

Original Research Article

A prospective comparative study of distal tibia and fibula fractures treated with tibial interlocking nailing with and without fibular plating

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ABSTRACT

Background: Distal both bone leg fractures present significant challenges in orthopedic surgery. The purpose of this study was to evaluate the functional and radiological outcomes of tibial interlocking nailing alone versus interlocking nail with supplementary fibular plating.

Methods: A hospital-based, prospective interventional study was conducted on 72 patients, divided into two groups. Karlstrom-Olerud scoring and radiographic assessment were used to evaluate outcomes. SPSS software will be used for all statistical calculations.

Results: Patients in the interlocking nail with fibular plating group demonstrated improved alignment values in varus/valgus angulation ($p=0.00008$) and anteroposterior angulation ($p=0.00029$), also Karlstrom Olerud score was significantly better in fibular plating group at 3 months ($p=0.002$). There was slightly earlier union time in fibular plating group than patients without fibular plating (14.86 and 15.55 respectively) and also there was higher rate of patients requiring secondary procedures in group without fibular plating (6) compared to group with fibular plating (2).

Conclusion: Patients with fibular plating group demonstrated significantly improved alignment and functional scores, suggesting that supplementary fibular plating enhances stability and reduces malalignment.

Keywords: Tibia, Fibula, Interlocking nail, Karlstrom Olerud score, Malalignment, Distal Metaphyseal

INTRODUCTION

Fractures of the distal tibia and fibula account for approximately 7-9% of lower extremity fractures, with 85% involving both bones.¹⁻⁴ Treatment is challenging in distal tibia due to the subcutaneous nature of the tibia and associated soft tissue complications.⁵ Interlocking nailing of distal tibial fractures with short distal fragment is associated with malalignment problem particularly in coronal plane, non-union and need for secondary procedures to achieve union because of muscular forces which result in displacement of fracture and instability due to mismatch between diameter of medullary canal and nail. Interlocking nailing is still widely accepted treatment for distal tibial fractures however, stability concerns remain. This study evaluates whether supplementary fibular plating improves outcomes in these fractures.

METHODS

A prospective study was conducted on 72 patients at SMS Medical College, Jaipur, between January 2023 and January 2024. Patients were randomized into two groups: interlocking nail alone ($n=36$) and interlocking nail with fibular plating ($n=36$). The purpose of the study was to compare interlocking nail alone with interlocking nail supplemented by fibular plating in distal tibia and fibula fracture.

Inclusion criteria

Patients aged 21-60 years with closed or Gustillo Andersen grade I/II open distal tibia and fibula fracture were included.

Exclusion criteria

Patients with Gustillo Andersen grade III open fractures, mid shaft fractures, segmental fractures, intra articular fractures of distal tibia and patients with uncontrolled medical comorbidities.

Operative technique

Interlocking nail

Through a patellar tendon splitting approach, entry point was made in the midline, progressive reaming is done and guide wire is passed under image intensifier control. Reduction is verified, if not satisfactory then fracture site is opened and tibia is reduced and interlocking nail is introduced and locked with one or two proximal screws and two or three distal screws.

Fibula plate

Supplementary fibular plating was always done first to align both tibia and fibula for easy passage of interlocking nail in tibia. It was done through a posterolateral skin incision. Skin, subcutaneous tissue and fascia were incised. Fibular fracture site was exposed, freshened and reduced. Plate was applied over the fracture site on the posterior surface of fibula.

Postoperative regime

Weight-bearing was initiated based on radiographic evidence of healing. Partial weight bearing was started once callus formation was seen on radiograph and full weight bearing was done once there is clinical and radiological union. Outcomes were assessed at 3 and 6 months using radiological changes and Karlstrom-Olerud scoring where patient was categorised as excellent/good/satisfactory/ moderate/poor according to his/her score.⁶

Statistical analysis

Data was analysed with suitable parametric and non-parametric tests. 'P' value <0.05 was considered statistically significant. SPSS software was used for all statistical calculations.

RESULTS

Table 1 demonstrates number of patients according to their age and sex group had 29 males and 7 females, while the interlocking nail with fibular plating group had 28 males and 8 females in various age groups.

