International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2017; 3(2): 86-89

www.orthopaper.com
Received: 16-02-2017
Accepted: 17-03-2017

Mihir R Solanki
Junior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences University, Karad, Maharashtra, India

Sandip R Patil
Associate Professor, Department of Orthopaedics, Krishna Institute of Medical Sciences University, Karad, Maharashtra, India

Gaurang C Chanchpara
Junior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences University, Karad, Maharashtra, India

Prashant L Alwani
Junior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences University, Karad, Maharashtra, India

Jayesh B Pawar
Junior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences University, Karad, Maharashtra, India

Correspondence
Mihir R Solanki
Junior Resident, Department of Orthopaedics, Krishna Institute of Medical Sciences University, Karad, Karad, Maharashtra, India

A comparative study of plating versus nailing in distal tibia metaphyseal fractures

Mihir R Solanki, Sandip R Patil, Gaurang C Chanchpara, Prashant L Alwani and Jayesh B Pawar

DOI: http://dx.doi.org/10.22271/ortho.2017.v3.i2b.16

Abstract
Background: Distal tibia fractures continue to be one of the most controversial fractures that we treat. The best option for surgical treatment of distal tibia fractures is still unclear. Aim of treating such fracture is to produce a stable construct which allows early mobilisation and weight-bearing, but with minimal complications.
Material and methods: We studied 50 patients with distal tibia fractures within two Muller squares of ankle joint. 25 each treated with Intramedullary Interlocking nail (Nailing group) and distal tibia locking plate (Plating group). The study was prospective and comparative for the methods used for management of fracture. Outcomes in terms of union, time to full weight bear, alignment, infection, secondary procedure required and functional outcome at one year follow up were measured and compared.
Results: Age range of patients was 18-75 years. Most common mode of trauma in both groups was road traffic accident (60%) followed by domestic accidents (40%). Time after which full weight bearing was started were significantly shorter in Nailing group (p=0.001). The average time for union was 19.1 weeks (19-22 weeks) in Nailing group and 23.8 weeks for Plating group (22-30 weeks), (p=0.001). Average dorsiflexion at the final follow-up in nailing group was 12.6 degrees and 9.6 degrees in plating group (p=0.025). Average plantar flexion at the final follow-up in nailing group was 32.4 degrees and 25.0 degrees in plating group (p=0.001). Infection was found in 28% of patients in plating group with 12% of patients undergoing secondary surgical procedure. Mal-alignment was found in 4% of patients in Nailing group. The mean functional score in nailing group was found to be better as compared to plating group.
Conclusion: We conclude that intra-medullary interlocking nail is a reliable and satisfactory method for the treatment of 43 A type distal tibia fractures with good functional results and high union rates with comparatively low complications.

Keywords: Muller square, distal tibia fracture, intramedullary interlocking nail, distal tibia locking plate

Introduction
The management of distal tibia fractures is controversial and has been debated among the orthopaedic surgeons from the world over. Distal tibia fractures are common but often difficult to treat. The subcutaneous location of the antero-medial surface of the tibia means that severe bone and soft tissue injury is not infrequent.
Distal tibia fractures continue to be one of the most controversial fractures that we treat. Most of the controversy resides in the treatment techniques regarding the choice of implants, as the indication for surgery is fairly clear. Fractures of the tibia traditionally have been treated with closed reduction and cast. Since the late 1950s, open reduction and internal fixation (ORIF) was reserved for situations in which an adequate reduction could not be obtained or maintained by conservative means. Excessive tissue dissection and tissue devitalisation is frequent during ORIF, which creates problems in wound healing and ultimately leading to infection. As a result, other less invasive methods were developed to treat fractures of the distal tibia [1].
A shorter period of disability and early return to routine activates, with a shorter time to union can be obtained by accurate closed intramedullary (IM) nailing compared to patients managed by closed reduction and fixation with a cast [2, 3]. IM nail designs has been greatly improved in recent years and indications for their use have been extended to fractures closer to the ankle joint [4, 5].

Conventional techniques of plating involve extensive dissection and periosteal stripping which increases the risk of soft tissue complication.

The purpose of this prospective study was to compare the radiographic and clinical results of patients with extra-articular closed distal third of the tibial shaft fracture, treated with distal tibia locking plate with those treated by IM nailing and assess the complications in both the treatment modalities.

