ORIGINAL RESEARCH PAPER
Volume-8 | Issue-10 | October - 2019 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

RADIOLOGICAL AND FUNCTIONAL RESULTS OF LOCKED INTRAMEDULLARY NAILING FOR FRACTURE DISTAL THIRD TIBIA AND CONCOMITANT PLATE FIXATION FOR FRACTURE DISTAL THIRD FIBULA

Orthopaedics

Rajwinder Gill Resident Orthopaedics, Safdarjung Hospital, New Delhi

Rajesh K Chopra Professor Orthopaedics, Safdarjung Hospital, New Delhi

Mozammil Pheroz* Senior Resident Orthopaedics, Safdarjung Hospital, New Delhi *Corresponding Author

Arvind Kumar Senior Resident Orthopaedics, Safdarjung Hospital, New Delhi

ABSTRACT

Both bones leg fracture is one of the commonest fractures seen in orthopaedics emergency and out-patients department. Treatment of these fractures depend upon site of the fracture and surgeon's preference. In this study we have endeavored to find out the radiological and clinical outcomes of nailing in fracture distal third tibia and concomitant plate fixation of fractured fibula distal third in same limb. This was a prospective case series that includes 30 patients with post traumatic fracture both bone leg in distal one third. Mean follow-up period was 6 months. Patients were evaluated for union of fracture, radiological outcome with Johner and Wruh's criteria, functional outcome with Olerud and Molander scale and residual deformity is noted and recorded. 25 patients achieved union at 6th month, mean duration of union was 3.65±0.49 month. None of the patients had any significant deformity and, 89 % achieved excellent to fair outcomes in Johner and Wruh's scale while as a whole, the operated patients achieved mean score of 77.5±20.22 on Olerud and Molander scale at 12 weeks. Intramedullary nail can be used for fixation of metaphyseal fracture of distal tibia and concomitant fibula should be fixed to have better ankle results

KEYWORDS

Distal tibia fracture, Intramedullary nail, Fibula fixation.

INTRODUCTION

Distal tibia fractures are estimated to comprise 3% to 10% of all tibia fractures and less than 1% of lower extremity fractures. [1-3] The management of these distal tibia injuries is often more complex than the treatment of Tibia diaphyseal fractures, leading to the potential of postoperative complication and poor outcome. Reduction and its retention are more difficult when a Fibular fracture is found at the same level as the Tibia. This fracture pattern reflects a high energy mechanism of trauma causing a increased angular and rotational instability, limb shortening soft tissue injuries.[4,5] High-energy distal tibial injuries involve concomitant Fibular fracture in 80% of cases.

The status of the Fibula is an important surgical consideration when managing fracture of the distal Tibia. The theories that the fixation of the Fibula provides a stiffer construct and aids in achieving a more anatomical reduction of the Tibia have promoted this procedure. However, previous studies have provided mixed information about the potential role of the Fibula in Tibia healing. Any change in the either in the length or the rotation of the distal Fibula reflected in the anterolateral and posterolateral segment of distal Tibia and hence have implication on distal Tibial reduction. Additionally, anatomic realignment of the fibula also indirectly reduces the talus beneath the anatomic axes of the Tibia.[6]

The closed distal tibia and fibula fracture treated with dual plating is associated with high rate of superficial wound infection, wound dehiscence, implant exposure and delayed or non-union in patients.[7]

For diaphyseal Tibia fracture, intramedullary interlocking nailing is standard procedure, but in distal third Tibial fibula fracture IM nailing was not a chosen method earlier. Due to less invasive nature of IM nailing, availability of multiple locking option and soft tissue sparing, gradually it is becoming treatment of choice. Concerns regarding difficulties with reduction, distal propagation of fracture, hardware failure, and inadequate distal fixation leading to malalignment have showed the acceptance of intramedullary nailing as a treatment of distal maetaphyseal fractures.[8]

Therefore, we conducted the study to assess the effect of concomitant fibular plating and locked intramedullary nailing in the treatment of distal third tibia and fibula fracture**.**

MATERIALAND METHODS

This is a case series type of study conducted in Central Institute of Orthopaedics, Vardhman Mahavir Medical College & Safdarjung Hospital, New Delhi from October 2015 to April 2017. Patients presenting to the orthopaedic emergency and Outpatient department with fracture distal third tibia and fibula from September 2015 to January 2017 were included in this study. Informed and written consent were taken from each of the patients.

