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Research Article

Interlocking nailing in fractures of distal tibia

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ABSTRACT

Background: The complex biomechanics of distal tibial fractures, lack of robust soft tissue coverage and a wide metaphysis makes their treatment a challenging prospect even for experienced surgeons.
Methods: A total of 42 patients of distal tibia fracture were treated with reamed intramedullary nailing. Fibula was fixed in selected cases either with nailing or a low profile plate. Outcome was measured with Klemm and Borner criteria.
Results: In this study 42 patients treated with reamed IM nailing were included. Fractures were classified according to AO classification. In present study, we got 22 patients (53.38 %) of fracture 43A1, 11 patients (26.19%) 43A2 and 9 patients (21.42%) 43A3 type. Fibular fracture was fixed with plate in 16 patients and intramedullary device in 15 patients. In the study all the fractures united. Mean time for union was 21 weeks. Time range for union was from 12-34 weeks. Four patients had mal-alignment. One patient had superficial infection which was treated with oral antibiotics. In the present study, 35 (83.33%) patients had no loss of ankle motion, while 5 (11.90 %) had loss of <25 degrees and 2 had loss of 25 degrees. Out of 42 patients, 33 (78.58%) patients had excellent results while 5 (11.90%) patients had good results, 4 (9.52%) patients had fair results.
Conclusions: Intramedullary nailing is an effective alternative for the treatment of distal metaphyseal tibial fractures. A proper patient selection, adjuvant fixation of fibula and use of at least two distal interlocking screws is suggested for better outcome.

Keywords: Distal tibial fractures, Intramedullary nailing, Interlocking nailing

INTRODUCTION

Treatment of a distal tibial fracture is a challenging prospect even for the most experienced surgeon. Tibia is a subcutaneous bone with vulnerable soft tissue coverage and is therefore predisposed to local soft tissue problems and delayed bone healing. The risk of soft tissue breakdown and bone healing complications is more likely related to open reduction and plating. Due to peculiar biomechanical characteristics of distal tibial fractures and due to lack of interference fit between nail and endosteum stable fixation with nailing is difficult. Newer generations of nails with multiple locking options have encouraged surgeons to use intramedullary nailing in fractures of distal tibia.[1,2]

METHODS

This study was conducted in the department of Orthopaedics, from May 2012 to October 2014 on patients having fracture of the distal tibia. This study included 42 patients of distal tibia fractures with age ranging from 23-71 years. All distal tibia fracture that were extra-articular and upto grade 1 compound were included. Simple fractures of distal tibia with minimum soft tissue injury were posted for surgery as soon as possible in the next surgery day. For those patients, who did not have skin and soft tissue condition suitable for immediate surgery, surgery was delayed until soft tissue condition improved. All the fibular fracture which were at the level of tibial fracture or below were fixed first

with either rush nails (in case of transverse fractures) or low profile plates (in oblique /communited fractures). Tibial fractures were fixed with reamed intramedullary nails and at least 2 distal interlocking screws. Poller screws were used intraoperatively to assist in reduction and subsequently removed after locking. Immedialte postop partial weight bearing and physiotherapy was started. Full weight bearing was allowed after clinical and radiological signs of union. Evaluation of functional outcome was done by Klemm and Borner's criteria - Table 1 for evaluation of final results, as given below.[3]

Table 1: Klemm and Borner's criteria.

Excellent	**Full knee and ankle motion No muscle atrophy Normal radiographic alignment**
Good	Slight loss of knee and ankle motion Less than 2 cm of muscle atrophy Angular deformity less than 5^0
Fair	Moderate (25^0)loss of ankle and knee motion More than 2 cm muscle atrophy Angular deformities 5^0- 10^0
Poor	Marked loss of ankle and knee motion Marked muscle atrophy Angular deformities greater than 10^0

RESULTS

During May 2012 to October 2014, total 67 patients were admitted to the hospital with fracture of distal tibia with associated injuries and treated with various modes of treatment, out of which 42 patients having fracture of distal tibia were included in this study according to inclusion and exclusion criteria for final evaluation of the result. Mean age was 46.19 years and most of the patients were male (78.6 %). Fractures were classified according to AO classification.[4] 22 (52.38%) fractures were of AO type A1, while 11 (26.19) were A2 and 9 (21.42) were A3 type.

In the present study out of total 42 cases, in 40 cases (95.23 %) two locking screws were put distally while in 2 patients (4.76%) only single locking screw was put due to fracture geometry.

In present study, fibula was fixed with plate in 16 patients (38%), intramedullary device in 15 patients (36%) and not fixed in 11 patients (26%) as they were proximal (Table 2).

Union was defined as the presence of bridging callus on two radiographic views and the ability of the patient to bear full weight on the injured extremity. All the fracture united. The time for union ranged from 12-34 weeks with an average of 21 weeks. 17 fractures healed before 20 weeks, 22 fractures healed between 20 to 32 weeks while 3 fractures took 32 or more weeks to unite.

Table 2: Various methods of fixation of fibula.

