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Role of fibular fixation in static intramedullary interlocking nailing for distal third tibia and fibula fractures

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Abstract

Treatment of distal third tibia and fibula fractures remains a challenge classically being treated with standard plating, but intramedullary nailing has gained popularity. As there is a mismatch between the diameters of the nail and the medullary canal, with no nail-cortex contact, the nail may translate laterally along coronally placed locking screws and increased stress in placed on the locking holes to maintain fracture alignment after surgery. Various techniques have been recommended to improve nailing in these fractures including fibular plating (distal third fractures), temporary unicortical plating, different nail design with different proximal bends (proximal third fractures) and blocking screws (poller screws). The aim of the study is to evaluate the clinical use of fibular plating as a supplement to stability in addition to intramedullary nailing in distal both bone fractures of leg.

Methods: A prospective study of 20 cases of distal third tibia fibula fractures treated with statically locked intra medullary nailing with supplementary fibular plating between March 2017 and September 2018 at RIMS, Ranchi. All the fractures were followed through till union of fracture with clinical and radiological examination at intervals of 4 to 6 weeks. On follow up axial alignment was assessed and functional analysis was quantified using Karlstrom – Olerud score. Complications were divided into those which were related to fibular plate and those which were not.

Results: All the fractures eventually united in a mean period of 12.8 weeks. Karlstrom-Olerud score was excellent in 12 fractures (60%), good in 5 patients (25%) and fair in 2 patients (10%) and poor in 1 patient (5%). The alignment was maintained in coronal plane till union with the mean remaining the same i.e 1.6 degrees. The mean sagittal plane alignment at the time of union was 0.4 degrees, the loss of alignment was not statistically significant. The fibular plate related complications were encountered in two cases where we had skin necrosis and deep infection, which needed aggressive antibiotic therapy and those patients were also given cast support for twelve weeks.

Conclusion: Fibular plating, when supplemented the intramedullary nailing of distal third tibia fibula fractures, were effective in achieving the fracture alignment especially in fresh fractures, Improves not only angular stability but also rotational stability, Maintained the fracture alignment till union and prevents loss of initial reduction.

Keywords: Distal third tibia fibula fractures, Fibular fixation, IM nailing

Introduction

Treatment of distal both bone fractures of leg remains a challenge. The goals of surgical management include correction and maintenance of sagittal and coronal alignment, establishment of length and rotation and early functional range of movements of knee and ankle. Treatment options include medullary implants, half pin, thin wire or hybrid external fixation, plate fixation or combination techniques. Interlocking nailing of tibial fractures are desirable because this technique allow some load sharing, spares extraosseous blood supply, avoids extensive soft tissue dissection and is familiar to most surgeons. Nailing of distal tibial fractures with short distal fragment is associated with an increase in malalignment particularly in coronal plane, non union and need for secondary procedures to achieve union ^[1]. The cause has been attributed both to displacing muscular forces and residual instability. As there is a mismatch between the diameters of the nail and the medullary canal, with no nail-cortex contact, the nail may translate laterally along coronally placed locking screws and increased stress in placed on the locking holes to maintain fracture alignment after surgery ^[2]. Various

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Various techniques have been recommended to improve nailing the distal both bone fractures of leg including fibular plating (distal third fractures), temporary unicortical plating, different nail design with different proximal bends (proximal third fractures) and blocking screws (poller screws). The Aim of the study is to evaluate the clinical use of fibular plating as a supplement to stability in addition to intramedullary nailing in distal both bone fractures of leg.

Fibular plating was selected for use for one or more of the following reasons

1. To correct alignment before insertion of nail
2. To maintain alignment or to improve the stability of bone implant complex
3. To achieve rotational stability

Methods

This was a prospective study of 20 cases of distal third tibia fibula fractures treated with statically locked intra medullary nailing with supplementary fibular plating between March 2017 and September 2018 at RIMS, Ranchi.

Inclusion Criteria

Displaced distal third both bone fractures of leg in adults treated with intramedullary nailing were included in this study. The fractures included were acute fractures and delayed union.

Exclusion Criteria

- Distal tibial fractures with articular extension (pilon fractures)
- Comminuted fibular fractures and gustillo grade 2 and 3.

X ray of the injured leg in AP & Lateral views taken. The fracture tendency for valgus or varus and antecurvatum or recurvatum malalignment was noted. The angle of malalignment was measured. All routine investigations were done. Approximate length of the nail was measured in the contralateral leg, from the tibial tuberosity to medial malleolus. In this technique, distal both bone fractures of leg were stabilized with statically locked intramedullary nail along with fibular plating on a standard radiolucent table with manual traction under spinal anesthesia. Tourniquet was not used in any case.

Operative Technique

Through a posterolateral incision Fibular fracture site exposed, freshened and reduced fibular plating done with appropriate one third tubular plate and cortical and cancellous screws. Then through a patellar tendon splitting approach, entry point was made in the midline progressive reaming done and guide wire was passed under image intensifier. The alignment was confirmed in both coronal and sagittal plane with image intensifier control reduction verified if not satisfactory fracture site opened tibia reduced and intramedullary nail introduced and locked with one or two proximal screws and two or three distal screws.

