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Original Research Paper

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EVALUATION OF OUTCOME OF MINIMALLY INVASIVE PLATING OSTEOSYNTHESIS (MIPO) TECHNIQUE FOR TREATMENT OF FRACTURE DISTAL TIBIA: A CASE SERIES FROM A TERTIARY CARE CENTER IN BIHAR

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ABSTRACT Distal tibia fractures are challenging injuries. They are primarily located within a square based on the width of the distal tibia without intra-articular extension. They are often caused by high energy axial compressive, direct bending or low energy rotation forces. **Methodology:** The current study was a prospective study planned and executed at Katihar Medical College, Bihar. Institutional ethics committee clearance was taken for study. The data collection was done over a period 6 months. Inclusion criteria was patients with age >18 years, closed fractures without intra-articular extension and Gustillo type 1 fractures of distal tibia attending the emergency from January 2018 to June 2018. **Results:** In the current study, 10 patients with fractures of distal tibia in adults were surgically managed by reduction and internal fixation with minimally invasive plate osteosynthesis (MIPO). The mean age of the patients in this study was 39 years and ranged from 25 years to 57 years. Male female ratio was 2.7. 8 patients had fracture of left and 2 patients had fracture of right tibia. 9 fractures were closed and only one was open fracture. Road traffic accident (high energy trauma) was etiological factor in 7, 3 cases sustained fractures following fall (low energy trauma). Head injury was present in 5 cases, chest injury in 2 and radius fracture in 1 case. There were 6 cases of associated fibular fractures. Injury surgery interval was less than 8 hours in 5 cases while 1 patient reported after 7 days. Average surgery time was 53 mins. **Conclusion:** Effective stabilization of distal tibia fractures can be achieved by distal tibia locking plating through MIPO technique which not only helps in achieving reduction in difficult situations, but also in rapid union, because it facilitates preservation of the blood supply to the fragment and anatomical reduction of the fracture. It is a simple, rapid and straight forward procedure which has good results.

KEYWORDS : Minimally Invasive Plating Osteosynthesis (MIPO), Fracture distal tibia,

INTRODUCTION

Distal tibia fractures are challenging injuries. They are primarily located within a square based on the width of the distal tibia without intra-articular extension. They are often caused by high energy axial compressive, direct bending or low energy rotation forces. These fractures constitute less than 7% of all the tibial fracture and less than 10% of all lower extremity fractures. The aim of treating the fracture is to preserve normal mechanical axis, ensure joint stability and restore a near full range of motion. This is a difficult task to accomplish in each and every case as we face compromised soft tissue condition, variable bone quality and associated medical conditions [1, 2].

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 [3, 4, 5].

Surgical fixation is considered for most distal tibia fractures which require meticulous preoperative planning. Available options for stabilizing fractures are external fixators, interlocking nails and locking plates. The factors determining the fixation methods are pattern of fracture, quality of bone and condition of soft tissues [5-8].

Ruedi TP et al., advocated open reduction and internal fixation with plate as the standard method of treatment of distal tibia fractures [3]. Results of conventional osteosynthesis with plates have been suboptimal with reported complications of wound infection, skin breakdown and delayed union or non-union, requiring secondary surgical intervention. Locking compression plating has gained popularity and is being used frequently for fixation of distal tibia fractures. With the use of minimal invasive techniques excellent results are obtained in complex fractures. Many studies are available in literature where encouraging results are reported. Locking compression plating is technically feasible and creates a stable, fixed angle device when locking screw heads lock itself with the plate. Locking plates provide excellent stability compared to a conventional plate and better protection against loss of reduction and minimization of bone contact. Preservation of vascularity of fracture fragments, fracture hematoma and minimal soft tissue damage favor minimally invasive percutaneous plating for distal tibia fractures [6-11].

This study was planned to assess the union rate, deformity, leg length discrepancy, gait and ankle range of motion, return to previous daily and sports activities, and infections and other complications associated with distal tibial plates.

METHODOLOGY

The current study was a prospective study planned and executed at Katihar Medical College, Bihar. Institutional ethics committee clearance was taken for study. The data collection was done over a period 6 months. Inclusion criteria was patients with age >18 years, closed fractures without intra-articular extension and Gustillo type 1 fractures of distal tibia attending the emergency from January 2018 to June 2018. Twelve such patients were approached and they were explained about the purpose of the study in a comprehensive way. They were ensured about the anonymity and confidentiality of the information provided. Informed consent was obtained from all patients before surgical procedure and for participation in the study. 10 patients who gave consent for participation in the study were included as study participants. Intra-articular fractures, tibial shaft fractures, elderly patients with co-morbid condition, non-weight bearing limb, pathological fractures and Gustillo type II open fractures were excluded. AO/OTA classification system was used to classify fractures [1].

