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A comparative study of functional and radiological outcome in the management of distal tibia fractures treated by intra medullary nailing and minimally invasive locking plate

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Abstract
Aim: To compare functional and radiological outcome in the management of distal tibia fractures treated by intra medullary nailing and minimally invasive locking plate.
Material and Method: This perspective observational study was undertaken in the Department of Orthopaedic Surgery of SRMS-IMS, Bareilly for a period of 18 months from November 2019 to April 2021 among patients with DISTAL TIBIAL FRACTURE. According to the hospital record, 30 patients of similar condition were treated by intra medullary nailing or minimally invasive locking plate last year. The study participants were split into two groups: those who received intramedullary interlock nailing (Group 1) and those who received a minimally invasive locking plate (Group 2). All patients who underwent intramedullary nailing or minimally invasive plating were evaluated using the American Orthopaedics Foot and Ankle Society score.
Results: Mean duration of surgery (in min) was 64.19±7.91 and 72.36±6.23 in group 1 and 2 respectively. After 6 months, excellent radiological union was revealed among 50% and 56.25% of the subjects in group 1 and 2 respectively. When AOFAS score was compared using chi square test among group 1 and group 2 at 3 and 6 months, it was found to be statistically insignificant as $p>0.05$ in our study.
Conclusion: Intramedullary nailing in distal tibial fractures allows for early mobilisation and is a simpler, less expensive and less complication-prone procedure. In cases where the fracture is very close to the ankle mortise and is associated with a greater rate of wound complications, plating is preferred.

Keywords: Radiological outcome, distal tibia fractures, intra medullary nailing and minimally invasive locking plate

1. Introduction
The tibia is one of the most commonly fractured long bones in the body. Distal tibia fractures are typically found inside a square dependent on the breadth of the distal tibia [1]. Based on the location of the fracture in the bone, distal tibia fractures have the second highest incidence of all tibia fractures after intermediate tibia fractures [2, 3]. Because the tibia is the largest bone in the body and one of the principal load-bearing bones in the lower extremity, fractures can cause long-term morbidity and disability if not adequately treated. Infection and nonunion are more frequent since it is a subcutaneous bone [4].
Distal tibia fractures remain one of the most difficult to treat [5, 6] due to the high risk of complications. In fractures of the distal section of the tibia, the metaphyseal flare is affected, resulting in decreased implant contact, poorer stability and increased mal-alignment. In modern orthopaedic practice, minimally invasive plating osteosynthesis (MIPO) and interlocking nailing are the preferred therapies for distal tibia fractures [7].
Intramedullary nailing should be used to treat the majority of closed lower third tibia and middle and lower third junction fractures [8], as well as open fractures with appropriate soft tissue cover when the fracture does not extend into the lower 4 cm of the tibia from the ankle joint [9, 10]. A number of minimally invasive plate osteosynthesis methods have been

developed, with union rates ranging from 80% to 100%. These methods aim to reduce surgical trauma while also creating a more physiologically favourable fracture healing environment. Minimally invasive plate osteosynthesis with locking plates is recommended in situations of displaced, unstable fractures of the distal part of the tibia. The best indications for plating are fractures within 3 cm of the ankle joint, with or without articular involvement, especially when the skin envelop is good and the patient can afford [10].

IMN, on the other hand, has been shown to be superior to plate treatment in several studies. IMN has been found to be a viable alternative to plate osteosynthesis in the treatment of distal tibial fractures, for example. In addition, when the percutaneous locking plate and the IMN are compared, the IMN is found to be more advantageous in terms of reducing the need for additional treatments. Despite the fact that it is preferred, IMILN has been related to fixation instability and a considerable risk of infection in the ankle joint. It could also not be properly positioned in the tibia metaphysis fracture [11]. Overall, there is no clear consensus on the most advantageous method. As a result, we decided to conduct this prospective study in order to provide more comprehensive and reliable assessments of the two therapy approaches.

Material and Method: After receiving approval from the Hospital Ethics Committee, the current prospective observational study was undertaken in the Department of Orthopaedic Surgery of SRMS-IMS, Bareilly for a period of 18 months from November 2019 to April 2021 among patients with DISTAL TIBIAL FRACTURE. Before enrolling participants in the trial, they had to sign a written informed consent form. According to the hospital record, 30 patients of similar condition were treated by intra medullary nailing or minimally invasive locking plate last year, despite the fact that no study on similar criteria has been published to my knowledge with a one-year study duration. As a result, a sample size of 30 was chosen. The study participants were split into two groups: those who received intramedullary interlock nailing and those who received a minimally invasive locking plate.

