of the patient in group 1 had infection while 2 (10%)of the patient in plating group 2 had sperficial infection.3 of the patient in group 2 had swelling postoperatively which responded to limb elevation and oral chymotrypsin administration.Anterior Knee pain was reported in 3 patients in group 1. Final outcome was measured on modified Klemn and Borner scoring system.Majority of patient in both group had excellent and good outcome.

Table1-Fracture Pattern		
Fracture classification(AO system)	Group 1	Group2
43 A1	13	8
43 A2	6	9
43 A3	1	3

A

Complications	Group 1	Group 2
Infections	0	2(10%)
Swelling	0	2
Angular deformity(>5 degrees)	3	0
Stiffness at ankle	0	0
Implant failure	0	0
Anterior Knee pain	3	0

Angulation >5degree	Group 1
10 degree	1
7degrees	1
8 degrees	1

	Group 1	Group 2
Excellent	8	7
Good	10	13
Fair	2	0
Poor	0	0

#### IV. Discussion

Minimally invasive plate technique has the inherent advantage of minimal iatrogenic injury to soft tissue and periosteum and preservation of hematoma(16,17)so,several studies have reported with low incidence of infection and non-union (10,11,18) but Francois et al reported malunion and hardware failure with ordinary plate.Locking plate has been described to overcome these problems.in these plates screws are fixed at the locked inthe plate at the fixed angle to the bone. Screw locking minimizes the compressive forces exerted by the plate on the bone and the system works as flexible elastic fixation so, it is also described as 'locked internal fixator'.The shape of plate matches with anatomical shape of the bone which allows better angular and axial stability(19,20) We therefore used locking plates in our study and compare its outcome with intramedullary nailing using various parameters like angulation deformity,infection, time to union ,modified Klemm and Borner Scoring System, and complications.

We did not found any difference in duration of union in both groups.Similar results have been reported by Jayesh et al. (21) We found that 2 patients in plating technique developed superficial infection in immediate postoperative period which responded to debridement and antibiotic administration guided by culture and sensitivity report.However, all of them heal eventually.Jayesh et al also reported higher rate of infection in patients treated with locked plate comparable to patients treated with nailing(25% vs 15%).However,natrajan et al reported higher rate of infection in nailing group(20%) compared to plating group(6%).(22) Malalignment is seen in 15% of patients in nailing group.Malunion of tibia is a well-known complication in distal tibia fractures and attributed to loose endosteal fitting of intramedullary nail in hourglass shape of canal. We could not find angulation deformity >5 degrees in plating group.Jayesh et al also reported higher angulation deformity in nailing group(10%) .Deebak et al reported significant rotational deformity in two cases in plating group.(23)

Anterior knee pain attributed to patellar splitting approach was reported only in nailing group(10%).This complication was found exclusively in Group 1 and attributed most likely to patellar splitting approach. This is a well known complication of nailing of tibia and has been reported by other researchers also(21) We evaluated the patient on modified Klemm and Borner Scoring System which includes Range of motion at ankle,muscle atrophy ,alignment,pain and time to union.We found 2 patients in nailig group had fair scoring and rest of the patients in both group had good to excellent results.Natrajan et al and deebak et al also used this score to evaluate the outcome and both study showed favourable outcome in both group. Olerud and Molander functional evaluation score is other scoring method to evaluate the outcome and used by some researchers.(21) Our study has several limitations.Firstly,our cohort was small.We only included closed fractures and type AO 43 A fractures and did not include intraarticular fractures which are difficult to treat.

#### V. Conclusion

We conclude that intramedullary interlocking nailing and plate osteosynthesis with locked plating by minimally invasive method are equally effective in achieving union with good functional outcome in closed extrarticular tibia fracture.However,intramedullary interlocking nail has higher rate of malalignment and complicated by anterior knee pain while plating has higher rate of infection and immediate postop complications like swelling.A large cohort is needed.

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