Partial weight bearing was started after three weeks in all except three cases. In two cases the distal screw purchase in fibula is poor as it is so osteoporotic, we recommended non weight bearing till radiological evidence of union and in the other case the reduction of tibia was so unstable, partial weight bearing could not be started. In these cases cast support was given for 4 weeks.

Partial weight continued up to 6 to 8 weeks thereafter full weight bearing started depending on clinical and radiological

evidence of union. All the fractures were followed through till union of fracture with clinical and radiological examination at intervals of 4 to 6 weeks. The maximum follow up was 12 months. On follow up axial alignment was assessed and functional analysis was quantified using Karlstrom – Olerud score.

Results

There were 14 males and 6 female patients with a mean age of 38.47 years. The injury was on the right side in 16 cases. The mechanism of injury was Road traffic accident in all except there in whom it was fall from height in three cases. Injury was closed in 17 fractures and Gustillo Anderson grade 1 in 3 patients. All the fractures eventually united in a mean period of 12.8 weeks. Karlstrom-Olerud score was excellent in 12 fractures (60%), good in 5 patients (25%) and fair in 2 patients (10%) and poor in 1 patient (5%). Radiologically the mean post operative varus/valgus alignment was +1.6 degrees when compared to the mean preoperative varus/valgus alignment of + 10.2 degrees. The alignment was maintained till union with the mean remaining the same in the coronal plane.

Table 1: Coronal Plane Alignment (Varus/Valgus)

	N	Mean (in degrees)
Pre-op	20	10.6
Post-op	20	1.6
At Union	20	1.6

The mean post operative antecurvatum/ recurvatum alignment was 0.3 degrees when compared to the mean operative antecurvatum/ recurvatum alignment of 7.5 degrees. The mean antecurvatum / recurvatum alignment at the time of union was 0.4 degrees, the loss of alignment was not statistically significant.

Table 2: Sagittal Plane Alignment (Procurvatum/Recurvatum)

	N	Mean (in degrees)
Pre-op	20	7.5
Post-op	20	0.3
At Union	20	0.4

The fibular plate related complications were encountered in two cases where we had skin necrosis and deep infection, which needed aggressive antibiotic therapy and those patients were also given cast support for twelve weeks. But the alignment was achieved and maintained and the fracture united within 18 weeks. No other complication of tendon injury or compartment syndrome were encountered.



Fig 1: Pre and Post-op Xrays of Distal tibia fibula fracture treated with IM interlocking nail Supplemented with fibular fixation

Discussion

The primary aim of the study was to analyze the effectiveness of achieving and maintaining reduction in distal both bone fractures of leg treated with intramedullary nailing using supplementary fibular plating. As described in various literatures the malalignment in these circumstances were significantly high when done without any supplementary procedures.

James Kellam ^[3] in his commentary and perspective on the effect of fibular plate fixation on stability of simulated distal tibial fractures treated with intramedullary nailing by Anand Kumar *et al.* concluded that meticulous intramedullary 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.

Kenneth A Egol ^[4] compared the loss of alignment in distal metaphyseal fractures treated with intra medullary nailing alone. They had immediate post operative malalignment in three cases in those treated with nailing alone, which were eventually corrected by using fibular plating or poller screws.

Richter⁵ in his prospective study of distal tibial fractures stabilized with undreamed nailing noted a rate of complications in in distal fractures of fibula without additional plating of fibula. They recommended additional plating for distal fibular fractures.

A. Bedi, T.T. Lee and M.A Karunakar ^[6] in their studies proved that in patients with ipsilateral distal tibial and fibular fractures who are treated with Russel and Taylor intramedullary nailing of tibia, rotational stability of the tibial fracture can be increased by plate and screw fixation of the fibula, which may reduce the risk of varus/valgus malunion.

Fibular plating improved the stability of the metaphyseal fractures after nailing and promoted union in our study. The proportion of fractures that lost alignment were minimal among those receiving stabilization of the fibula in conjunction with intramedullary nailing in many studies as compared with those receiving intramedullary nailing alone. The reduction should be ensured in two planes with image intensification after placing the fibular plate and before applying the tibial locking screws. We found that interlocking nailing when supplemented with fibular plating did influence the stability or 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. We had excellent to satisfactory outcome in 85% by Karlstrom-Olerud scoring which is comparable to the results of studies conducted by Tyllianikis ^[7] *et al.* with 86% excellent to satisfactory.

Conclusion

We conclude that fibular plating, when supplemented the intramedullary nailing of distal both bone fractures of leg, were effective in achieving the fracture alignment especially in fresh fractures, Improves not only angular stability but also rotational stability, Maintained the fracture alignment till union and preventing loss of initial reduction.

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