Material and methods

We managed 50 patients with a fracture of the distal tibia with or without fibula fracture from May 2014 to May 2016. The criteria for inclusion in the study were patients with extra articular distal tibia fractures, patients aged 18 years and above and patients having a closed or type I (Gustillo and Anderson) open fracture. Those patients having distal tibia fractures with intra-articular extension, previous fracture of tibia on same side and patients with pathological fracture were excluded from the study. Trauma radiographs were used to determine the location and AO classification of the fractures of distal tibia [6]. The distal tibia was defined as the area with in two Muller squares [7] of the ankle joint, in which the proximal and the distal segments of long bones are defined by square whose sides have the same length as the widest part of the epiphysis.

In this prospective study, eligible patients were randomly divided into two groups. Nailing Group included patients managed with closed reduction and reamed IM nailing and Plating Group included patients treated by distal tibia medial locking plate by minimally invasive method. Twenty five patients were randomly allocated to each group with the help of computer generated random numbers. The study was conducted after obtaining approval from the institutional ethics committee.

History was documented regarding mode of injury, time of injury, personal history and other relevant history. All patients were immobilized in an above knee plaster splint after being diagnosed with distal tibia fracture. Pre-operative evaluation of the patients was done and consent for surgery was taken from each of the patients.

Postoperatively, limbs were immobilized in plaster splint in all the cases for two weeks till soft tissue oedema was settled. Static quadriceps exercises were allowed within slab. After two weeks plaster was removed and patients were instructed strict non- weight bearing walking with crutch or walker. At the end of six weeks the progress of healing was assessed by obtaining radiographs and weight bearing was initiated after signs of callus were visible on radiographs.

Patients were followed up at 6, 12, 18 and 24 weeks and then every three monthly till one year. Delayed union was defined as radiographic union >24 weeks. Mal-alignment was defined as >5° varus/valgus deformity, >5° ante-/recurvation or >15° rotation.

Functional outcome was assessed by Olerud and Molander functional evaluation score[8] (% of normal). Angulation was measured by Radi-ant Dicom viewer software. Statistical analysis were performed using SPSS 16.0 software package with the use of un-paired *t* test to compare differences between the two groups with regard to mean age, time to weight bear and time to union.

Follow ups took place at six weeks and 3, 5, 7, 9 and 12 months after surgery with clinical and radiological examination.

Results

A total of 50 patients were included in this study, 25 patients were operated with IM interlocking nail (Nailing group) and 25 operated with distal tibia locking plate (Plating group).

1. **Age distribution:** A majority of the patients, 26 (52%) included in the study, were in the age group 36-55 years; 14 (28%) patients were in the age group of 18-35 years and 10 (20%) were in the age group of 56-75 years (Table 1).
2. **Sex distribution:** Out of the total 50 patient, 39 (78%) were male and 11 (22%) were female.
3. **Mode of injury:** Thirty patients (60%) had distal tibia fracture due to road traffic accident and 20 patients (40%) had distal tibia fracture due to domestic accident (Table 2).
4. **Type of fracture:** Out of 50 patients, 18 patients (36%) had AO/OTA 43A1 type fracture, 21 patients (42%) had 43A2 type fracture and 11 patients (22%) had 43A3 type fracture of distal tibia (Table 3).
5. **Associated fibula fracture:** Twenty nine (58%) patients had associated fibula fracture along with distal tibia fracture while in the remaining 21 (42%) patients, fibula was intact. Both the groups did not differ significantly with regard to the age group of patients, sex distribution, mode of injury, type of fracture or associated fibula fracture.
6. **Time to full weight bear:** The average time after which patients could be allowed to bear full weight on the operated limb was 14.2 ± 1.12 (range, 13-17 weeks) weeks in nailing group and 17.3 ± 0.94 (range, 16-19 weeks) weeks in plating group. The patients in the nailing group were able to bear weight on the operated limb in a significantly shorter time (P value 0.001).
7. **Time to union:** The average time taken for radiological union in the nailing group was 19.1 ± 1.14 (range, 18-22 weeks) weeks and in the plating group it was 23.8 ± 1.16 (range, 22-30 weeks) weeks. Thus, union occurred significantly earlier in the nailing group (P value 0.001). Five patients from the plating group had delayed union.
8. **Ankle range of motion:** In this study, a significantly better range of ankle motion was noticed in the nailing group as compared that in the plating group. Average dorsiflexion at the final follow-up (12 months) was 12.6 degrees and 9.6 degrees in the nailing group and the plating group respectively (P value 0.025) and the average plantar flexion at the final follow-up in was 32.4 degrees and 25.0 degrees the respective group (P value 0.001).
9. **Functional outcome:** The mean Olerud and Molander functional score at the end of 1 year was higher for the nailing group (83.4) as compared to that for the plating group (74.4). Both the groups had good outcomes with slightly better outcome in nailing group, though not significantly different (Table 4).
10. **Complications:** The only post-operative complication encountered in the study was infection. We found deep infection at the operative site in 7 patients (14%), all in the plating group. None of the patient from the nailing group had infection.
11. **Secondary procedures:** In this study, 1 patient required vacuum assisted closure of wound, 1 patient required flap surgery and 1 patient required fibula plate removal due to persistent wound problems. All three patients belonged to the plating group.

