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Outcome of Minimal Invasive Percutaneous Plate Osteosynthesis in closed fractures of distal tibia

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ABSTRACT

Background

The limited soft tissue, subcutaneous location and poor vascularity render the dista tibial fractures very challenging. Treatment of distal tibial fractures using minimally invasive percutaneous plate osteosynthesis technique may minimise damage to soft tissues and vascular integrity of bony fragments, leaving comminuted fragments out of the mechanical construct, preserving soft tissues with limited operative exposure.

Objective

To assess the outcome of patients treated with minimally invasive percutaneous plate osteosynthesis technique for closed distal tibial fractures.

Methods

The study included total of 30 patients (24males and 6females) with close distal tibia fracture, which were treated with distal tibia locking plate using minimally invasive percutaneous plate osteosynthesis technique.

Results

The mean ages of the patient were 44.23 years (30 to58 years). Patients were followed up at 2 weeks, 6weeks, 12weeks, 24weeks and 1 year after the operation and evaluated clinically and radiologically. Among 30 pateints, all fractures went to union. The mean American orthopaedic foot and ankle score was 89.23% (SD-3.92). There was 2case of superficial infection and 3 case of plate impingement with no intraoperative complication and mortality rates.

Conclusion

Minimally invasive percutaneous plate osteosynthesis is an effective technique for the management of distal tibial fractures. It is minimally invasive, though technically demanding, but preserves the biological environment by preserving the soft tissue with better outcome in terms of radiological union and functional outcome.

Keywords: Minimally invasive percutaneous plate osteosynthesis , Distal tibia fracture, open reduction and internal fixation

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INTRODUCTION

Fractures of distal tibia are one of the most commonly encountered fractures due to the increasing number of road traffic accident. Distal tibial fractures are usually the result of high energy. They are usually associated with severe soft tissue compromise.[1,2] The limited soft tissue, subcutaneous location and poor vascularity renders the distal tibial fractures very challenging.[3,4] Several methods of treatment are implemented including non-operative treatment, external fixation, intramedullary nailing, and internal fixation with plates and screws[5]. However, each of these treatment options is associated with certain challenges.[6] Non-surgical treatment option is possible for stable fractures with minimal shortening, but requires prolonged immobilisation. It has also been associated with malunion, shortening of affected limb, limitation of range of motion.[7,8] External fixation can be a useful option in open fractures with soft tissue injury, but can lead to pin-track infections, mal-alignment and delayed union.[9,10] Conventional plating techniques if applied to multifragmentary fractures, requires anatomic reduction, wide surgical exposure and the fractured fragments are stripped off the soft tissue attachments resulting in a variety of complications like delayed union, non-union, infections and implant failure.[11,12]

The major goals of treatment are to obtain a healed, well aligned fracture, pain free weight bearing and functional range of motion of the knee and ankle joints.Mminimally invasive percutaneous plate osteosynthesis (MIPPO) technique helps to achieve above criteria by realigning with manipulation at a distance to fracture site, leaving comminuted fragments out of the mechanical construct and preserving soft tissues attachment with limited operative exposure.[13]

The objective of this study was to assess the outcome of patients treated with MIPPO technique for closed distal tibial fractures.

METHODS

The study included total of 30 patients admitted in Nepal Medical College Teaching hospital from September 2009 to November 2011 with close fracture distal tibia which were treated with distal tibial locking plate using MIPPO technique. Out of 30 patients 24 (80%) were males and 6 (20%) were females. The patients were in between the age group of 30 to 58 years with an average age of 44.23 years. 17 patients had right sided fractures and 13 patients had left sided fractures. All fractures were classified using the AO classification. In which Type A1 was 18, A2 and A3 was 7 and 5 respectively. 24 cases (80%) was associated with fibula fracture out of which 15cases (62.5%) were distal fibula fracture which required open reduction and internal fixation with dynamic compression plate to restore the length and the alignment. The American orthopaedic foot and ankle score (AOFAS) were used to assess the functional outcome and soft tissue was assessed from history of wound infection, wound dehiscence, plate impingement. Patients were followed up at 2weeks, 6weeks, 12weeks, 24weeks and 1 year after the operation.

Surgery was performed under spinal anaesthesia with a tourniquet in the supine position. A small incision was made on one end of the fractured comminuted area without disturbing the soft tissue envelope of the fractured fragments. The incision was extended right up to the bone with the

periosteal tube. A sub-muscular tract was made along the surface where the plate was going to be applied and extended across the fracture to the other side. The tract was made with the plate to be used itself. The size of plate used depended on the anatomy and location of the fracture. Once the tract was made, an appropriate length plate was selected so that at least 6–8 cortices hold could be obtained on either side. A plate was made to slide along the previously created tract. With the plate in-situ and some traction given manually and reduced using positional screw the alignment was checked using the standard anterior superior iliac spine-centre of patella-second toe guide line. An x-ray was taken to check the alignment radiologically and also to confirm the length of the plate, if it is appropriate. The plate was fixed with appropriate screws.

