OUTCOME OF MINIMALLY INVASIVE PLATE OSTEOSYNTHESIS (MIPO) IN DISTAL TIBIA FRACTURES IN ADULTS

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ABSTRACT

Background: Treatment of the distal tibia fractures are challenging due to the limited soft tissue, subcutaneous location and poor vascularity. Minimally invasive plate osteosynthesis (MIPO) is an established technique for fixation of fractures of the distal third tibia. Our study aimed to find out the Outcome of Minimally invasive plate osteosynthesis (MIPO) in distal tibia fractures in adults.

Methods & Materials: From July 2015 to July 2017, 28 patients of closed distal tibia fractures were operated by MIPO technique with a distal tibia pre contoured locking plate. The follow up duration was for 6 months. Clinical and radiological outcomes were studied.

Results: The mean fracture healing time was 20.6 weeks (range 18-30 weeks). Superficial infection occurred in 2.8% and all fractures united but three (10.7%) patients had union in external rotation and valgus angulation of 10 degree, however it was accepted clinically.

Conclusion: MIPO technique provides good stability with minimal soft tissue dissection without delayed bone healing and decreases incidence of nonunion and need for bone grafting. There was decrease incidence of infection due to limited exposure.

Keywords: Distal tibia fracture, MIPO

INTRODUCTION

Distal tibial or pilon fractures are usually the result of combined compressive and shear forces, and may result in instability of the metaphysis, with or without articular depression, and injury to the soft tissue. The complexity of injury, lack of muscle cover and poor vascularity make these fractures difficult to treat.[1]

Conservative management can be done in selected cases whenever fractures are stable with minimal shortening. High rate of complications like malunion, limb length discrepancy, decreased range of motion and early osteoarthritis of the ankle have been reported following conservative treatment of these fractures. [2, 3]

Distal tibial fractures are a challenge for treatment due to the poor coverage and particular vascularization. Surgical treatment of distal tibial fractures includes several options: external fixation, IM nailing, ORIF and minimally-invasive plate osteosynthesis (MIPO). In the past, open reduction and internal fixation using traditional metal plates for low energy trauma were quite successful.[2] However, if complications occur, prolonged hospital stay and increased number of subsequent operations are inevitable. Some will even lead to disastrous complications like gangrene and finally result in amputation. [4] The ring fixator once offered promising results but pin tract infection and later malunion are common in this group of patients. [5, 6]

In recent years, the concept of biological osteosynthesis has gained a reputation in fracture treatment. Management of distal tibial fractures with MIPO enables preservation of soft tissue and remaining blood supply. This study was aimed to evaluate the radiological and functional outcome of closed distal tibial and pilon fractures treated with MIPO.

MATERIAL AND METHODS

This prospective case series was conducted in Medical teaching institute Hayatabad Medical Complex Peshawar from July 2015 to July 2017. Ethical approval was taken from hospital ethical committee. 28 patients with distal tibia fractures were operated with using MIPO technique.

Informed consent for surgery and study were taken. All closed fractures and Gustilo and Anderson type I fracture of the distal tibia, with or without intra articular extension, up to 2 weeks old were included in the study. We excluded patients with pathological fractures, fractures older than 2 weeks, Gustilo and Anderson Type II and Type III fractures, patients having Diabetes Mellitus and patients who were unfit for surgery.

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Patients who fulfilling our inclusion criteria presented through A& E or OPD were examined; Antero-posterior and lateral X-rays of tibia with joint above and below were performed. Backslab was applied and admitted to orthopedic department. Patients were operated on next available operation list.

Surgery was performed by senior orthopedic consultant. Surgery was performed under fluoroscope. Tourniquet was applied. Closed reduction was performed under image intensifier by traction and close manipulation. Pre contoured LCP 3.5 and 4.5 designed for distal tibia were used. Small 2-3cm incision over the medial malleolus was used, plate size was determined, plate was passed through the incision and fixed with minimum 4 screws proximally and 5 screws distally. The reduction was assessed repeatedly using visual and fluoroscopic control. Angulation, length of tibia and fibula, rotation and integrity of the ankle mortise were considered. The mechanical axis and anatomical axis of the lower limb was checked with the cautery cord. If the associated fracture fibula required fixation, it, was fixed by 3.5 DCP or one third tubular plates according to the fracture type, before fixation of the tibia.

The plate was centered on the proximal fracture fragment in both antero-posterior and lateral views with the help of a locking sleeve inserted into the most proximal hole. Following confirmation, a drill bit or K-wire was used to fix the plate onto the tibia. Non locking screws were inserted first in either the proximal or distal fragment as required to aid in the reduction of the fracture so as to pull the bone to the plate. The locking screws were inserted only and only when the fracture reduction was satisfactory.

On first postoperative day X-rays were performed. Patient was discharge on 2nd post operative day with one week antibiotic courage. Patients were followed on 2nd week, 6th week, 16th week and 24th weeks for wound infection, rotational deformity and radiological union.