For angulation and alignment of the fracture site radiographs were analysed postoperatively. According to Trafton's recommendation the acceptable malalignment is less than 5 degrees of varus/valgus angulation and 10 degrees of anteroposterior angulation.⁷ Table 2 and 3 shows the value of angulation in both groups i.e., group with interlocking nail alone and group with interlocking nail with supplementary fibula plating. The 'p' value for varus/valgus and anteroposterior angulation came out to be 0.00008 and 0.00029 respectively which were clinically significant values.

The patients were analysed clinically and functionally by using Karlstrom Olerud scoring system. Table 4 explains scoring criteria in Karlstrom Olerud scoring system. The scoring was done at 3 months and 6 months in both groups. Table 5 and 6 shows the score at 3 and 6 months respectively. The p value at 3 months came out to be 0.002 which was statistically significant showing better results in patient with interlocking nail supplemented by fibular plating. The 'p' value at 6 months was 0.215 which was not clinically significant. The score at 6 months improved in both groups may be since most patients had union of the fracture site complete till that point and due to loss of follow up of patients from both groups.

Average time of union was 15.55 weeks in the interlocking nail only group and 14.86 weeks in the interlocking nail with fibular plating group as shown in Table 7. There was no significance difference in union time in both groups.

Some patients of both groups needed some form of secondary procedure due to complications. Table 8 shows the number of patients requiring secondary procedures in both groups. The most common complication in group with only interlocking nail was malreduction leading to persistent pain and delayed union while the most common complication in group of interlocking nails with fibula plating was infection and exposure of plate at fibula. The 'p' value came out to be 0.133 on comparison which was not significant.

Table 1: Distribution of study population according to gender and sex.

Age (in years)	Interlocking nail only		Interlocking nail with fibular plate	
	Female	Male	Female	Male
21-30	1	11	4	7
31-40	2	8	2	11
41-50	0	7	2	7
51-60	4	3	0	3

Table 2: Varus/valgus angulation.

	Interlocking nail only	Interlocking nail with fibular plating
≤5°	30	35
>5°	6	1
Grand total	36	36

Table 3: Anteroposterior angulation.

	Interlocking nail only	Interlocking nail with fibular plating
≤10°	31	35
>10°	5	1
Grand Total	36	36

Table 4: Karlstrom Olerud scoring system.

Measures	3 points	2 points	1 point
Knee pain	No	Little	Severe
Ankle pain	No	Little	Severe
Difficulty in walking	No	Moderate	Severe
Difficulty in climbing stairs	No	Supported	Unable
Difficulty in previous sports activity	No	Some sports	Unable
Limitation at work	No	Moderate	Unable
Status of skin	Normal	Various colours	Ulcer/sinus
Deformity	No	Little	Remarkable
Muscle atrophy (cm)	<1	1-2	>2
Shortening (cm)	<1	1-2	>2
Loss of motion at knee (degrees)	<10	10-20	>20

Table 5: Karlstrom Olerud scoring at 3 months post operatively.

	Interlocking nail only	Interlocking nail with fibular plating
≤23 (Extremely Poor)	7	2
24-26 (Poor)	18	7
27-29 (Moderate)	10	21
30-32 (Satisfactory)	1	6
33-35 (Good)	0	0
36 (Excellent)	0	0
Grand total	36	36

Table 6: Karlstrom Olerud scoring at 6 months post operatively.

	Interlocking nail only	Interlocking nail with fibular plating
Loss of follow up	9	8
≤23 (Extremely Poor)	0	0
24-26 (Poor)	5	2
27-29 (Moderate)	7	4
30-32 (Satisfactory)	13	14
33-35 (Good)	2	8
36 (Excellent)	0	0
Grand Total	36	36

Table 7: Time of union (weeks).

	Interlocking nail only	Interlocking nail with fibular plating
Average time of union	15.55 weeks	14.86 weeks

Table 8: Distribution according to requirement of secondary procedure.

	Interlocking nail only	Interlocking nail with fibular plating
No	30	34
Yes	6	2
Grand total	36	36

DISCUSSION

Over the past ten to fifteen years, there has been a dramatic change in the way tibia fractures are managed. For the majority of these injuries, interlocking nailing has emerged as the gold standard of therapy, particularly when there is substantial soft tissue injury. Because of wider distal tibial metaphysis diameter which is not filled by interlocking nail there is increased incidence of instability and malalignment in these fractures, so some surgeons have added fibular plating in an attempt to increase fracture stability.

