Original Article

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The Role of Fibular Fixation in Distal Tibial Fractures

Orthopaedics Section

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ABSTRACT

Introduction: Lower tibial extra-articular fractures of lower tibial extra-articular bone, treated with Minimally Invasive Percutaneous plate osteosynthesis (MIPPO) may have certain advantages, though the modiality is technically demanding.

Aim: To assess the results of distal tibial fractures treated with minimally invasive plate osteosynthesis utilizing precontoured dital medial tibial locking plates without fibular fracture fixation.

Material and Methods: The study was conducted during the period from june 2009 to june 2011. A series of 30 patients (22 men and 8 women) with concurrent distal tibia and fibula fractures who underwent minimally plate osteosynthesis utilizing precontoured distal tibial medial locking plates without fibular fracture fixation have been reviewed after surgery. 14 fractures were type A1, 6 type A2, and 4 type A3. Open Grade II fracture were 4 and Open Grade IIIA fracture is2.

Results: The mean follow-up duration was 2 years. The mean time to bone union was 20 weeks. No patient had shortening, hardware breakdown, or deep-seated infection.

Out of 30 patients, 24 had excellent results, 6 had good results. Four patients had palpable screws, two patient had blisters which subsidized with conservative treatment. This minimally invasive technique for treatment of distal tibial fractures proved to be a feasible and worthwhile method of stabilization.

Conclusion: It appears from our study that fibula fixation is not required in non-syndesmotic distal metaphyseal extra articular fractures when fixed by locking plate using minimal invasive techniques.

Keywords: Distal tibial fractures, Fibular fixation. Minimally invasive technique.

INTRODUCTION

Lower tibial extra-articular fractures occur following complex high-energy injuries, which may involve associated, ankle fracture, fibular fractures and/or soft tissue injury. Minimally invasive percutaneos plate osteosynthesis (MIPPO) is technically demanding, but has an advantage of minimizing the soft tissue damage and periosteal stripping [1,2]. Unstable plafond fractures where intramedullary nailing is not possible are the most common indications [3]. In such situations fixation of fibula fractures when associated is said to be not clear- because of the soft tissue injury, two nearby incisions, swelling and a doubtful delayed union of lower tibia fracture . The MIPPO technique, using cortical as well as locking screws for the anatomical precontoured locking plates, are hence used in these cases. Since this is a rigid / semirigid fixation without much compression at the fracture site, the postoperative protocol is almost like that of intramedullary nailing. The weight bearing is allowed as the fracture healing progresses. The plate fixation is more biological ie; results in less blood loss, causes minimal soft tissue stripping, the compression at the fracture site is less, maintains axial alignment, are rotationally stable [3].

Tibial fractures are seen in less than 7% fractures and less than 10% of all lower limb fractures and again 15% of all distal tibia fractures are extra-articular [4,5].These fractures are common , following road traffic accidents [2,3,6].

Since the muscles and soft tissues covering are less in the lower leg hence the fracture will tend to be an open fracture [2]. Thus, the complications of infection (16%), soft tissue damage [7], delayed union (14%) are more common in distal tibia fractures [8].

The incidences of associated lower fibula fracture is also equally high (80%) and when it is associated , it is usually a result of high energy trauma and such fractures are very unstable [9]. Skin and soft tissue trauma are more vulnerable. Our study uses these principles and techniques in treating distal tibia fractures as well as avoiding fibula fracture fixation.

MATERIALS AND METHODS

A series of 30 patients (22 men and 8 women) with concurrent distal tibia and fibula fractures underwent minimally plate osteosynthesis utilizing precontoured dital tibial medial locking plates without fibular fracture fixation. The outcome of the surgery was assessed and the patients were followed up clinically and radiographically during the post-operative period. 14 fractures were type A1, 6 type A2, and 4 type A3. Open Grade II fracture were 4 and Open Grade IIIA fracture were 2.

Inclusion criteria

Extra-articular distal tibial metaphyseal fractures with concomitant fibular fracture at or above the level of the distal tibio-fibular syndesmosis.

- Age group: 18 – 70yrs
- Closed and open fractures grade I, II, IIIA

Exclusion criteria

- Fibular fracture below the level of distal tibio-fibular syndesmosis and tibial pilon fractures.
- Delayed presentations

For minimally invasive plate osteosynthesis of distal tibial fractures, the patient was placed supine on radiolucent table. The plate position was medial , the length of the plate was determined by fracture geometry and the locking plate principles. Distal 3cm incision over medial malleolus was taken, the plate passed over the medial aspect of tibia proximally under fluoroscopic guidance. A 4mm and 5mm locking screws were placed at each end of the plate through the two incisions and in the mid position via small percutaneous stab incisions. The distal metaphyseal articular fragment was indirectly reduced to the proximal shaft. Post-operatively the limb was positioned with strict elevation, cryo application, gentle ankle-toes movements. Absolute non- weight bearing walking in the first post-operative month was mandatory,

later partial to full weight bearing was started as the fracture healing progressed [3,7,8] and radiological bony union appeared.

The evaluation was done based on Teeny and Wiss clinical assessment criteria [Table/Fig-1] [10].

RESULTS

Most of the patients were in age group of 20-50 years (70%) with mean age of 36 years. Road traffic accidents were found to be the most common mode of trauma (90%). Right limb was involved more often (70%) than the left. The time taken for partial weight bearing, mean time for starting partial weight bearing, time taken for full weight bearing, time for starting full weight bearing & time interval for complete union are shown in [Table/Fig-2]. The mean interval for radiological union was 20 weeks. The range of motion at the ankle & degrees of dorsi & plantar flexion is shown in [Table/Fig-2].