RESULTS

28 patients with distal tibia fractures were included in the study. Mean age was 36 years+2.1 SD and age ranges from 22 to 64 years. There were 21 male and 7 female patients with male to female ratio of 3:1. The majority of the 24(85.3%) fractures were extra-articular fractures, i.e. AO/OTA 43-A with 4 (14.7%) were intra articular AO/OTA 43-C fracture in our study. The mode of injury in the majority of the patients was road traffic accidents 20(71.4%) followed by fall 7(25%) and sport injury 1(2.8%).

18 (64.3%) patients were associated fibula fractures occurring at the level of the tibial fracture, suggesting a bending mechanism. Out of the 18 patients with an associated fibula fracture, only 2 patients needed fixation of the fibula and in 16 patient's fibula was not fixed.

The mean time for radiological union was 20.6 weeks with a range of 18–30 weeks. 10(35.7%) fractures healed at 16 weeks, 13 fractures (46.4%) united within a period of 24 weeks, 5(17.9%) fractures has delayed union in which 2 fractures needed Bone grafting at 12 and 24 weeks respectively and One patient had implant failure with plate pull out distally, which was re-fixed and Bone grafting done. Three (10.7%) patients had union in external rotation and valgus angulation of 10 degree, however it was acceptable clinically.

We encountered only one (2.8%) superficial infection in of our study which was managed with dressings and appropriate antibiotics and healed within two weeks. Two patients had implant prominence without any delayed in union and implant was removed on 24 weeks in these patients.

DISCUSSION

Treatment of the distal tibia fractures are challenging due to the limited soft tissue, subcutaneous location and poor vascularity and remain management challenge for the orthopedic surgeons. The treatment modalities evolved from conservative to open surgical and then to minimally invasive.

Clinical thinking has shifted from mechanical concept of absolute stability to the biologic concept of indirect reduction and relative stability using minimally invasive approach.[7] MIPO technique reduces the surgical trauma and maintains a biologically favorable environment for healing of the fracture[8]. However, minimally invasive techniques do not allow direct visualisation of the fracture, and hence intraoperative fluoroscopy is required to confirm the reduction[9]. With the development of minimally invasive surgery, percutaneous plating has challenged interlocking nailing as locked plate designs act as fixed-angle devices whose stability is provided by the axial and angular stability at the screw-plate interface instead of relying on the frictional force between the plate and bone, which is thought to preserve the periosteal blood supply around the fracture site.[10]

In our series most of fractures was Road Traffic Accident followed by fall. Our results were comparable to other studies by Gupta et al.[11], and Paluvadi et al.[12] which also showed that RTA is the most common mode of injury as modernization and industrialization have intruded our lives.

Union was defined as painless full weight bearing and radiological union of 3 cortices in standard antero-posterior and lateral X-rays. In our study mean time to union was 20.6 weeks with a range of 18–30 weeks. 10(35.7%) fractures healed at 16 weeks, 13 fractures (46.4%) united within a period of 24 weeks, 5(17.9%) fractures has delayed union in which 2 fractures needed Bone grafting at 12 and 24 weeks respectively and One patient had implant failure with plate pull out distally, which was re-fixed and Bone grafting done. Three

(10.7%) patients had union in external rotation and valgus angulation of 10 degrees, however it was accepted clinically. Sharestha et al.[13]and Lau et al.[6] reported the average time to radiological bony union was 18.5 and 18.7 weeks respectively while Paluvadi et al[12] and Bahari et al[14] reported mean fracture healing in distal tibia were 21.4 weeks and 22.4 weeks respectively.

In our study, we found only one patient (2.8%) had post-operative superficial wound infection neither patient had developed a deep infection which healed with oral antibiotics and surgical dressing. Two patients had implant prominence without any delay in union and implant was removed on 24 weeks in these patients. Our results was comparable to the results in other series.[12,13]

This MIPO technique has some drawbacks as well. As it requires indirect reduction of the fracture, there are risks of mal-reduction and mal-alignment which subsequently may cause mal-union.[15] Severe mal-union in tibial shaft fractures may deviate the mechanical axis of the lower limb causing imbalance in force distribution to the adjacent joints, with adverse joint effects. Furthermore, with the small skin incisions the insertion of the plate is technically demanding and also requires strict fluoroscopic control throughout the procedure leading to greater radiation exposure compared to open extensile surgical approach.[16]

The major advantage of this study was absence of deep infection, high rate of union with average time of 20 weeks and early mobilization. The excellent success rate was achieved due to indirect or closed reduction of fracture without disturbing fracture hematoma. The limitations in our study were the small sample size and the lack of a control group. Another major pre-requisite was the surgical skill and experience required to carry out the procedure accurately.

CONCLUSION

The MIPO is a reliable surgical technique for fractures of the distal tibia, preserving most of the osseous vascularity and fracture haematoma and thus providing for a more biological healing. The bone healing, though slightly delayed, was universal with this type of fixation. This technique useful for distal tibia fractures where locked nailing cannot be done. Due to preserved vascularity, there is lesser incidence of delayed union and non-union. There was decreased incidence of infection due to limited exposure.

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