Treatment of fibula fracture	No. of patients	percentage
Plate	16	38.09
Intramedullary device	15	35.71
Left without fixation	11	26.19
Total	42	100%

In 3 cases (7.14%) with delayed union dynamization (removal of proximal static locking screw) was done after 12 weeks. Malalignment was defined as angulation in a coronal plane (varus-valgus) of >5°, Sagittal plane (antero-posterior) angulation of >10° or >10 mm of shortening. Malrotation was evaluated by comparing the amounts of internal and external rotation of the injured extremity with those of the uninjured extremity. In four cases malalignment was noted. In two cases 5° of varus angulation was noted. One case had varus angulation of 10 degrees. In one case anterior angulation of 10 ° was noted. One patient had superficial infection and was treated with oral antibiotics. 8 patients reported anterior knee pain but it was not severe enough to cause any functional deficit. In the present study, 5 patients had <25° while 2 patients had ≥25° loss of ankle motion.

Table 3: Functional outcome on basis of Klemm and Borner criteria.

Klemm and Borner criteria	No .of patient	Percentage (%)
Excellent	33	78.58
Good	5	11.90
Fair	4	9.52
Poor	0	0
Total	42	100%

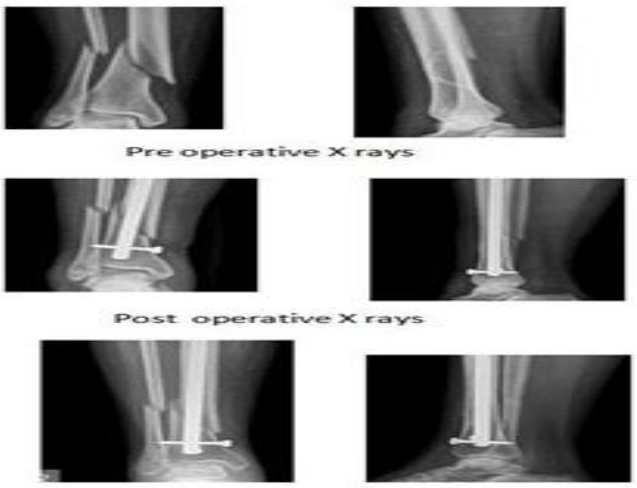

Figure 1: Case 1-distal tibial fracture fixed with lacking nail without fixation of fibula.

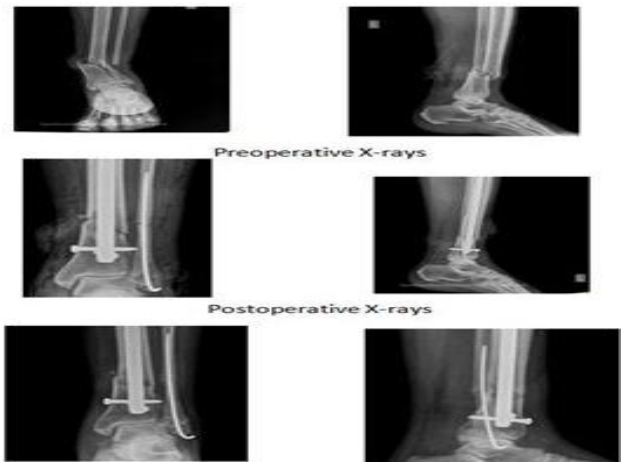

Figure 2: Case 2-distal fibular fracture fixed by rush nail.

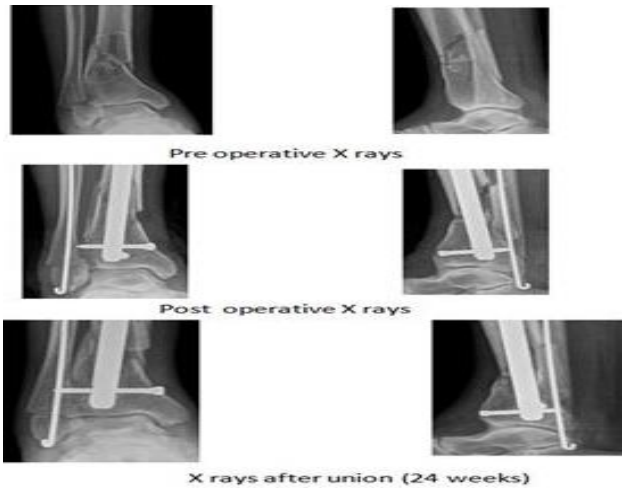

Figure 3: Case 3-distal tibial fracture fixed with intramedullary nails showing malunion.

Out of 42 patients, 33 (78.58%) patients had excellent results while 5 (11.90 %) patients had good results, while 4 (9.52 %) patients had fair results.

