



Orthopaedics

COMPARISON OF FUNCTIONAL OUTCOME BETWEEN EXPERT TIBIA NAIL AND DISTAL TIBIAL MEDIAL LOCKING PLATE BY MIPPO TECHNIQUE FOR CLOSED EXTRA ARTICULAR DISTAL TIBIAL FRACTURE – A PROSPECTIVE STUDY

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(ABSTRACT) **Background:** Distal tibia fractures often result from road traffic accidents, falls from heights, or twisting injuries to the ankle. Managing these fractures is challenging due to the delicate blood supply in this area and its subcutaneous location, which complicates treatment. Internal fixation methods, including locking intramedullary nails and locking compression plates, are commonly employed for stabilizing distal tibia fractures. **Methods:** The study was undertaken among 40 patients in the department of orthopaedics, Government Medical College and Hospital, Amritsar from May 2022 to June 2024. Patients were allocated randomly into two groups. 20 of them were treated with ETN and rest 20 were treated with LCP by MIPPO technique. The patients were followed up for clinical and radiological evaluation. After six months, the final outcomes were assessed using the Olerud and Molander ankle scoring system, categorizing the results as excellent, good, fair, or poor. **Results:** Majority of the patients were males (80%). The mean age of patients was 45.5 $\pm$ 10.88 years and 43.3 $\pm$ 10.6 years in groups A and B respectively. Average time to operate was 66.25 $\pm$ 11.95 min in ETN group and 77.75 $\pm$ 13.20 min in LCP by MIPPO group showing significant difference ($p=0.006$). Average time for union was 17.82 $\pm$ 2.88 weeks in ETN compared to 21.45 $\pm$ 3.43 weeks in LCP which was significant ($p=0.001$). Complications like superficial infection, deep infection, non union, hardware failure were seen more in plating group, while malalignment, anterior knee pain were seen more in ETN. **Conclusion:** It was observed that the Expert tibia nail is superior in terms of allowing early full weight bearing, promoting quicker union, and reduced risk of complications. Consequently, it is considered a better choice of implant for patients undergoing treatment for extra-articular distal third tibia fractures.

KEYWORDS : Expert tibia nail, locking compression plate, MIPPO, extra-articular distal tibia fractures.

INTRODUCTION

Road side accidents are becoming epidemiologically one of the largest killers and the most dreadful enemy of human beings all over the world. Fracture, defined as a break in the continuity of a bone, is common sequel following accidents.¹

The goal of treatment of fracture is to achieve union of fracture in most compatible anatomical position with maximal and full restoration of the function of the extremity.²

Tibia is one of the principal load bearing bone in the lower extremity.

It is the most commonly fractured long bone in the body with an incidence of 2 per 1000 individuals annually. The anteromedial surface of the tibia is located subcutaneously due to which there can be severe bone and soft tissue injury and there is a high incidence of open fractures compared to other long bones.³

In contrast to the rest of appendicular skeleton, distal tibia has precarious blood supplies due to inadequate muscular envelope. The presence of hinge joints at knee and ankle, allows no adjustment for rotator deformity after union of fracture.⁴

Distal tibia fractures can be challenging to treat because of limited soft tissue, the subcutaneous location and precarious vascularity and proximity of ankle joint⁵⁻⁶

Fractures of distal tibia remain a controversial subject despite advances in both non-operative and operative care. The aim in treatment of distal tibia fracture is to realign the fracture, maintain limb length and alignment and achieve union in good anatomical position to achieve better functional outcome.

Distal tibia fractures generally require surgical intervention and can be managed through various methods, such as external fixation, or open reduction and internal fixation using plates or locking compression plates (LCP) with the minimally invasive percutaneous plate osteosynthesis (MIPPO) technique. Alternatively, intramedullary nailing may also be used.

The current focus is on achieving indirect reduction, maintaining axial

alignment, and ensuring stable fixation while minimizing disturbance to the fracture environment. This approach helps preserve the surrounding vascularization and fracture hematoma, which contain essential growth factors for bone healing.

Intramedullary nails have seen significant advancements in recent years. A shortened intramedullary nail has been developed for treating distal tibia fractures. This modification involves reducing the distal tip of a standard intramedullary tibia nail by 1 cm. The Expert Tibia Nail (ETN) is a new type of low, multidirectional locked intramedullary tibia nail. Its advanced interlocking system is designed to provide greater angular stability and improve both axial and lateral stability achieved through nail fixation.

This study is conducted to evaluate and compare the results of Expert Tibia Nail and LCP by MIPPO technique in treatment of distal tibial fractures in terms of rate of healing, functional outcome and complications.

MATERIAL AND METHODS:

This was a prospective and comparative study of 40 cases of fractures of distal tibia admitted in Department of Orthopaedics, Government Medical College, Amritsar between May 2022 to July 2024 after obtaining patients informed and written consent. Patients were divided into two groups by randomization, Group A (20 cases) treated with expert tibia nail and Group B (20 cases) treated with MIPPO technique using distal tibial medial locking compression plate.