Inclusion Criteria:

1. Age > 18 years
2. Extraarticular closed distal third tibia and fibula fractures.
3. Fractures in distal third tibia and fibula with un-displaced intraarticular extension of tibia.
4. Closed or Gustillo Anderson Open grade 1 distal third tibia and fibula fractures.

Criteria for exclusion:

1. Pathological fracture.
2. Refractures.
3. Any evidence of Syndesmotic injury.
4. Medical comorbidities precluding surgery.
5. Comminuted intraarticular tibia fracture.
6. Open grade II/III/IV tibia fracture Following admission to the hospital, a careful history was elicited.

All patients were thoroughly examined. Patient's general condition, associated systemic diseases and associated injuries were noted. All the findings were duly recorded in the patient proforma. Anteroposterior and lateral views of the ankle and full-length radiographs of the involved lower leg were taken to analyse the presence and location of the Tibial and Fibular fracture, length of distal fragment, the degree of articular involvement, and the associated fracture. The fractures were classified according to the AO Muller classification. We included 43A Extraarticular fractures in the present study. Routine blood investigations were done. The involved leg was immobilized in the above knee POP slab/ splintage and kept elevated. Pain and inflammation were managed using analgesics.

Operative steps-The procedure was done under spinal/ epidural/ general anaesthesia. The patients were positioned supine on OT table with pillow under hip and knee. Tourniquet applied to the affected limb. Painting and draping of patient were done.

Fibular fixation is done first with 1/3 tubular plate by standard lateral or posterolateral approach. The dissection plane was between the peroneus tertius anteriorly and the peroneus longus and brevis posteriorly. The plate fixation of Fibula fracture is done according to fracture pattern of Fibula. Following type of Fibular plate fixation done. (Bridge plating/ Antiglide plating / Compression plating / neutralisation plating). Tibia interlocking was done in standard approach with patella tendon splitting approach. Proximally and distal locking was done with screws under image intensifier. Assessment of alignment was done before completing this step. Then closure all the

surgical wounds done. Post operatively limb elevation was done for 2-5 days. Mobilization was started as soon as pain allowed. Suture were removed on 14 days. Progressive weight bearing was encouraged after the first 6 weeks according to callus formation. Depending on the consolidation, weight bearing was increased after 6-8 weeks with brace.

Clinical and radiological follow-up was done at 2, 6, 12 weeks after symptoms and further at regular interval till union. Atrophy in the leg and thigh, knee and ankle joint ranges of motion were assessed. Radiographs were taken and evaluated about union rate, angulations, and status of bolts. Union times and postoperative seen complication were taken into consideration at each follow up visit. Patients were evaluated radiologically and clinically with Johner and Wruh's (1983) criteria with modification.[9] Olerud and Molander scoring system used for evaluating the ankle function.[10]

STASTICAL ANALYSIS

For descriptive statistics mean, standard deviation, median, inter quartile range (IQR), range for the continuous data was used. For categorical data, total number and percentage was used. Chi square test was used to determine differences in the categorical data and t-test was used to compare mean between the two group if data was normally distributed otherwise Mann Whitney t –test was used. Level of statistical significance was set at P<0.05. Statistical Package for social sciences (SPSS) version 18.0 and STATA version 13 were used for statistical analysis.

RESULTS

In our study 15 (50%) patients were less than 30 years, 10 (26.7%) between 31-50 years, 5 (16.6 %) between 51-60 years of age. The mean age of patients was 32±13.94, range from 18 to 60 years. 18(60%) were male and 12(20%) were female. 14 (46.67%) patient suffered due to road traffic accidents, 9 (30%) due to fall from height and 4 (13.33%) due to fall from stairs and 3 (10%) due to physical assault. Right side was involved in 20 (67%) patients and the left side was involved in 10 (33%) patients. 6 (20%) patients were Alcoholic and 24 (80%) were non-alcoholic. 8 (26.67) patients were Smoker and 22 (73.33%) were non-smoker. 12 patients (40.0%) suffered associated injuries of pelvis, spine and femur shaft.