DISCUSSION

Intramedullary nailing is widely accepted for treatment of diphyseal fractures. Modifications in the nails have now extended its use to more distal and proximal peri-articular fractures. Nails now have multiple locking options near the tip to increase fracture stability. Many properties of intramedulalry nailing make them a popular option for fixation of distal tibia fractures. Nail is a load sharing device and resists both axial and tortional forces. It preserves the soft tissue sleeve around fracture site which allows early motion of adjacent joints. Use of image intensifiers have made possible locking, which provides control of length, alignment and rotations in unstable fractures. Closed nailing involves least disturbance of soft tissue, fracture hematoma and natural process of bone healing as compared to other forms of internal fixation.

In this study, we used stainless steel interlocking nails in all patients for surgery. In majority of cases minimum of two interlocking screws were placed distally. Only in 2 cases single screw was placed due to fracture configuration. Lucas studied biomechanical effect of distal locking screws.[5] When choosing intramedullary fixation for the treatment of distal tibia metaphyseal fractures, they suggested that two medial to lateral screws provides the necessary biomechanical stability for satisfactory fixation and is clinical beneficial. Mohammed et al studied relation of nonunion and distal interlocking and showed that there was a high incidence of non-union in distal third tibia fractures treated with IM nailing when only one distal locking screw was used.[6] Therefore, they recommend two distal locking screws in IM nail fixation of distal third tibia fractures. If two distal locking screw insertions are not possible due to the distal nature of the fracture, they recommend an alternate form of fixation. Kneifel and Buckley compared one distal locking screw to two in tibial fractures treated with unreamedtibial nails.[7] One distal locking screw failed (59.1%) significantly more often than two distal screws (5%). However, there was no significant difference between groups with respect to fracture union. But in present study we did not find any problem of union with single distal locking screw.

In present study, we fixed fibula with plate in 16 patients and intramedullary device in 15 patients to restore fibular length and did not fix fibula in 11 patients, as fracture was proximal in most of the cases, fibular length was maintained and intraoperatively reduction of tibial fracture was stable and acceptable.

Fibular fixation is necessary because it increases rotational stability, allows early weight bearing, restores ankle mortise, and prevents the development of posttraumatic arthritis, permanent swelling, and limitation of movements of the ankle joint. It is very important to restore the original length and rotation of the lateral column of the ankle joint. Although there is no general agreement in the literature.

The need for fibular fixation in such fractures is controversial. Many agree that fibular fractures associated with syndesmotic or ankle mortise instability should be stabilized, as malreduction of the ankle mortise has been shown to be a factor in poor functional outcomes, but there is no consensus over the role of fibular fixation in extraarticular fractures of the distal tibial metaphysis. Egol and colleagues retrospectively evaluated adjunctive fibula fixation in distal tibia fractures and found a loss of tibial alignment when the fibula was not fixed.[8] Morin et al found that fibular plating in addition to tibial IM fixation of distal third tibia and fibula fractures leads to slightly increased resistance to torsional forces but this small difference was not likely to be clinically relevant.[9] Attal et al investigated the role of supplementary fibular plating in the treatment of distal tibial fractures using an intramedullary nail and found that in conventional

biplanar locking nails, fibular plating improved stiffness at the tibial fracture site, to a small degree (p = 0.013).[10] In the multidirectional locking nails additional fibular plating did not increase the stiffness. They suggested that additional fibular plating does not improve stability if a multidirectional distal locking intramedullary nail is used, and is therefore unnecessary if not needed to aid reduction.

Intramedullary nailing is difficult to perform because the diameter of the tibial distal metaphysis is wider than the diameter of the nail. Furthermore, because the diameter of the nail is smaller than the diameter of the tibial metaphysis, angulations may occur in the sagittal and frontal planes.[11] The most commonly accepted reduction criteria include a varus/valgus angulation less than 5°, and anteroposterior angulation less than 10°, rotation less than 10°, and shortening less than 15 mm.

In this study we had 4 patients with malalignment. In two cases 5° of varus angulation was noted. One case had varus angulation of 10 degrees. In one case anterior angulation of 10 ° was noted. No case of rotational deformity was noted. None of the patient received corrective procedures.Out of 42 patients, 33 (78.57%) patients had excellent results while 5 (11.90%) patients had good results, while 4 (9.52%) patients had fair results. In the present study, we got excellent – good result in 90.47%.This could be the result of exclusion of intraarticular and grade II and grade III compound injuries from the study.

Our study showed that there were a few cases of delayed union, malalignment and superficial infection in distal tibia fracture treated with intramedullary interlocking nailing. In present study in majority of the cases, two distal locking screws were used and the fibular fracture fixation was carried out. Knowing the challenging biomechanical nature of the distal tibia and its limited soft tissue coverage that makes open fixation modalities rather risky, intramedullary interlocking nailing may still offer a good treatment option for extra-articular distal tibial fractures. With our experience of present study we recommend this as an effective option, though careful technique and patient selection are crucial. The risk and benefits of its use should however be carefully weighed before surgery.

CONCLUSION

Intramedullary nailing is an effective alternative for the treatment of distal metaphyseal tibial fractures. A proper patient selection, adjuvant fixation of fibula and use of at least two distal interlocking screws is suggested for better outcome.

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