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Outcome of intramedullary nailing of distal third tibial fractures

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Abstract

Fractures of extra articular distal third tibia remain a controversial subject despite advances in treatment care. Various treatment modalities include conservative treatment or operative with fixation of plate or intramedullary interlocking nail. The aim of this study is to determine role of nailing in distal third tibial fractures. Thirty patients with distal third tibial fractures which were treated between January 2017 to June 2018 were included in the study. The mean age of our patients was 36years (18years – 75 years). 20 were male and 10 females. Road traffic accident was the most common mode. The mean delay between injury and surgery was 5days (Range 1-21 days). 28 had concomitant fibula fracture. Intramedullary interlocking nail was applied in all these patients. Two or preferably three distal screws were applied taking care of reduction. The results were analysed with Johner and Wruh's criteria. All fractures united. Radiological union was achieved at 22.1weeks. 90% had excellent to good outcome as per Johner and Wruh's criteria. None of the patients had infections, implant failure or any thromboembolic episode. The use of intramedullary interlocking nail is an effective method for distal third tibial fracture treatment.

Keywords: distal third tibia fractures, intramedullary tibia nailing, extra articular distal tibial fractures

1. Introduction

Fractures of distal third tibia has no single definitive treatment option though same exists for diaphyseal fractures. These fractures may go in nonunion if not handled properly as soft tissue cover is not extensive and there is paucity of vascular supply. The goal in expert care is to realign the fracture, realign limb length and early functional recovery. Treatment of distal tibial metaphyseal fractures can be challenging. The mechanism of injury, treatment principles and prognosis for these fractures is different from and must be distinguished from those for both proximal diaphyseal fractures and distal intra-articular pilon fractures. Open reduction and internal fixation with plate have been associated with poor results, including soft tissue devitalization, skin slough and infection [1]. Conservative treatment in an attempt to avoid these complications has resulted in unacceptable deformity and loss of ankle range of motion [4]. Minimally invasive surgical techniques have been developed to avoid soft tissue complications while providing the stability and alignment offered with internal fixation [4]. Several techniques have emerged: hybrid external fixation, external fixation with limited internal fixation, percutaneous plate osteosynthesis and intramedullary nailing.

Intramedullary nailing of open and closed tibial shaft fractures has been associated with high rates of radiographic and clinical success, but the use of this procedure has not become widely accepted for distal third tibial fractures. Fractures of distal third tibial fractures may represent a different injury. The distal segment of these fractures is more difficult to control with intramedullary implants because the metaphysis is much wider than the diameter of the nail [4]. Recent changes in intramedullary nail design which have more distal placement of distal screw holes have extended the spectrum of fractures amenable to this type of fixation [4]. But there are concerns about using intramedullary nailing as a treatment for distal metaphyseal fractures because of difficulties with reduction, risk of distal propagation of the fracture, hardware failure, and inadequate distal fixation leading to loss of reduction and malalignment. Only a few studies have assessed the use of intramedullary nailing in dealing with such fractures.

The aim of this study is to assess the outcomes of distal third tibial fractures treatment by interlocking intramedullary nail.

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2. Material and Methods

We studied 30 patients of distal third tibial fractures from January 2017 to June 2018 at Mahatma Gandhi Medical College and Hospital, Jaipur after approval from Ethical Committee and informed consent from patients. We included distal third extra articular tibial fractures that allowed placement of atleast 2 screws in distal fragment. Both Gustilo type 1 and 2 skeletally mature patients were included. We excluded patients not fit for surgery. Initial treatment included radiological examination of the region with both anteroposterior and lateral view with posterior slab application. Patient was thoroughly investigated and was taken up for surgery as soon as fit for surgery. Patient was operated in supine position with median parapatellar approach. Atleast two distal screws were ensured. Blocking screws were used occasionally. Postoperatively limb was elevated and toe movements encouraged. Static and active quadriceps exercises with non-weight bearing were allowed initially and weight bearing as tolerated. Patient was then followed up regularly and was evaluated clinically and radiologically for union and outcomes were measured in terms of Johner and Wruh's criteria score.