Closed fractures involving the distal metaphysis-diaphyseal region (Extra-articular 4-9cms above the articular margin), belonging to AO type 43A1/A2/A3 in a skeletally mature individual (>18 yrs) were included in the study, while all compound fractures, pathological fractures, patients with comorbidities, fractures belonging to AO 43B/C, were excluded from the study. Patients were advised to follow up on 3rd, 6th, 12th, 16th, 20th week and final follow up at 6 months. At each followup patient was subjected to X-ray and functional evaluation with specific reference to evidence of union, any pain, range of motion especially at ankle and knee joint, mal-alignment if any, shattering and any other complications. Final Follow up wherever required was done at 9 months, and the fractures that did not unite at end of 9 months and were considered as non union and were taken as

complication. Results were analysed as per Olerud and Molander Ankle Scoring System (OMAS).

RESULTS:

Table 1: Duration Of Surgery

Duration of surgery	Group A (ETN)		Group B (DTLP by MIPPO)	
	No.	%age	No.	%age
<60 minutes	7	35.00	3	15.00
>60 minutes	13	65.00	17	85.00
Total	20	100.00	20	100.00
Mean duration of surgery (min)	66.25±11.95		77.75±13.20	
p-value	0.006			

The mean surgical duration was 66.25 ± 11.95 minutes in Group A and 77.75 ± 13.20 minutes in Group B, with a statistically significant difference observed between the groups (p = 0.006).

Table 2: Duration Of Hospital Stay

Hospital stay	Group A (ETN)		Group B (DTLP by MIPPO)	
	No.	%age	No.	%age
<7 days	15	75.00	13	65.00
>7 days	5	25.00	7	35.00
Total	20	100.00	20	100.00
Mean duration of hospital stay (days)	5.85±1.46		6.40±1.27	
p-value	0.212			

The mean duration of hospital stay was shorter in nailing group than that in plating group, although statistically not significant (p=0.212)

Table 3: Mean Time Of Union

Time of union (in weeks)	Group A (ETN)		Group B (DTLP by MIPPO)	
	No.	%age	No.	%age
12-16	9	45.00	2	10.00
16-20	7	35.00	8	40.00
>20	4	20.00	9	45.00
Total	20	100.00	19	95.00
Mean	17.82±2.88		21.45±3.43	
p-value	0.001			

The average time taken for fracture to unite was significantly shorter in Group A (ETN) than in Group B (DTLP by MIPPO) (p=0.001)

Table 4: Complications

Complications	Group A (ETN)		Group B (DTLP by MIPPO)	
	No.	No.	No.	No.
Superficial infection	3	4		
Deep infection	2	3		
Anterior knee pain	3	0		
Mal-alignment (varus)	3	2		
Delayed union	1	1		
Non union	0	1		
Implant failure	0	1		

Superficial infection, deep infection, non union, implant failure was more common in Group B while anterior knee pain, varus mal-alignment was more seen in Group A. But these observations were statistically not significant.

Table 5: Results According To Olerud And Molander Ankle Scoring System

Results at 24 weeks	Group A (ETN)		Group B (DTLP by MIPPO)	
	No.	%age	No.	%age
Excellent (91-100)	12	60.00	9	45.00
Good (61-90)	5	25.00	6	30.00
Fair (31-60)	2	10.00	3	15.00
Poor (0-30)	1	5.00	2	10.00
Total	20	100.00	20	100.00
Mean result	84.00±13.37		77.25±15.89	
p-value	0.154			

Mean Olerud-Molander Ankle score at final follow up for Group A was 84.00±13.37 and Group B was 77.25±15.89. There was higher no of patients in excellent category in Expert tibia nail group when compared to DTLP by MIPPO group but the results were statistically

not significant (p=0.154)

DISCUSSION:

Treating fractures in the distal tibia that are extra-articular poses significant challenges due to complexities in soft tissue condition, precarious blood supply and fracture comminution.

Intramedullary nailing (IMN) has long been superior to alternative techniques due to its early weight bearing and union rate as well as lower infection incidence. With the modification in nail designs, Expert tibia nail has emerged as a promising treatment option for extra-articular distal tibia fractures. Functional assessment becomes crucial for expanding the indication of an expert tibia nail to use in an extra-articular metaphyseal distal tibia fracture.

The rise of minimally invasive surgical methods has led to the growing popularity of percutaneous plating. This is primarily due to the locked plate designs, which act as fixed-angle devices. Their stability relies on axial and angular support at the screw-plate interface, rather than depending on frictional force between the plate and bone. This design is believed to help preserve the periosteal blood supply around the fracture site.

In the current study, we aimed to evaluate the functional and radiological outcome in adults in distal third tibial fractures fixed internally using either Expert tibia nail or distal tibia medial locking plate by MIPPO technique.