All skeletally mature patients with closed and open gustilo anderson type 1 and type 2 distal tibia fractures treated with intramedullary nailing or a minimally invasive locking plate were included in the study. Subjects with fracture of middle 1/3 and proximal 1/3 region of tibia, skeletally immature individuals or individuals less than 18 years of age, unfit for the surgery due to other co-morbidities, Gustilo-anderson type III open fractures and intra-articular and pathological fractures and any other associated fracture except for ipsilateral fibula were excluded from the study.

Pre-operative regimen: The patients were resuscitated at the emergency room, and a thorough examination for other injuries was performed. The involved limbs were evaluated neurologically and vascularly. According to the first assessment and injuries to the patient, wound lavage, dressing and splintage were performed. Analgesics, antibiotics and intravenous fluids were given according to procedure and tetanus prophylaxis was provided as needed. The basic parameters of the blood were assessed. Antibiotic cover was given for closed fractures, both gramme positive and gramme negative. Patients with open fractures were given anaerobic antibiotic cover in addition to the antibiotics listed above. After initial resuscitation, stability of vital indicators and pre-anaesthetic check-up and clearance, the patients were brought to surgery.

A post-operative X-ray was taken to ensure that the fracture pieces were properly reduced and fixed. Ankle mobilisation began on the second or third postoperative day, depending on the patients' tolerance and any concomitant injuries. Antibiotics (intravenous and oral) were given till the wound state required it. Weight bearing was gradually authorised based on the callous formation as determined by follow-up X-rays. Patients were followed up on a regular basis in the OPD, with X-rays and functional assessments. All long-term problems were recorded[25], including non-union, malunion, angular deformity, implant fracture, shortening, and infection.

All patients who underwent intramedullary nailing or minimally invasive plating were evaluated using the American Orthopaedics Foot and Ankle Society score, and both groups were followed up on at 2 weeks, 4 weeks, 3 months, and 6 months. At 2 weeks, 4 weeks, 3 months and 6 months after surgery, X-Rays of the knee and leg with ankle AP and Lateral views were taken.

Statistical analysis: Under the supervision of a statistician, the data was tallied in an excel sheet. For statistical analysis, the means and standard deviations of the measurements per group were employed (SPSS 22.00 for windows; SPSS Inc., Chicago, USA). The chi square test was used to measure the difference between two groups, and the level of significance was chosen at $p<0.05$.

Results: Male were comparatively more as compared to females in both the study groups. Maximum subjects were from the age group of 31-40 years in group 1 (37.5%) as well as group 2 (37.5%) while minimum subjects were from the age group of >60 years in both the groups (table 1). Most common mode of injury was road traffic accident, reported among 50% and 75% of the subjects in group 1 and 2 respectively. Fall from height was revealed among 25% and 12.5% of the subjects in group 1 and 2 respectively. Right and left side involvement was found among 37.5% and 62.5% of the subjects in group 1 and 2 respectively.

Table 1: Gender and age distribution among the study groups

Gender	Group			
	Group 1 (Intramedullary Interlock Nailing)		Group 2 (Minimally Invasive Locking Plate)	
	N	%	N	%
Male	6	75	10	62.5
Female	2	25	6	37.5
Age Group (in years)				
18-30	2	25	4	25
31-40	3	37.5	6	37.5
41-50	1	12.5	3	18.75
51-60	1	12.5	2	12.5
>60	1	12.5	1	6.25
Total	8	100	16	100

In 62.5% group 1 subjects, surgery was done within 60-70 min while in 56.25% group 2 subjects, surgery was done within 71-80 min. Mean duration of surgery (in min) was 64.19±7.91 and 72.36±6.23in group 1 and 2 respectively. When mean duration of surgery was compared using t test among group 1 and group 2, it was found to be statistically significant as $p<0.05$ (table 2).

Table 2: Comparison of duration of surgery among the study groups

Duration of Surgery	Group				Chi Square	p value
	Group 1		Group 2			
	N	%	N	%		
60-70 Min	5	62.5	5	31.25	2.39	0.30
71-80 Min	2	25	9	56.25		
81-90 Min	1	12.5	2	12.5		
					t test	p value
Mean ± SD	64.19±7.91		72.36±6.23		3.62	0.031*

*: statistically significant

At 4 weeks, good outcome was noted more in group 2 with statistically insignificant difference as p>0.05. At 3 months; excellent, good, fair and poor outcome was found among 37.5%, 37.5%, 12.5%, 12.5% and 37.5%, 43.75%, 12.5%, 6.25% of the subjects in group 1 and 2 respectively. At 3 months; excellent, good and fair outcome was found among 50%, 37.5%, 12.5% and 56.25%, 37.5%, 6.25% of the subjects in group 1 and 2 respectively. When AOFAS score was compared using chi square test among group 1 and group 2 at 3 and 6 months, it was found to be statistically insignificant as p>0.05 (table 3).