3. Results

The present study had 32 patients in toto but two of them were lost to follow up and hence only 30 included in the study. Out of these major parts was aged between 31 and 40 years (40%) with mean age of 36 years. Males were predominant portion of our patients accounting for 20 (66.67%) out of total 30. Servicemen were most commonly affected (43.33%) compared to all other occupations. Road traffic accident was the most common mode of injury (86.67%). 42A1 (40%) and 43A1 (26.67%) were the most common types of AO type fracture class. Head injury (23.33%) was the major associated injury. 83.33% of the fractures were closed type and 93.33% had concomitant fibula fracture. Majority of our patient involved right side (63.33%). Mean delay in surgery was 5 days. Mean operative time was 75 minutes. Mean follow up was 35.93 weeks. Mean bone union time (Callus in atleast three cortices) was observed to be 22 weeks. Average hospital stay was 9.5 days. 10% patient in the series had knee pain. Valgus incidence were higher than varus.

Table 1: Fibula fracture fixation

Fibula Fracture Fixation	Concomitant Fibula Fracture Fixation	Number	Percentage (%)
	Done	3	10.71
	Not done	25	89.28
Total		28	100.00

Table 2: Incidence of coronal plane deformity

Incidence of Varus/Valgus	Varus/Valgus	Number	Percentage (%)
	None	22	73.33
	2-5° Valgus	6	20.00
	6-10° Valgus	1	3.33
	2-5° Varus	1	3.33
Total		30	100.00

Table 3: Incidence of sagittal plane deformity

Incidence of Anteversion/Recurvation	Anteversion/Recurvation	Number	Percentage (%)
	None	26	86.67
	1-5° Anteversion	2	6.67
	6-10° Anteversion	1	3.33
	1-5° Recurvation	1	3.33
Total		30	100.00

Table 4: Incidence of rotation

Incidence of Rotation	Rotation	Number	Percentage
	0-5 External Rotation	28	93.33
	0-5 Internal Rotation	2	6.67
	6-10 External Rotation	0	0.00
Total		30	100.00

Table 5: Incidence of shortening

Incidence of Shortening	Shortening	Number	Percentage
	0-5 mm	28	93.33
	6-10 mm	2	6.67
	>10mm	0	0
Total		30	100.00

Table 6: Outcome score based on Johner and Wruh's criteria

Johner and Wruh's Criteria		Number	Percentage
	Excellent	16	53.33
	Good	11	36.67
	Fair	3	10.00
	Poor	0	0.00
Total		30	100.00

None of the patients required hardware removal. 25 patients had normal knee mobility, 26 patients had normal ankle mobility and 29 had normal subtalar joint mobility.



Fig 1: Preoperative and post-operative radiograph of a patient.



Fig 2: 16week follow up of the patient for range of motion.

4. Discussion

Treatment principles for extra articular distal third tibial fractures are different from and must be distinguished from those for both proximal diaphyseal fractures and distal intra-articular pilon fractures. Nailing of extra articular distal tibia fractures is challenging and should be approached with caution. Surgical tenets such as central placement of the guide wire and reamers, maintenance of the reduction at the time of nail passage and placement of nail in subchondral region, are described to avoid intraoperative malalignment⁵. In spite of all these, malalignments are more common in intramedullary nailing because it is difficult to control distal fragment and is technically more demanding. The aim of this study was to assess outcome of distal tibial fractures treatment by interlocking intramedullary nailing by Johner and Wruh's criteria. In present study 32 patients of distal tibial extra articular fracture admitted to The Department of Orthopaedics at Mahatma Gandhi Medical College and Hospital during January 2017 to June 2018 were treated. Two patients were lost to follow up and so total 30 patients were included in the study analysis.