In our study we encountered more male patients in both nailing and plating groups (80%) owing to more involvement of men in travelling and occupation. Similar results were observed by studies done by Court Brown et al.⁷ and Hooper et al.⁸ Also the most common mode of injury in both the groups was road side accident. The mean age of patients in this study was 45.5±10.88 years and 43.3±10.6 years in groups A and B respectively, which was in accordance with the studies done by Bhaskar SK et al.⁹ Roshan raj KM et al.¹⁰ and Kumar YC et al.¹¹ which showed that the distal tibia fracture is more common in males in 40-60 years of age group.

Duration Of Surgery

The mean duration of surgery was 66.25±11.95 min in Group A and mean duration of surgery was 77.75±13.2 min in Group B which shows a significant difference. It is well in accordance with studies done by Bhaskar SK et al.,⁹ Pawar et al.,¹² Li Y et al.¹³

Table 6: Comparison Of Studies- Duration Of Surgery

	MEAN DURATION OF SURGERY (IN MINUTES)	
	Group A (ETN)	Group B (DTLP by MIPPO)
Li Y et al. ¹³	76.10	90.4
Pawar et al. ¹²	57.20	70.36
Roshan Raj KM et al. ¹⁰	72.19	98.13
Im GI et al. ¹⁴	89	72
Bhaskar SK et al. ⁹	61.76	74.63
Our Study	66.25	77.75

Time For Radiological Union

In our study, the mean time to achieve fracture union was 19.82 ± 2.88 weeks in the nailing group and 23.45 ± 3.43 weeks in the plating group. Fracture union occurred significantly faster with intramedullary expert tibia nailing compared to plating using the MIPPO technique. The results of our study were comparable with other studies.

Table 7: Comparison Of Studies- Radiological Union Time (in weeks)

	Mean time for radiological union (weeks)	
	Group A (ETN)	Group B (DTLP by MIPPO)
Li Y et al. ¹³	21.30	23.1
Pawar et al. ¹²	17.43	21.40
Roshan Raj KM et al. ¹⁰	19.25	24.13
Im GI et al. ¹⁴	20	18
Vallier HA et al. ¹⁵	22.6	27.8
Bhaskar SK et al. ⁹	18.46	22.46
Our Study	19.82	23.45

DURATION OF HOSPITAL STAY

Although the duration of hospital stay in our study was shorter in nailing group than in plating group, there was no significant difference between the two. This is in accordance with studies done by Yu J et al.¹⁶ and Sun M et al.¹⁷ where the duration of hospital stay in both the groups was comparable.

COMPLICATIONS

In the current study various complications were encountered which include superficial infection, deep infection, malunion, delayed union, non union, implant failure etc. Superficial and deep infection were seen more in plating group while mal-alignment mainly varus angulation was more in nailing group (15%) compared to plating group (10%). Anterior knee pain was also seen in nailing group probably due to wrong size of nail or patellar tendon splitting approach during nailing. 1 case each in both the groups which failed to unite at final follow up at 6 months was labeled as delayed union at 9th month follow up. 1 case in plating group didn't show signs of union even at 9 months and was declared as non union. Implant failure was seen in 1 case of plating group. P value was not found to be significant in all the above results. The above results are comparable to some other similar studies done by Pawar et al.¹² Bhaskar SK et al.¹⁹ Roshan Raj KM et al.¹⁰ Im GI et al.¹⁴

FINAL FUNCTIONAL ASSESSMENT

Final functional outcome was assessed using Olerud & Molander Ankle Scoring System. 24 weeks final analysis showed Excellent results in 60%, Good results in 25%, Fair results in 10% and Poor results in 5% of patients in Group A as compared to Excellent results in 45%, Good results in 30%, Fair results in 15% and Poor results in 10% of patients in Group B. the mean OMAS was 84.00 in Group A and 77.25 in Group B. The difference was statistically non-significant ($p=0.415$) The results of our study were consistent with that of a study done by Li Y et al.¹³ where the mean Olerud-Molander Ankle score was 89.0 ± 7.1 in Group A and 87.6 ± 8.4 in Group B ($p=0.478$).

CONCLUSION

Both techniques have proven to be reliable methods for treating distal metaphyseal extra-articular fractures of the tibia, preserving osseous vascularity and the fracture hematoma essential for biological repair. In our study, intramedullary nailing with the Expert Tibia Nail allowed for earlier weight-bearing and quicker union, coupled with a lower incidence of infection and failure, making it the preferred choice for fixing extra-articular distal tibial fractures. This approach offers robust mechanical and rotational stability, enhanced by its multidirectional distal locking capabilities.

We acknowledge that a larger sample size would have provided more accurate and statistically significant results and observations in this study. The limited number of patients, duration, and follow-up period were constraints due to time limitations. We believe that additional time is necessary for a thorough assessment of the final clinical and functional outcomes. A randomized controlled trial (RCT), involving a larger cohort and long-term follow-up, is essential to elucidate the differences between the two techniques conclusively.

Radiographs



Figure 1: Expert Tibia Nail



Figure 2 : DTLP by MIPPO

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