Minimally invasive plate osteosynthesis for the treatment of proximal tibial fractures

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ABSTRACT

The concept of biological osteosynthesis refers basically to the conservation of vascularity of the bone during surgical intervention to ensure the continued vitality of the individual fragments and to achieve improved fracture healing. Intramedullary nailing has become the standard of care for most displaced tibial shaft fractures. However, proximal tibial fractures are difficult to control with an intramedullary device, increasing the frequency of malalignment. Also, Metaphyseal comminution is a challenge to conventional plate fixation. The present study was carried out for evaluation & analysis of the role of minimally invasive plate osteosynthesis in cases of Proximal tibial fractures. Total of 50 patients were taken up & after proper pre-operative assessment, plating was done and the results were evaluated. On the basis of the finding of this study it was concluded that: MIPO technique preserves most of the osseous vascularity thus providing for a more biological repair.

Keywords: Proximal tibial fractures, Minimally invasive plate osteosynthesis

INTRODUCTION

A fracture is the result of mechanical overload with important biological consequences. Proper understanding of mechanical and biological aspects of fracture repair is key to selection of type of treatment for a particular fracture.

With the damage to soft tissues following the high energy of proximal tibial fractures, conventional open reduction and internal fixation often result in substantial soft tissue complications such as wound breakdown and deep infection. It is now preferred to have a stable biologic fixation than a rigid fixation. This again is based on results of extensive laboratory and clinical studies. In biological fixation utmost respect is given to soft tissues and vascularity of the bone. The term rigid fixation was mainly used in the context of plating used for fixation of fractures.

Biological plating is the concept that is particularly useful in comminuted articular or metaphyseal fractures that cannot be nailed. This technique described by Mast et al. uses “indirect reduction”, which minimises direct exposure and muscle stripping, reducing the fracture by distraction using either a distractor, tension device, or lamina spreader. In 1997, Wenda and Krettke introduced a percutaneous plating technique called “minimally invasive plate osteosynthesis (MIPO)”. Farouk et al. studied the vascular supply to the femur in the cadaver and compared the effects of two surgical plating techniques, the conventional lateral plate osteosynthesis and MIPO, on femoral vascularity. The results showed that MIPO maintained the integrity of the perforators and nutrient arteries and was associated with superior periosteal and medullary perfusion. Wenda et al. reported 17 cases of comminuted femoral fractures treated with the MIPO technique, where 13 cases had excellent healing and three needed bone grafting. There were no infections nor bleeding from perforator vessel injury. MIPO does not make bone graft unnecessary but reduces the rate significantly compared to conventional plating in complex fractures. The MIPO technique allows biological fracture healing by preserving the vascularity of all bone

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fragments, thus serving as a living bone graft.

The objective of biologic fixation is to assist physiological process of bone healing wisely and optimally with minimal amount of operative intervention. Stress is laid on maintaining a precarious balance between devascularisation and mechanical perfection.

MATERIAL AND METHODS

50 patients of proximal tibial fractures were operated by minimally invasive plate osteosynthesis and results were observed.

For proximal tibial fractures, patients were placed supine on a fracture table to allow access to the image intensifier. Closed reduction of the fracture was done. The whole of operative limb was cleaned. For proximal tibial fractures the anteromedial/antrolateral approach was used. A 2 cm incision was made proximal to the fracture site and a subcutaneous tunnel was created with the help of a periosteal elevator. The appropriate length of the plate (T- buttress or a locking compression plate) was determined by placing a plate along the anterior aspect of the leg and adjusting it so that under fluoroscopy the proximal end of the plate is just below the joint line and the distal end extends at least three screw holes beyond the distal limit of the tibial fracture. The plate was then slid subcutaneously across the fracture site to reach distal fragment. Another 2 cm incision was given distally where the plate ended. This plate was then contoured precisely to conform to the condyle and proximal metaphyses and secured to the condyle with appropriate locking/cortical/cancellous screws of sufficient length.

Post-operative check x-rays was taken to access the reduction. Active knee mobilisation and static quadriceps exercises were allowed at postoperative day 1. Weight bearing

Fig 1. Showing incision and plate insertion

Fig 2. Pre-op and post-op x-ray of proximal tibial fracture fixed with mipo technique

Fig 3. Photograph showing range of motion at knee in post-op case of proximal tibial fracture
was initiated depending on the radiological evidence of bone union. Full weight bearing was not permitted until consolidation of the fracture site. The progress of healing was assessed with routine anteroposterior and lateral radiographs at 4 weekly intervals up to 24 weeks, then every 3 months up to one year, and 6 monthly thereafter. Clinical and functional outcomes were assessed using criteria laid down by Savoie et al (1987).6

RESULTS
In this study mean age of patients was 33.6 years (range 22-50). Of the 50 patients, 34 were males and 16 were females. Road traffic accidents was the commonest mode of trauma. Mean time of radiological union is 14.8 wks(range 12-22 wks).

In this study, 29 patients had achieved 0° to ≥ 110° of movement at the knee, in 18 patients range of movement at the knee achieved was 0-5° (extension gap) to 90-110° (flexion) and in only 3 patient the range of motion was >5° (extension gap) to 90° (flexion).

The overall results were tabulated into three groups i.e excellent, good and poor, according to the criteria laid down by Savoie et al (1987). Out of 50 cases, 47 cases had an acceptable result (i.e 29 excellent and 18 good), whereas 3 cases had poor result.

Overall there were 3 cases who had early infection; all three were superficial, that healed after appropriate antibiotics and antiseptic dressing. There were no case of late infection.1 patient had valgus angulation > 5 degrees and 1 had varus angulation of 8 degrees.

DISCUSSION
Open reduction and fixation with plate has the advantage of lowest rate of angular malunion compared to external fixation or intramedullary nailing but the downside is the high infection rates7. MIPO however relies primarily on the indirect reduction of the fractures using various techniques and in this way, the fracture environment is better preserved, as well as the blood supply to the bony fragments is not disturbed, which finally leads to decreased infection rate, better fracture healing. MIPO offers several theoretical advantages compared to conventional open plating technique. A mechanically stable fracture-bridging osteosynthesis can be obtained without significant dissection and surgical trauma to the bone and surrounding soft tissues. As a consequence, the vascular integrity of the fracture and the osteogenic fracture hematoma are preserved.8,9

In this study, overall results were tabulated into three groups i.e excellent, good and poor, according to the criteria laid down by Savoie et al (1987), out of 50 patients, 47 patients had an acceptable result (i.e. 29 excellent and 18 good). Chang-Wug Oh et al (2006)10 obtained excellent or good clinical and radiographic results in 21 out of a total of 23 patients of unstable proximal tibial fractures treated by plating using minimally invasive percutaneous osteosynthesis technique.

It has been rightly said by well-known anatomist R Schenk (1997), “If the fracture surgeon does something ‘LOGICAL’ then ‘BIO’ will do the rest”11.

Advantages cited for MIPO are:12
1. Simpler technique and easy to master. Learning curve short.
2. No need of additional expensive instrumentation.
3. Improved rates of fracture union.
4. Decreased infection rate.
5. Decreased need for bone grafting.
6. Ideal technique for dealing with the multiply injured patients.
7. Early mobilization of the extremity possible
8. Decreased incidence of refracture after plate removal.

CONCLUSION
On the basis of the finding of this study it can be concluded that MIPO technique preserves most of the osseous vascularity and fracture hematoma thus providing for a more biological repair. There is rapid fracture consolidation due to preserved vascularity. There are fewer incidences of delayed union and non-union. There is a decreased need for bone grafting and incidence of infection is less due to limited exposure.

REFERENCES