The fractures of distal leg bones mainly affect younger age group of population. In our series the mean age was 36 years. This is very much comparable to the retrospective study of Heather A. Vallier, T. Toan Le and Asheesh Bedi⁶ in 2008 on 111 patients with 113 extra articular distal tibial fractures who reported mean age of 39.1 years. The present study had males (66.67%) affected more than females and serviceman as the profession of majority (43.33%) of the patients. They are more mobile and hence use vehicles regularly and hence are at increased risk of meeting a road traffic accident. Right side was affected in 63.33% of the patients as vehicles are driven on left side in India. In 2017 Arup K Daolagupu *et al*⁷

studied 42 patients and reported 57.14% involvement of right side. Road traffic accident (RTA) was exceedingly the most common mode of injury which involved 86.67% of the whole list. This is due to the increasing vehicular ownership and non obeying of traffic rules leading to higher incidence of high velocity vehicular accidents. In 2017 Arup K Daolagupu *et al*⁷ studied 42 patients and published road traffic accidents as their mode of injury in 66.67% of the patients. The most common fracture type in our study sample as per AO classification was 42A1 type (40%) which was followed by 43A1 type (26.67%).

This series had no associated injuries in majority of the patients (50%). The most common injury among those involved was skeletal injury (26.67%) which involved fractures of various bones of upper and lower limbs. Colle's fracture was most common among these. Head injury was present in 23.33% of total patients. Sarabjeet *et al*⁸ in 2016 studied 30 such patients and observed that 50% of the patients had some associated injuries. Present study had 83.33% closed fractures and only 16.67% fractures were open Gustilo Type I. Study by De Giacomo AF *et al*⁹ (Level IV study) in 2016 with 122 such patients reported 70% closed fractures.

Fibula fracture is commonly present along with tibia fractures. In this study 93.33% of the total patients had fibula fracture. Only 2 out of 30 patients had fibula intact. In their prospective study, Heather A. Vallier, Cureton and Patterson¹⁰ in 2011 reported 87.5% incidence of fibular fracture on 104 patients. Fibular fixation is always a point of discussion. In our study we had fixed 10.71% of the total fibula fractures before the tibial fixation. In the retrospective study of Heather A. Vallier, T. Toan Le and Asheesh Bedi⁶ in 2008 on 111 patients with 113 extra articular distal tibial fractures, 27% of the total fractured fibulae were fixed. In the study by Satish R Gawali¹¹ *et al* in 2016 on 60 patients, 33.33% of the total fibulae had been fixed. Morin PM *et al*¹² reported on the effect that fibular plating of the same level tibia-fibula fractures has on the rotational stability of distal tibial fractures treated with an IM nail. They concluded that fibular fixation leads to slightly increased resistance to torsional forces but this may not be clinically relevant. Though some studies show improved distal tibial fracture stability with fibular fixation, there is always a possibility of increased soft tissue related complications and a delay in fracture healing. We had plated fibula in three of our cases. In others we did not require fibula fixation as the fracture was undisplaced or we could achieve reduction. Some researchers have advocated the use of adjunctive blocking screws to obtain the reduction and alignment. These were used in our series as and when required along with other means of reduction methods, including plate fixation of the fibula prior to intramedullary nailing, reduction with a percutaneous clamp, long K wire fixation and manual manipulation. Our study supports not to use fibular stabilization if not really necessary.

Mean delay in surgery was 5 days with range from 1 to 21 days delay. Head injuries defer the surgery for longer durations. Our mean operative time was 75 minutes. Yong Li *et al*¹³ in 2012 studied 46 patients and had performed the surgery in 76.1 minutes on average. Mean follow up in present study was 35.93 weeks ranging from 24 weeks to 96 weeks. Yong Li *et al*¹³ in 2012 studied 46 patients and followed the patients for 24.7 months. Bone union was defined as presence of callus in at least 3 out of four cortices and patient able to walk without pain. Mean observed bone union time was 22.1 weeks. This is very much comparable to the various other studies. Nork *et al*¹⁴ in 2005 on 36 patients

observed 23.5 weeks as the average union time. Average hospital time that the patient had to spend in our hospital was 9.5 days. Yong Li *et al* [13] in 2012 studied 46 patients of similar characteristics and recorded 5.8 days as the average hospital stay time. Longer time was attributed to multiple reasons like indecisiveness of the patient and his family to consent for surgery, swelling of the limb, blisters, financial issues of the patients and remote location of their abode.