Table 3: AOFAS score among the study groups at different intervals

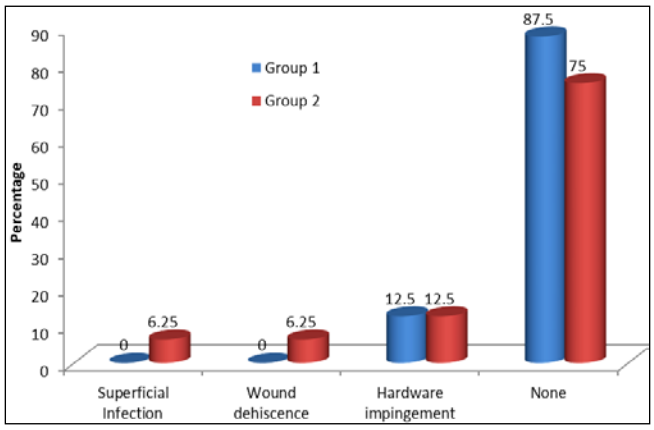
Outcome at 2 Weeks	Group				Chi Square	p value
	Group 1		Group 2			
	N	%	N	%		
Excellent	0	0	0		2.07	0.43
Good	1	12.5	3	18.75		
Fair	3	37.5	9	56.25		
Poor	4	50	4	25		
Outcome at 4 Weeks						
Excellent	0	0	0	0	3.57	0.22
Good	2	25	7	43.75		
Fair	4	50	7	43.75		
Poor	2	25	2	12.5		
Outcome at 3 Months						
Excellent	3	37.5	6	37.5	0.78	0.59
Good	3	37.5	7	43.75		
Fair	1	12.5	2	12.5		
Poor	1	12.5	1	6.25		
Outcome at 6 Months						
Excellent	4	50	9	56.25	0.92	0.52
Good	3	37.5	6	37.5		
Fair	1	12.5	1	6.25		
Poor	0	0	0	0		

Good-excellent radiological union at 3 months was found among 75% of the subjects in group 1 while in group 2, the same was reported among 81.25% of the subjects after 3 months of surgery. After 6 months, excellent radiological union was revealed among 50% and 56.25% of the subjects in group 1 and 2 respectively. When radiological union was compared using chi square test among group 1 and group 2, it was found to be statistically insignificant as p>0.05 (table 4).

Table 4: Radiological union among the study groups at different intervals

Time Interval	Group				Chi Square	p value
	Group 1		Group 2			
	N	%	N	%		
2 Weeks	0	0	0	0	2.39	0.45
4 Weeks	0	0	0	0		
3 Month	6	75	13	81.25		
6 Month	2	25	3	18.75		

Hardware impingement was found in 12.5% of the subjects in group 1 as well as 2 respectively. Superficial infection and wound dehiscence was revealed in 6.25% each of the subjects in group 2 (graph 1).



Graph 1: Complications among the study groups

Discussion

Road traffic accidents and fall injuries frequently result in distal tibia fractures. Its administration is still a challenge, with a number of unsolved questions. The distal tibia has low soft tissue cover, poor vascularity and is located in close proximity to the ankle joint, which is unusual in comparison to other body parts. Intramedullary nails, locking plates and external fixation are the most common surgical techniques for treating distal tibial fractures today. When the soft tissue circumstances allow it, IMN and plate LP are the most widely employed final treatments for DTF [12].

The current study was conducted over an 18-month period in the Department of Orthopaedic Surgery at SRMS-IMS, Bareilly, on 30 patients who had a distal tibial fracture and were treated with either intramedullary nailing or a minimally invasive locking plate. As a result, a sample size of 30 was chosen. The study participants were split into two groups: those who received intramedullary interlock nailing and those who received a minimally invasive locking plate.

In both study groups, males were disproportionately more than females. In both groups, the maximum subjects were from the age range of 31-40 years (37.5%), Male participation in our study was likely related to more outside activities and harder labour performed by guys in the Indian setting compared to females. In their study, Deepak Kumar *et al.* [13], RK Jain *et al.* [14] and Madhuchandra R *et al.* [15] discovered a similar gender and age distribution.