Excellent	(>92 points)
Good	(87-92 points)
Fair	(65 - 86 points)
Poor	(<65 points)

[Table/Fig-1]: Clinical results graded as excellent, good, fair or poor as per Tenny Wess criteria[10].

S.No.	Characteristics		No.
1.	Age (yrs)	Range (21-57)	Mean age 36
2.	Sex	Male Female	22 08
3.	Mode of trauma		
		Automobile accidents Fallstairs/height	27 03
4.	Limb side injured		
		Right left	21 09
5.	Time taken for weight bearing (wks) mean		
		Partial Full	6 20
6.	Time for radiological union (wks)		20
7.	Range of motion at ankle (degrees)		
		Dorsiflexion Plantar flexion	(Average) 15 (Average) 30
8.	Complications		6
9.	Result grading		
		Excellent Good Fair	24 06 00

[Table/Fig-2]: Characteristics of Minimally Invasive Technique.

DISCUSSION

Debating the need for fibular fixation

The need for fibular fixation in such fractures is somehow not clear. Many researchers agree, but there is no consensus over the role of fibular fixation in extra-articular fractures of the distal tibia.

It was seen in a study by Lambert [11] that the fibula carries a total of 1/6 of the load applied to the knee joint also the load distribution is around 6% and 7% of the total load transmitted through both the tibia and fibula [12,13].

From plantar flexion to dorsi flexion of the ankle, Close [14] reported an increase in intermalleolar distance of 1.5 mm and lateral rotation of the fibular by 2.5°. This is usually seen due to the trochlear shape of the talar dome being wide anteriorly and narrow posteriorly. It was demonstrated that the fibula usually descends approx 2.4 mm during stance phase of gait [15].

The interosseous membrane between the tibia and fibula has been shown to function as a conduit for stress transmission, creating a load sharing function of the fibula. In a holographic investigation of cadaveric limbs, complete sectioning of the interosseous membrane revealed that there was an reduction in fibular load transference by 30% [16]. In another study, complete transection of the interosseous membrane revealed that the fibular strains to almost zero [17]. These findings suggest that the tibia bears most of the weight bearing stress during the disruption of interosseous membrane.

The historic reasons for fibular fixation in distal tibial fractures are based on the findings by Ruedi and Allgower [1], in 1969. They have described the principles and classic technique for open reduction with internal fixation of the distal tibial intra-articular fracture as:

- fibular length maintainance;
- reconstruct the articular surface of the distal tibia;
- use of autogenous cancellous bone to fill the tibial metaphyseal gap
- stabilising tibia with a medial plate.

These principles still form the standard of care. The importance of fibular reconstruction and accurate restoration of the articular surface of the distal tibia was considered as an important criteria for good functional outcome in these fractures [1,4,5]. These ideas were used in experimental studies and they showed that malreduction of fibular fractures at the level of ankle joint have often lead to increased focal pressure on the joint surface, which then can lead to early degenerative arthritis [18,19]. It has been shown that the distal metaphyseal fractures with syndesmotic injury and fibula fracture need fibula fixation [2,3,10]. The clinical outcome also depends on other factors - whether syndesmotic injury is present or not [20].

Few studies confirmed that fibula fixation improves mechanical stability of middle third tibia fractures also [21].

Disadvantages of adjunctive fibular fixation in distal tibial fractures

Increased soft tissue envelope morbidity: High-energy fractures of the distal tibia are often associated with a high incidence of soft tissue trauma along with a high incidence of wound infections and necrosis [1,22]. This high incidence of complications suggests that a more open approach should be utilized.Correspondingly, open reduction internal fixation of the fibula are often accompanied by an increased rate of wound complications [23].

Effects of an intact fibula: There are no studies that demonstrate the effect of fibular fixation on union rates of tibial fractures. However, several clinical reports have demonstrated that fracture stability of the distal tibia with an intact or stabilised fibula does not ensure successful healing. Teitz et al., [24] examined the effects of an intact fibula associated with a tibial fracture. They found that distal tibial fractures in patients aged 20 years or older with an intact fibula had a 61% complication rate including 22% delayed union, 4% nonunion and 26% varus malunion. Other reports of delayed tibial fracture healing with an intact or healed fibula have suggested that an intact fibula may prevent cyclic compression of the fractured tibia necessary for physiologic bone healing. Minimally invasive techniques are based on principles of limited exposure, indirect reduction methods and limited contact between bone and implant. As a result, in the present study, we could avoid major soft tissue complications and shorten the length of the patient's stay in the hospital [3,6]. The bone healing was excellent with this type of fixation because the stresses were distributed over a longer segment of bone [25].

CONCLUSION

Hence, it can be concluded that minimally invasive percutaneous plate osteosynthesis for distal tibia fractures without fibula fixation is more feasible and has less complications.

The concept is not clear about the fibula fracture fixation in distal metaphyseal extra articular tibia fracture with non syndesmotic fibula fracture. In such situations fixing fibula fracture may invite more local soft tissue morbidity. Hence in such distal tibia and fibula fractures, stabilisation of tibial fracture alone with distal medial locking plate using minimally invasive technique is proved to be a feasible and worthwhile method of stabilization.

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