10% of the patients in the series had complaints of knee pain. This is lower than the study done by Arup K Daolagupu *et al* [7] in 2017 who studied 42 patients and had 23.80% of the patients treated there with knee pain. In this series the incidence of valgus was higher than varus. Majority of the patients (60%) had no deformity. Patients with valgus less than 5 degrees were the next major group with 33.33% of the total patients. 3.33% patients had valgus deformity with angulation in excess of 5 degrees and 3.33% patients had varus deformity with angulation in excess of 5 degrees. In the study by Nork *et al* [14], on 36 patients in 2005 on fractures located within 5 cm of the ankle joint treated by nailing an 8% rate of malunion was reported. No patient demonstrated loss of alignment during the follow-up period. In present study the incidence of sagittal plane deformity was minimum. Most of the patients (86.67%) had no deformity. This study had major chunk of patients with 0-5 degree of external rotation (93.33%). This was regarded as excellent as per Johner and Wruh's classification [15]. Use of atleast two screws in two different directions is advocated to prevent rotation deformity. 93.33% of the patients in our study had shortening less than 5mm. This is well accepted and does not cause any deformity to the patient. There was no shortening in patients with intact fibula and those in which fibula was fixed. In this series 83.33% patients had normal knee mobility, 86.67% had normal ankle movements and 96.67% patients had normal subtalar joint movements. These lower restrictions of movements was attributed to early post-operative mobilization. Patient was encouraged early active and assisted hip, knee, ankle and toe movements. None of our patient had hardware problems requiring implant removal.

The present study had categorized 53.33% of the patients as Excellent as per Johner and Wruh's classification. 36.67% had been labeled Good, 10% as Fair and none as Poor. 90% in toto had excellent and good results put together. This is in comparison with the study by Tyllinakis *et al* [16] in 2000 who treated 73 patients with non pilon distal tibial fractures with interlocking intramedullary nailing which concluded 86.3% satisfactory or excellent results. Pai Vasu *et al* [16] in 2007 studied 26 patients and stated excellent and good results together constituted 86.95% of the patients. No bone-grafting procedures were required to obtain union in any patient. One patient with delayed union underwent dynamization procedure following which the fracture united.

Limitations in this study include the small number of patients and the fact that multiple surgeons participated in the treatment. Furthermore, the ability to differentiate which fractures are appropriate for intramedullary nailing with adjunctive fibular stabilisation was largely qualitative and based on experience and an understanding of the fracture pattern. Open reduction internal fixation of distal third tibial fractures with plating is also a commonly used method. Yu J *et al* [18], in 2015 did a meta analysis on intramedullary nail versus plate treatments for distal tibial fractures and concluded that interlocking intra medullary nailing is advantageous over plate with lower superficial infections and comparable union time, operation time and hospital time.

However nailing has higher incidence of malunion. Another meta analysis by Guo C *et al* [19] in 2018 showed that intramedullary nailing reduced the time of surgery and the risk of wound complications compared with plate fixation. Furthermore, union time and union complications were common following both treatments. Overall, intramedullary nailing is found to be taken priority for distal tibial fractures. More RCTs are required to support current evidence.

5. Conclusion

Intramedullary nailing is a safe and effective technique for the treatment of extra articular distal third tibial fractures if careful preoperative planning is allied with meticulous surgical technique. Acceptable alignment of the distal fragment during surgery is necessary for good functional outcome. Knowledge and recognition of inherent instability of the distal fragment is necessary to enable stable fixation. Fibula fixation may aid in reduction but many delay union. Prospective, randomized, clinical trials are needed to determine the outcomes of methods of internal fixation in the management of extra articular distal metaphyseal tibial fractures.