Table 1: Age distribution of patients

Age group	Nailing group	Plating group
18-35	6	8
36-55	13	13
56-75	6	4

Table 2: Mode of injury

Mode of trauma	Nailing Group	Plating Group
Road traffic accident	16	14
Fall at home	8	9
Staircase injury	1	3

Table 3: Morphology of fractures AO type

AO type	Nailing Group	Plating Group
43 A1	13	15
43 A2	9	12
43 A3	3	8

Table 4: Outcome of patients in both groups

Outcome	Nailing Group	Plating Group
Ankle range of motion (degree)		
Dorsiflexion	12.6	9.6
Plantar flexion	32.4	25.0
Functional evaluation*		
Excellent (91-100)	7	4
Good (61-90)	15	14
Fair (31-60)	3	7
Poor (0-30)	0	0

*Olerud and Molander functional evaluation score;
Figure in parenthesis indicate range

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.

All the cases in this study, from both groups were comparable with regards to age, sex and fracture types. Mean age of cases was 46 years in nailing group compared to 43 years in the plating group. Most common mode of trauma in both groups was road traffic accident (60% cases) and the rest had fractures resulting from domestic accidents. This is similar to study conducted by Mohammed A *et al*. [9] in which mean age of cases was 42 years with male to female ratio 4:1 and most common mode of trauma was road traffic accidents.

Average time after which patient was allowed full weight bear on the operated limb was 14.2 weeks in nailing group and 17.3 weeks in plating group, (p value 0.001). The cases in nailing group were able to bear weight on the operated limb in a significantly earlier time and able to perform independent activities at earlier time compared to plating group. Jayesh V *et al*. [10] in their prospective study had a similar result where time to full weight bearing was significantly earlier in IM nailing group.

Average time taken for radiological union in nailing group was 19.1 weeks and in plating group it was 23.8 with a highly significant statistical difference (p value 0.001). Thus, union occurred earlier in nailing group in this study. In a similar study by Kasper W *et al*. [11] it was observed that the mean time to radiographic union was 21 weeks for the ORIF group versus 19 weeks for the IM nailing group.

All the patients in the nailing group had primary bone union. Out of the 50 patients, five patients (10%) in the plating had delayed union. We did not have any case of non-union. In a similar study, Kasper W *et al*. [11] observed 2 cases (16.7%) of delayed union with ORIF group.

The only post-operative complication we encountered in our study was infection. We found deep infection at the operative site in seven patients (14%) in the plating group. None of the patients in the nailing group had operative site infection. Krzysztof Piątkowski *et al*. [12] in their study of 45 patients observed late infection reaching the metal implant that required admission and treatment at the septic ward in five patients (11.1%).

In our study, better range of ankle motion was noticed in the nailing group as compared with that in the plating group. Average dorsiflexion at the final follow-up in the nailing group (12.6 degrees) was significantly higher compared to that (9.6 degrees) in the plating group, (P value 0.025). Similarly, average plantar flexion at the final follow-up in the nailing group (32.4 degrees) was significantly more than (25.0 degrees) in the plating group, (P value 0.001). Significantly, lower mean range of dorsiflexion and plantar flexion observed in the plating group could be attributed to stripping of the muscles and tendons during open reduction in those patients in which reduction was difficult by closed means while plating. In a similar study by Im GI *et al*. [13] average dorsiflexion at final follow-up in the nailing group (14 degrees) was significantly higher than that (7 degrees) in the plating group.

The current study showed that excellent to good results were achieved in 88% of patients in nailing group and 72% of patients in plating group according to Olerud and Molander scoring [8] system. Although, the difference was statistically not significant. Similar results were obtained by Im GI *et al*. [13] where the Olerud and Molander functional ankle score was 88.5% of normal side in intramedullary nailing and 88.2% in plating group.