A retrospective study by Egol and colleagues that suggested a higher failure rate in patients whose fibulas were not plated in distal metaphyseal tibia and fibula fracture.⁸ Malalignment was also significantly more common in our study's patients treated with only tibial interlocking nailing, which was similar to the Nork et al study's findings.⁹ Malalignment was found in one case of distal tibia fractures treated with interlocking nailing for tibia with fibular plating as compared to six cases of distal third fractures treated with interlocking nailing only for the fracture.

Effect of malunion

Importance of achieving anatomical reduction cannot be over emphasized. There is a possibility of more degenerative changes in the ankle due to malaligned fractures as recorded by Puno et al "long term effects of tibial angular malunion of knee and ankle joints in his 28 tibial fractures with an average follow-up of 8.2 years". His analysis showed that greater degrees of ankle malalignment produce poorer clinical results.¹⁰ Thus, it's important to prevent any malalignment in distal tibia fracture.

Kellam et al in his commentary and perspective on the effect of fibular plate fixation on stability of simulated distal tibial fractures treated with interlocking nailing by Kumar et al concluded that meticulous interlocking techniques combined with use of fibular plate fixation or blocking screws will achieve the best results in maintaining the reduction of distal tibial fractures till union.^{11,12} The proportion of fractures that lost alignment were minimal among those receiving stabilization of the fibula in conjunction with interlocking nailing in many studies as compared with those receiving interlocking nailing alone as comparable to the study conducted by Whittle et al.¹³

In our study we found that interlocking nailing when supplemented with fibular plating did influence the stability and the functional outcome. When compared to other techniques described for preventing metaphyseal malalignment during nailing in distal both bone fractures of leg, fibular plating is not technically demanding, do not require any special instrumentation and do not need any special design modification in the nail. There is no significant increase in radiation exposure for applying fibular plating. Fibular plating improved the stability of the metaphyseal fractures after nailing and promoted union in our study.

CONCLUSION

Supplementary fibular plating in distal both bone leg fractures treated with interlocking nail results in superior alignment and functional outcomes. This technique should be considered in cases where distal fragment stability is a concern.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Brown CM, McBirnie J, Wilson G. Adult ankle fractures: an increasing problem. *Acta Orthop Scand*. 1998;69:43–47.
2. Koval KJ, Lurie J, Zhou W. Ankle fractures in the elderly: what you get depends on where you live and who you see. *J Orthop Trauma*. 2005;19:635–9.
3. Kannus P, Palvanen M, Niemi S, Parkkari J, Jrvinen M. Increasing number and incidence of low-trauma ankle fractures in elderly people: Finnish statistics during 1970–2000 and projections for the future. *Bone*. 2002;31(3):430-3.
4. Canale ST, Beaty JH. *Campbell's operative orthopaedics e-book: expert consult premium edition-enhanced online features*. Elsevier Health Sciences; 2012.
5. Guo J, Tang N, Yang H, Tang T. A prospective, randomised trial comparing closed interlocking nailing with percutaneous plating in the treatment of distal metaphyseal fractures of the tibia. *J Bone Joint Surg Br*. 2010;92:984-8.
6. Karstrom G, Olerud S. Fractures of tibial shaft, a clinical evaluation of treatment alternatives. *Clin Orthop*. 1974;105:82-115.

7. Campbell's Operative orthopaedics. 10th ed. Volume 3. Mosby Publication; 2003: 2671-3.
8. Egol KA, Weisz R, Hiebert R, Tejawani 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.
9. Nork SE, Schwartz AK, Agel J, Holt SK, Schrick JL, Winquist RA. Intramedullary nailing of distal metaphyseal tibial fractures. *JBJS*. 2005;87(6):1213-21.
10. Puno RM, Vaughan JJ, Stetten ML, Johnson JR. Long-term effects of tibial angular malunion on the knee and ankle joints. *J Orthop Trauma*. 1991;5(3):247-54.
11. James K. Commentary and prospective on Effect of fibular plate fixation on rotational stability simulated distal tibial fractures treated with intramedullary nailing by Anantkumar. *eJBJS*. 2003:32.
12. Kumar A, Charlebois SJ, Cain EL, Smith RA, Daniels AU, Crates JM. Effect of fibular plate fixation on rotational stability of simulated distal tibial fractures treated with intramedullary nailing. *JBJS*. 2003;85(4):604-8.
13. Whittle AP, Wester W, Russell TA. Fatigue failure in small diameter tibial nails. *Clin Orthop Relat Res*. 1995;(315):119-28.

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