Surgery was completed in 60-70 minutes in 62.5 percent of group 1 subjects and 71-80 minutes in 56.25 percent of group 2 subjects. When the mean surgical length between groups 1 and 2 was examined using a t test, it was determined to be statistically significant at $p<0.05$. In their investigation, Enrico Vaienti *et al.* [12] discovered that patients treated with LP had a statistically significant longer operational time and a longer hospital stay. Jain *et al.* [14] discovered that the average surgery time in the interlocking group was 68 minutes and the average surgery time in the plating group was 75 minutes, which is similar to our findings. In their study, Madhuchandra R *et al.* [15] found that the average operation time for MIPPO was 60.8 minutes and for intramedullary nailing was 64.2 minutes. Our findings differed from those of Kumar *et al.* [13], who found that the operating time in the intramedullary nailing group was 57.14 minutes, whereas the plating group was 66.67 minutes. The variance in operation time could be

related to differences in the beginning point from which the time is recorded.

At 4 weeks, good outcome was noted more in group 2 with statistically insignificant difference as p>0.05. At 3 months; excellent, good, fair and poor outcome was found among 37.5%, 37.5%, 12.5%, 12.5% and 37.5%, 43.75%, 12.5%, 6.25% of the subjects in group 1 and 2 respectively. At 3 months; excellent, good and fair outcome was found among 50%, 37.5%, 12.5% and 56.25%, 37.5%, 6.25% of the subjects in group 1 and 2 respectively. When AOFAS score was compared using chi square test among group 1 and group 2 at 3 and 6 months, it was found to be statistically insignificant as p>0.05 in our study.

Seven randomised clinical trials comparing nail versus plate fixation for this injury were found in a systematic review of the literature. In two trials, there was no difference in functional scores, but there was a difference in wound complications, with the plate group having higher infections. However, instead of the modern fixed-angle locking systems, both of these studies used normal non-locking plates. The authors found no change in the time to union on radiographs in the third study, however more than 20% of the patients were lost to follow-up. The Foot Function Index did not differ in a fourth experiment, however only 25 patients were participated in total. The results of external fixation with both LP and IMN were compared in the fifth and sixth investigations and it was concluded that all three surgical treatments were effective for treating distal tibia fractures, but their complication profiles were different [12].

After 3 months of surgery, 75 percent of the subjects in group 1 had radiological union, whereas after 3 months of surgery, 81.25 percent of the subjects in group 2 had radiological union. After 6 months, 25 percent and 18.75 percent of the participants in groups 1 and 2 had radiological union, respectively with statistically insignificant difference in our study (p>0.05).The mean union time in the RK Jain *et al.* [14] study was 14.2 weeks in the nailing group and 18.1 weeks in the plate osteosynthesis group of patients. According to Deepak Kumar *et al.* [13], patients who had nailing had a mean healing time of 24.9 weeks, whereas patients treated with plate osteosynthesis by MIPO technique had a mean healing time of 24.2 weeks. According to Natarajan *et al.* [16], the average period of radiological union was 24.2 weeks for the plating group and 24.9 weeks for the nailing group in their study. The mean union times in Tzeng *et al.* [17] investigation were 22.6 weeks in the nailing group and 27.8 weeks in the plating group.

Hardware impingement was identified in 12.5 percent of the individuals in groups 1 and 2, respectively, in our investigation. In group 2, 6.25 percent of the participants had a superficial infection and wound dehiscence in our study. In conclusion, prior studies have shown that different types of fixation for patients with a distal tibia fracture may have distinct complication profiles, but no difference in functional outcomes. Specifically, nailing has been linked to malalignment and knee discomfort, whereas tibial plating has been linked to infections, wound problems and implant prominence [18]. According to the RK Jain *et al.* [14] study, plate osteosynthesis patients experienced the most problems, which included superficial infection and hardware impingement in two patients each, as well as wound dehiscence in one patient. In one example, a patient who had interlocking nail surgery experienced hardware impingement.

There are several limitations of present study:

1) The sample size was small.
2) It was a single-centre investigation.
3) A randomized controlled trial with a larger sample size and longer follow-up would be persuasive.