Table 1-Demographic Chart

	Number (total= 30)
Age	
<30 years	15
30-50 years	10
>50 years	5
Sex (M/F)	18/12
Mode of injury	
Road traffic accident	14(46.7%)
Fall from height	9(30.0%)
Fall from stairs	4(13.33%)
Physical assault	3(10.0%)
Side involved (Right/Left)	20/10
Alcoholic	6(20.0%)
Smoker	8(26.7%)
Associated injuries	12(40.0%)

Mean duration of surgery was 92±7.2 minutes range from 84 min to 124 min. 6(20%) patients had infections. 4 of the patients were managed by exploration and thorough wound lavage followed by secondary suturing and rest two were managed with expression of discharge and giving higher dose antibiotics. 3(10%) of the patients had wound dehiscence of fibular incision and required flap coverage At 6 month, 25 patients achieved union while 5 patients showed delayed union.

Table 2-Union at Six months in the study population

	Number	Percent
Union	25	83
Delayed union	5	17
P Value	<0.001	

Mean duration of union was 3.65±0.49 months range from 3.5 month to 18 months.

Table 3-Time to unioun

Statistics	Union Time (months)
Mean	3.65
Standard Deviation (SD)	0.49
Total (n)	30

Patients were assessed with Johner and Wruh criteria for residual deformities. All patients displayed excellent to fair for valgus/varus, rotation, shortening or anteversion/ recurvatum. None of the patients were poor for valgus/ varus, rotation, shortening or anteversion/ recurvatum.

Table 4-Residual deformity after treatment

	Excellent	Good	Fair	Poor
Valgus	5	22	3	0
Rotation	24	5	1	0
Shortening	6	20	4	0
Anteversion/recurvatum	25	3	2	0

The assessment of radiological results was done with Johner and Wruh's 1983 criteria with modification.

Table 5- Johner Wruh Evaluation Score

Johner Wruh Evaluation Score	Score	no (%) 2 weeks	no (%) 6 weeks	no (%) 12 weeks
	Excellent	12(41.3)	16(57.1)	23(78.6)
	Good	13(44.8)	9 (32.14)	4(10.71)
	Poor	4 (13.79)	3(10.71)	3(10.71)

Johner Wruh's evaluation at two, six and 12 weeks suggested that 41.35% patients had excellent outcome at two weeks, 57.14% patients had excellent outcome at six weeks and 76.7% patients had excellent outcome, at 12 weeks.

Functional outcome was assessed with olerud and Molader scale. Olerud and Molader scale at 12 weeks suggested that patients had excellent recovery with mean 77.5±20.22.

Table 6-Olerud and Molander outcome assessment

Olerud and Molander scale total score	Mean and SD 12 weeks
	77.5±20.22

DISCUSSION

Distal third Tibia-Fibula fracture fractures are a great challenge to treat. Reduction and holding the fracture in reduced position is even more difficult when a fibular fracture is found at the same level of Tibia. In addition, the precarious soft tissue envelope in this region is associated with wound complicaitons.[11] Greater problem in distal Tibia Fibula fracture now a day is associated with soft tissue damage which merits minimum tissue handling. Traditionally, techniques fail to achieve an appropriate reduction and maintenance of reduction of fractures or may further damage soft parts.