Twenty nine patients had associated fracture fibula out of the 50 patients. All Fibula fractures within 7 cm of ankle joint were fixed with plating. In this series, two patients (4%) presented with valgus mal-alignment of >5 degrees in the nailing group. None of the patients in the plating group had mal-alignment. In a similar study on 35 patients, Krishan A *et al*. [14] observed that two patients had malalignment (angulation of >5 degrees in any plane). Similarly, Egol KA *et al*. [15] in his 72 patients series concluded that fibular fixation helped to maintain axial alignment.

Failure of nail or locking screws and nail is reported complication in intramedullary nailing of distal tibial fractures. We did not observe any case of nail failure in this study.

Conclusion

From this study we conclude that in the management of distal tibia fractures with intramedullary interlocking tibia nail gives better results compared to fractures managed with distal tibia locking plate. Nailing ensured better improvement in the range of motion at ankle joint. Also, fracture union was seen earlier in patients with intramedullary interlocking tibia nail compared to fractures managed with distal tibia locking plate. Intramedullary nail being load sharing device, early mobilization can be started. Plating of distal tibia fractures were associated with high infection rate and secondary surgical procedures for wound closure. Further, prolonged duration of protected weight bearing was required in patients treated with locked plate.

We conclude that intra-medullary interlocking nail is a reliable and satisfactory method for treatment of fractures of

distal tibia 43 A type fractures with good functional results and high union rates with comparatively low complications.

Financial support and sponsorship - Nil.

Conflicts of interest - Nil.

References

1. Bone LB, Sucato D, Stegemann PM *et al*. Displaced isolated fractures of the tibial shaft treated with either a cast or intramedullary nailing. J Bone Joint Surg Am. 1997; 79:1336-1341
2. Hooper GJ, Keddell RG, Penny ID. Conservative management or closed nailing for tibial shaft fractures. A randomized prospective trial. J Bone Joint Surg Br 1991; 73(1):83-85.
3. Karladani AH, Granhed H, Edshage B *et al*. Displaced tibial shaft fractures. A prospective randomized study of closed intramedullary nailing versus cast treatment in 53 patients. Acta Orthop Scand. 2000; 71(2):160-167.
4. Megas P, Zouboulis P, Papadopoulos AX, Karageorgos A, Lambiris E. Distal tibial fractures and non-unions treated with shortened intramedullary nail. Int Orthop 2003; 27(6):348-351.
5. Nork SE, Schwartz AK, Agel J, Holt SK, Schrick JL, Winquist RA. Intramedullary nailing of distal metaphyseal tibial fractures. J Bone Joint Surg Am. 2005; 87(6):1213-1221.
6. Orthopaedic Trauma Association Committee for Coding and Classification: Fracture and dislocation compendium, J Orthop Trauma. 1996; 10(1):1.
7. Muller ME, Nazarian S, Koch Schatzker P. The comprehensive classification of fractures of long bones. Frist ed. Berlin Heidelberg Newyork: Springer-Verlag, 1990.
8. Olerud C, Molander H. A scoring scale for evaluation after ankle fractures. Arch Orthop Trauma Surg. 1984; 103:190-194.
9. Aso Mohammed, Ramaswamy Sarawan, Jason Zammit, Richard King. Intramedullary nailing in distal third tibial fractures: distal locking screws and fracture nonunion.
10. Jayesh Vaza V, Bhoomika Chauhan R, Girish Chauhan R, Pradip Chauhan R. print ISSN: 2249 4995 | eISSN: 2277 8810 Comparative study of plating versus nailing in distal tibia metaphyseal fractures.
11. Kasper Janssen W, Jan Biert, Albert van Kampen. Treatment of distal tibial fractures: plate versus nail A retrospective outcome analysis of matched pairs of patients Int Orthop. 2007; 31(5):709-714.
12. Piątkowski K, Piekarczyk P, Kwiatkowski K *et al*. Comparison of different locking plate fixation methods in distal tibia fractures International Orthopaedics (SICOT). 2015; 39:2245. doi:10.1007/s00264-015-2906-4
13. Im GI, Tae SK. Distal metaphyseal fractures of tibia: a prospective randomized trial of closed reduction and intramedullary nail versus open reduction and plate and screws fixation J Trauma. 2005; 59(5):1219-23; discussion 1223.
14. Krishan A, Peshin C, Singh D. Intramedullary nailing and plate osteosynthesis for fractures of the distal metaphyseal tibia and fibula JOrthop Surg (Hong Kong). 2009; 17(3):317-20.
15. Egol KA, Weisz R, Hiebert R, Tejwani NC, Koval KJ, Sanders RW. Does fibular plating improve alignment after intramedullary nailing of distal metaphyseal tibia fractures? J Orthop Trauma. 2006; 20(2):94-103.