Conclusion

When it comes to union rates and eventual functional outcome, minimally invasive technique and intramedullary interlocking nailing are almost equally effective methods of stabilisation for distal tibia fractures. Intramedullary nailing in distal tibial fractures allows for early mobilisation and is a simpler, less expensive and less complication-prone procedure. In cases where the fracture is very close to the ankle mortise and is associated with a greater rate of wound complications, plating is preferred. Patients who underwent minimally invasive locking plate surgery had a lengthier operational time, hospital stay, and recovery time. Tibia plating can accomplish anatomic reduction, but the inadequate soft tissue cover over the anteromedial tibia increases the risk of wound dehiscence and infection. The above-mentioned parameters, as well as the pattern of fracture and the state of soft tissues, must all be taken into account while selecting the proper surgical treatment. There were no predictors of an unfavourable outcome found.

References

1. Gray's Anatomy, 40th Edition, The anatomical basis of clinical practice 2008.
2. Court-Brown CM, MC Birnie J. The epidemiology of tibia fractures, J Bone Joint Surg. 1995; 77B:417-421.
3. Pawar ED, Agrawal SR, Patil AW, Choudhary S, Asadi G. A comparative study of intramedullary interlocking nail and locking plate fixation in the management of extra articular distal tibial fractures. Journal of Evolution of Medical and Dental Sciences. 2014; 3(24):6812-27.
4. Chandra CP, Rao KC, Reddy AK, Srinivas B. A study on internal fixation of compound fractures of tibia using interlocking nail without reaming. Journal of Evolution of Medical and Dental Sciences. 2016; 5(45):2797-801.
5. Reudi T, Matter P, Allgower M *et al.* Intra-articular fractures of the distal tibial end. Helv Chir Acta 1968;35:556-582.
6. Reudi TP, Allgower M. The operative treatment of intra-articular fractures of the lower end of the tibia. Clin. Orthop Relat Ras 1979;138:105-110.
7. Paluvadi SV, Lal H, Mittal D, Vidyarthi K. Management of fractures of the distal third tibia by minimally invasive plate osteosynthesis-A prospective series of 50 patients. Journal of clinical orthopaedics and trauma 2014;5(3):129-36.
8. Robinson CM, McLauchlan GJ, McLean IP, Court-Brown CM. Distal metaphyseal fractures of the tibia with minimal involvement of the ankle: classification and treatment by locked intramedullary nailing. J Bone Joint Surg Br 1995;77(5):781-787.
9. Gorczyca JT, McKale J, Pugh K, Pienkowski D. Modified tibial nails for treating distal tibia fractures. J Orthop Trauma 2002;16(1):18-22.
10. Gawali SR, Kukale SB, Nirvane PV, Toshniwal RO. Management of Fractures of Distal third Tibia by Interlock Nailing. J Foot Ankle Surg (Asia-Pacific) 2016;3(1):15-22.
11. Yu J, Li L, Wang T, Sheng L, Huo Y, Yin Z *et al.* Intramedullary nail versus plate treatments for distal tibial

fractures: a meta-analysis. International Journal of Surgery 2015;16:60-8.
12. Vaienti E, Schiavi P, Ceccarelli F, Pogliacomi F. Treatment of distal tibial fractures: prospective comparative study evaluating two surgical procedures with investigation for predictive factors of unfavourable outcome. International orthopaedics 2019;43(1):201-7.
13. Kumar D, Ram GG, Vijayaraghavan PV. Minimally invasive plate versus intramedullary interlocking nailing in distal third tibia fractures. IOSR J Dent Med Sci 2014;13(3):15-7.
14. Jain RK. Comparative study between intramedullary nailing and plating for extra articular distal tibia fractures. National Journal of Clinical Orthopaedics 2020;4(1):01-05.
15. Madhuchandra R, Mudgal C, Sandeep *et al*. Outcome of distal tibia fracture by nail or plate (MIPPO)-A comparative study. J. Evid. Based Med. Healthc 2017;4(14):837-841.
16. Natarajan GB, Srinivasan DK, Vijayaraghavan PV. Comparison of clinical, radiological, and functional outcome of closed fracture of distal third tibia treated with nailing and plate osteosynthesis. African Journal of Trauma 2014;3(2):68.
17. Yang SW, Tzeng HM, Chou YJ, Teng HP, Liu HH, Wong CY. Treatment of distal tibial metaphyseal fractures: plating versus shortened intramedullary nailing. Injury 2006;37(6):531-5.
18. Costa ML, Achten J, Griffin J, Petrou S *et al*. Effect of locking plate fixation vs intramedullary nail fixation on 6-month disability among adults with displaced fracture of the distal tibia: the UK Fix DT randomized clinical trial. JAMA 2017;318:1767-1776.