Intramedullary nailing in the surgical treatment of extra-articular distal tibial fractures is an minimally traumatic method that does not cause extensive soft tissue injury, spare vascular structures and is performed without opening the fracture area. Due to new intramedullary implant designs and advanced surgical technique, the popularity of intramedullary nailing of distal Tibial fractures is rising [12,13]

For a combined distal tibia and fibula fracture, there exists a debate among surgeons as to whether or not fibular fixation is required as an adjuvant to IM nailing. Several studies have reported complications such as malalignment and non-union after the intramedullary nailing of distal Tibia-Fibula Fractures [12,14]

The present study was undertaken to determine the clinical outcomes of concomitant fibular plating and locked intramedullary nailing in distal third tibia and fibula fractures We evaluated our results and compared them with those reported by various published studies in the literature. In our study, distal Tibia-Fibula fracture was common in young people with an average of 32.76 years which is comparable with the studies of Nork et al 15 (2005), Vallier et al [13](2008), Stamatious Paraschou et al [16] (2009), Mustafa Isik et al [17] (2012) and Manish Prasad et al [18] (2013) which had an average age of 30, 39.1, 42, 41 respectively.

The present study had higher number of male patients (60%) as compared with the female patients (40%). The incidence of male population observed in the present study is comparable with the previously reported studies in the literature. Nork et al[15] had 60 %, Egol et

al[19] had 67%. Vallier et al[13] had 70%. Higher incidence in male subjects is probably attributed to their involvement in the outdoor activities.

In the present study, total 20% patients had infection which is higher than the previously reported studies. 16.67% patients had wound dehiscence. While Robinson et al [14] Dogra AS et al [20] Vallier et al [13] had reported 0% infection, Nork et al (3.3 %)[15] R. Buzzi et al (4.8%)[21] M. Ehlinger (5.8%)[22] had infection comparabe to our study.

Our study observed that 17% patient had non-union which is comparable with the studies published by Dogra et al 2005[20] Nork et al, 2005[15], Vallier et al 2008[13], and R. Buzzi et al. 2009[21]. CM Robinson et al (1995)[9], M. Ehinger et al 2010[22] and Vallier HA et al 2011[23] reported non-union or delayed union in below than 10% of study population.

In Vallier HA 2011[23] series four patients (7.1%) developed non-union after the nailing with a trend for non-union in patients who had distal Fibula fixation. Vallier et al 2008[13] 12% had the delayed union or non-union after nailing. They also observed that non-union was more common after concurrent fixation of the Fibula (14%) versus 12% in without fixation.

Labronici et al 2009 [24], Guo et al 2010 [25] and Mustafa Isik et al 2012 [17] observed that mean union time in their series 14 weeks, 17.7 weeks and 15 weeks respectively that was comparable with finding of the presents study. While Nork et al 2005[15] and Vallier et al 2008 [13] observed that mean union time 23.5 weeks and 18.8 weeks respectively. In present study mean union time was 16 weeks.

Valgus angulation assessment show excellent in 16.6% of cases, good in 73.4% of cases, Fair in 10 percent of cases and none of the patient had the poor outcome. Our results are consistent with the finding observed in the study published by Manish Prasad et al. [18] who had 80 % good and 20 % fair in result.

In our study combine excellent and good outcomes of rotational deformity were observed in 96.7% and Manish Prasad et al 100% in the study published by. [18] Merchant and Dietz, [26] in their clinical study of 37 patients followed up for 29 years, had a mean ankle evaluation score of 88.4 points for patients with distal-third fracture of the shaft of tibia. All of the patients in their series were treated non-operatively with a cast. In this study, the mean ankle evaluation score for patients in whom the fibula was fixed was 93.86 points and it was 90.53 points for patients without fibular fixation; that is, the ankle evaluation score was statistically similar in patients with and without fixation of fibula ($p = 0.01$). [26]

In the present study, we observed that 78.67 patients had Excellent Outcome, 10.71% patients had Good outcome and 10.71% patients had poor outcome on the basis of Johner and Wruh'S evaluaion scale.

Patients who obtained the excellent results had no pain. Range of motion was within the normal functional range. They had no other complications. These patients were also co-operative to physiotherapy. 10.71% patients had good results at the 12 weeks follow up. These patients experienced minimal pain when walking on uneven surface. Patients with poor results, pain along with stiffness at ankle joint and deformity. Few of their movements were less that that required for normal function. In our study 10.71% patients had poor outcomes.