6. Acknowledgement

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7. References

1. Bisaccia M, Cappiello A, Meccariello L, Rinonapoli G, Falzarano G, Medici A *et al*. Nail or plate in the management of distal extra-articular tibial fracture, what is better? Valuation of outcomes. SICOT-J. 2018; 4:2.
2. Sarmiento A, Gersten LM, Sobol PA, Shankwiler JA, Vangsness CT. Tibial shaft fractures treated with functional braces. Experience with 780 fractures. J Bone Joint Surg Br. 1989; 71:602-9.
3. Oh CW, Kyung HS, Park IH, Kim PT, Ihn JC. Distal tibia metaphyseal fractures treated by percutaneous plate osteosynthesis. Clin Orthop Relat Res. 2003; 408:286-91.
4. Christina B, Robert V. Rockwood and Green's Fractures in Adults. 8th ed. Philadelphia; USA: Lippincott, 2015.
5. Russell GV Jr, Pearsall AW IV. Intramedullary nailing of distal tibia fractures: A technique to prevent malalignment. Orthopedics. 2003; 26:183-185.
6. Vallier HA, Le TT, 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. 2008; 22(5):307-11.
7. Daolagupu AK, Mudgal A, Agarwala V, Dutta KK. A comparative study of intramedullary interlocking nailing and minimally invasive plate osteosynthesis in extra articular distal tibial fractures. Indian J Orthop 2017; 51:292-8.
8. Sarabjeet Kohli *et al*. Minimally invasive percutaneous plate osteo-synthesis in type 2 and type 3 AO distal tibia fractures. Sch. J App. Med. Sci. 2016; 4(3):1013-1028.
9. De Giacomo AF, Tornetta P. Alignment After Intramedullary Nailing of Distal Tibia Fractures Without Fibula Fixation. J Orthop Trauma. 2016; 30(10):561-567.
10. Vallier HA, Cureton BA, Patterson BM. Randomized, prospective comparison of plate versus intramedullary nail fixation for distal tibia shaft fractures. J Orthop Trauma. 2011; 25(12):736-41.
11. Satish R Gawali *et al*. Management of fractures of Distal third tibia by interlock nailing. The journal of foot and ankle surgery (Asia-Pacific), Jan to.2016; 3(1):15-22.

12. Morin PM, Reindl R, Harvey EJ, Beckman L, Steffen T. Fibular fixation as an adjuvant to tibial intramedullary nailing in the treatment of combined distal third tibia and fibula fractures: A biomechanical investigation. *Can J Surg.* 2008; 51:45-50.
13. Li Y, Liu L, Tang X, Pei F, Wang G, Fang Y *et al.* Comparison of low, multidirectional locked nailing and plating in the treatment of distal tibial meta diaphyseal fractures. *Int Orthop.* 2012; 36:1457-62.
14. 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):1213-21.
15. Johner R, Wruhs O. Classification of tibial shaft fractures and correlation with results after rigid internal fixation. *Clin Orthop Relat Res.* 1983; (178):7-25.
16. Tyllianakis M, Megas P, Giannikas D, Lambiris E. Interlocking intramedullary nailing in distal tibial fractures. *Orthopedics.* 2000; 23(8):805-8.
17. Vasu P, Gareth C, Vishal P. Minimally invasive plate fixation of the tibia. *Int Orthop (SICOT).* 2007; 31:491-496.
18. Yu J, Li L, Wang T *et al.* Intramedullary nail versus plate treatments for distal tibial fractures: a meta-analysis. *Int J Surg.* 2015; 16(Pt A):60-68.
19. Chaowei Guo, Jianxiong Ma, Xinlong Ma *et al.* Comparing intramedullary nailing and plate fixation for treating distal tibial fractures: A meta-analysis of randomized controlled trials. *International Journal of Surgery.* 2018; 53:5-11.