RESULTS

The patients were allowed to start mobilization of ankle, once the patients felt pain free and partial weight bearing after 6weeks. Among the 30 patients, all fractures went to union. The 19 cases (63.33%) showed union between 9 to 12 weeks. While 11 cases (36.66%) showed union between 12 – 16 weeks. Average period of union was 13 weeks. The mean American orthopaedic foot and ankle score (AOFAS) was 89.23% (SD- 3.92) (Fig 1). There were 2case of superficial infection which were treated with oral antiobiotics. There were 3 case of plate impingement over the medial aspect of the medial malleolus. There were no intraoperative complication, no case of delayed union, non union and mortality rates during the 1 year follow up.

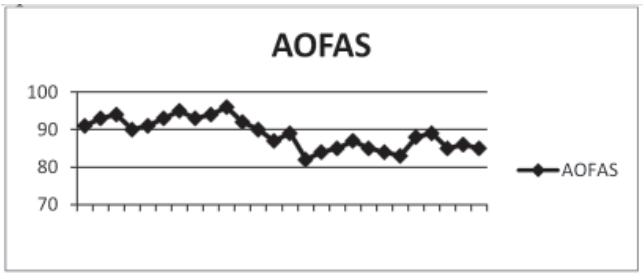

Fig – 1 Graphical representation of AOFAS

Fig. 2a - Preoperative x ray

Fig. 2b - Immediate Post up x ray

Fig. 2c - Follow up x ray of 6 weeks

Fig. 2d - Follow up x ray of 24 weeks

DISCUSSION

Fractures of the distal tibia or pilon fractures are often associated with significant soft tissue injury. The key point in management of this injury is to recognise the importance of the soft tissue component.[14] Failing to appreciate the soft tissue condition will invariably complicate the injury with infection, wound dehiscence or non union. Where the soft tissue injury is significant, bridging external fixation is advantageous for skeletal and soft tissue stabilisation.[15] Definitive fixation is only advisable when the soft tissue allows it, when the 'wrinkle sign' is evident. The high-energy trauma sustained during the initial injury causes massive soft tissue injury and often devitalises the soft tissue around the fracture site. The anteromedial aspect of the distal tibia is most at risk of wound infection and dehiscense.[16]

MIPPO technique reduces the iatrogenic soft tissue injury and damage to the vascularity of bone as well as preserves the osteogenic fracture haematoma which is essential to prevent the potentially severe complications.[17] The infection rates in the previously published reports while managing such injuries range from 0% to 50%. [18-21, 22, 23, 24-28, 29-32, 33-38] Open Reduction & Internal Fixation(ORIF) has shown to have the highest infection rates compared to other methods of treatment.[32] Deep infection and wound dehiscence are the major soft tissue complications. Studies using external fixation techniques reported significant reduction in infection rates. [26,27,29-32] Infection rates in the MIPPO technique are less than in previously reported study comparable with ORIF and external fixation technique.[18,21,22,23,30,35,36] This is reflected in our results, with only two cases of superficial wound infection which completely resolved with appropriate antibiotics.

Reports suggest that intramedullary nailing has the lowest infection rates compared with other techniques [24,25] but the technique is associated with other complications such as malunion, fat embolism syndrome, compartment syndrome and anterior knee pain.[24] Angular malalignment and malunion have been reported with intramedullary nailing of these fractures.[24] Studies involving

external fixation techniques showed complications such as loosening, malunion, imperfect articular reductions and pin tract infections.[31,32] ORIF has the lowest rate of angular malunion[20,24,35] compared to external fixation [29,32] or intramedullary nailing[24] but the downside is the high infection rates.

The distal tibia locking plate applied with minimally invasive percutaneous plate techniques (MIPPO) allows fracture alignment without the associated wound complications.

Our results are comparable to other studies using the MIPPO technique. [21,33] Comparing the results with other methods of fixation, our results are better in comparison with ORIF and external fixation. [18-21,22,23,26,27,29-31,33,35-38]

Distal tibia plating allows early active range of movement as postoperative plaster immobilisation is not necessary. We found that ankle stiffness is not a problem, with a mean AOFAS score of 89.23% . Partial weight bearing after 6 weeks postoperatively.

CONCLUSION

MIPPO is an effective technique for the management of distal tibial fractures. It is minimally invasive, though technically demanding, but preserves the biological environment by preserving the soft tissue with better outcome in terms of radiological union and functional outcome.

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