In the present study we observed mean 77±20.22 at the 12 weeks follow up. Mean Olerud score in the different studies are shown below In the present study the mean olerud score was 77.5 which is comparable the earlier reported studies C M Robinson et al 1995[14], Im GI et al 2005 [27] and M Ehlinger et al.[22] 2010.

CONCLUSION

It can be easily concluded that intramedullary nail is an excellent option for metaphyseal fracture of distal tibia and fibular plate fixation prior to intramedullary nailing of distal tibial-fibular fracture is a valid technique which prevents malalignment, and works well in situation of compromised soft tissue scenario, offer excellent skeletal stabilization in less invasive method.

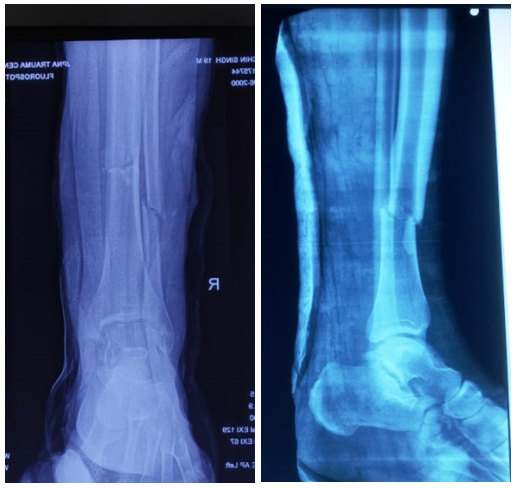

Figure 1a, 1b- Preoperative X rays of fracture both bones leg

Figure 2a, 2b- Postoperative X rays at 6 weeks showing unioun in progress and acceptable alignment.

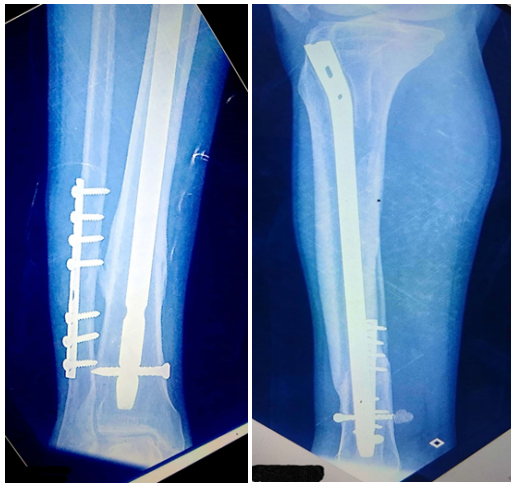

Figure 3a, 3b- X rays showing complete unioun of both the bones at 6 months follow-up.

REFERENCES

1. Bone, L. B. Fractures of the tibial plafond. The pilon fracture. Orthop. Clin. North Am. 18, 95–104 (1987).
2. Mandracchia, V. J., Evans, R. D., Nelson, S. C. & Smith, K. M. Pilon fractures of the distal tibia. Clin. Podiatr. Med. Surg. 16, 743–767 (1999).
3. Mast, J. W., Spiegel, P. G. & Pappas, J. N. Fractures of the tibial pilon. Clin. Orthop. 68–82 (1988).
4. Kumar, A. et al. Effect of fibular plate fixation on rotational stability of simulated distal

tibial fractures treated with intramedullary nailing. J. Bone Joint Surg. Am. 85–A, 604–608 (2003).
5. Bedi, A., Le, T. T. & Karunakar, M. A. Surgical treatment of nonarticular distal tibia fractures. J. Am. Acad. Orthop. Surg. 14, 406–416 (2006).
6. Rouhani, A., Elmi, A., Akbari Aghdam, H., Panahi, F. & Dokht Ghafari, Y. The role of fibular fixation in the treatment of tibia diaphysis distal third fractures. Orthop. Traumatol. Surg. Res. OTSR 98, 868–872 (2012).
7. Teeny, S. M. & Wiss, D. A. Open reduction and internal fixation of tibial plafond fractures. Variables contributing to poor results and complications. Clin. Orthop. 108-117 (1993).
8. Court-Brown, C. M. & McBirnie, J. The epidemiology of tibial fractures. J. Bone Joint Surg. Br. 77,417-421 (1995).
9. Johner, R. & Wruhs, O. Classification of tibial shaft fractures and correlation with results after rigid internal fixation. Clin. Orthop. 7–25 (1983).
10. Olerud, C. & Molander, H. A scoring scale for symptom evaluation after ankle fracture. Arch. Orthop. Trauma. Surg. Arch. Orthopadische Unf.-Chir. 103, 190–194 (1984).
11. Kumar, A. et al. Effect of fibular plate fixation on rotational stability of simulated distal tibial fractures treated with intramedullary nailing. J. Bone Joint Surg. Am. 85–A, 604–608 (2003).
12. Mosheiff, R., Safran, O., Segal, D. & Liebergall, M. The unreamed tibial nail in the treatment of distal metaphyseal fractures. Injury 30,83-90 (1990).
13. Vallier, H. A., Le, T. T. & Bedi, A. Radiographic and clinical comparisons of distal tibia shaft fractures (4 to 11 cm proximal to the plafond): plating versus intramedullary nailing. J. Orthop. Trauma 22, 307–311 (2008).
14. Robinson, C. M., McLauchlan, G. J., McLean, I. P. & Court-Brown, C. M. Distal metaphyseal fractures of the tibia with minimal involvement of the ankle. Classification and treatment by locked intramedullary nailing. J. Bone Joint Surg. Br. 77, 781–787 (1995).
15. Nork, S. E. et al. Intramedullary nailing of distal metaphyseal tibial fractures. J. Bone Joint Surg. Am. 87, 1213–1221 (2005).
16. Paraschou, S. et al. [Evaluation of interlocking intramedullary nailing in distal tibial fractures and nonunions]. Acta Orthop. Traumatol. Turc. 43, 472–477 (2009)
17. Isik, M., Subasi, M., Karsli, B., Saricicek, V. & Karsli, G. Intramedullary nailing and angulation prevention in distal metaphyseal tibial fractures. Orthopedics 35, e1765-1768 (2012)
18. Prasad, M. et al. Assessment of the role of fibular fixation in distal-third tibia-fibula fractures and its significance in decreasing malrotation and malalignment. Injury 44, 1885–1891 (2013).
19. Egol, K. A. et al. Does fibular plating improve alignment after intramedullary nailing of distal metaphyseal tibia fractures? J. Orthop. Trauma 20, 94–103 (2006).
20. Dogra, A. S., Ruiz, A. L., Thompson, N. S. & Nolan, P. C. Dia-metaphyseal distal tibial fractures--treatment with a shortened intramedullary nail: a review of 15 cases. Injury 31, 799-804 (2000).
21. R Buzzi, F A Bertini, F Cecchiand F Giron. Distal tibial-fibular fractures treatment with fibular fixation and locked intramedullary nailing. Journal of Orthopaedics 2009;1:317-20.
22. Ehlinger, M. et al. Distal quarter leg fractures fixation: The intramedullary nailing alone option. Orthop. Traumatol. Surg. Res. OTSR 96, 674–682 (2010).
23. Vallier, H. A., Cureton, B. A. & Patterson, B. M. Randomized, prospective comparison of plate versus intramedullary nail fixation for distal tibia shaft fractures. J. Orthop. Trauma 25, 736–741 (2011).
24. Labronici, P. J. et al. Entry point for the antegrade femoral intramedullary nail: A cadaver study. Rev. Bras. Ortop. 44, 487–490 (2009).
25. Guo, J. J., Tang, N., Yang, H. L. & Tang, T. S. A prospective, randomised trial comparing closed intramedullary nailing with percutaneous plating in the treatment of distal metaphyseal fractures of the tibia. J. Bone Joint Surg. Br. 92, 984–988 (2010).
26. Merchant, T. C. & Dietz, F. R. Long-term follow-up after fractures of the tibial and fibular shafts. J. Bone Joint Surg. Am. 71, 599–606 (1989).
27. Im, G.-I. & Tae, S.-K. 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 59, 1219–1223; discussion 1223 (2005).