Operative procedure

Complete preoperative radiographic assessment was done and preoperative plan was prepared. Broad spectrum intravenous antibiotics were given immediate preoperatively. The patient was positioned supine on a radiolucent operating

table under spinal or epidural anesthesia. Locking Plate Osteosynthesis is done with the MIPO technique. Incision is made over the medial malleolus measuring about 3cms with a gentle curve, sparing the saphenous vein and nerve. Extraperiosteally a tunnel is made by blunt dissection in right orientation. Anatomical distal tibial locking plate is passed through this tunnel by retrograde technique. Locking sleeves can be attached to plate and used to hold the plate at distal end while insertion. Plate is passed in such a way that end of plate is visualized adequately and screws can be inserted distally. Using C arm plate is adjusted to meet the contour of the bone. Fracture reduction is achieved under image intensifier by assessing length, axial and rotational alignment. Plates can be held temporarily by K wires whenever required. Varus-valgus angulation of <50, anterior posterior angulation <100, and shortening of <15mm were considered acceptable reduction. Sagging of distal fragment at fracture site-can be prevented by elevating fracture site with a bolster and plantar flexion of foot. A locking cortical or cancellous screw is inserted. Fracture reduction is confirmed and cortical screw is inserted into proximal diaphyseal fragment which helps plate to contact with plate surface [8]. Remaining screws are inserted by stab incisions. Associated fibula fractures when present at syndesmotic level was fixed with plates or Rush nail depending on fracture type. Wound was irrigated with saline and closure done in layers. Sterile dressing was done and well-padded posterior splint was given with ankle in neutral position [12–15].

Post-operative management

Static quadriceps exercises & toe movements, as tolerated were begun from 1st postoperative day. Ankle mobilization was started from 3rd postoperative day. Intra-venous antibiotics were given for 3 days followed by a course of oral antibiotics for 5 days. Analgesics were given as per need. Suture removal was done on 10th Postoperative day. Protected weight bearing was allowed only once signs of progress toward union were evident, usually at 6 weeks postoperatively. Full weight bearing was allowed after 10 to 12 weeks, depending on the radiographic signs of fracture healing. X-rays would be taken at regular intervals and evaluated for fracture healing, alignment at fracture site & look for any evidence of mal-alignment. Clinically union was defined as painless fracture site during full weight bearing. Radiographically fracture was considered united if 3 of 4 cortices in 2 radiographic views were continuous. Patients were followed up for a period of 1 year at 6 weeks, 12 weeks, 3 months, 6 months and 1 year. At the final follow up patients were evaluated using American Orthopedic Foot and Ankle Society (AOFAS) score [16].

RESULTS

In the current study, 10 patients with fractures of distal tibia in adults were surgically managed by reduction and internal fixation with minimally invasive plate osteosynthesis (MIPO). The mean age of the patients in this study was 39 years and ranged from 25 years to 57 years. Male female ratio was 2.7. 8 patients had fracture of left and 2 patients had fracture of right tibia. 9 fractures were closed and only one was open fracture. Road traffic accident (high energy trauma) was etiological factor in 7, 3 cases sustained fractures following fall (low energy trauma). Head injury was present in 5 cases, chest injury in 2 and radius fracture in 1 case. There were 6 cases of associated fibular fractures. Injury surgery interval was less than 8 hours in 5 cases while 1 patient reported after 7 days. Average surgery time was 53 mins. Average union time was found to be 22.3 weeks. The fractures united in almost all patients except 1 who presented with delayed union Cpcomplications are mentioned in table 1. Good amount range of mobility of ankle joint was present in almost all patients. Based on AOFAS scores excellent results were obtained in 7, good in 2 and fair in 1 case.

Table 1: Table showing various complications noted in the study participants over a duration of 12 months

Complications	Number (%)
1. Superficial site infection	2 (20%)
2. Deep seated infection	1 (10%)
3. Varus angulation	1 (10%)
4. Implant failure	2 (20%)
5. Restriction of ankle movement	
a. <25%	0
b. 25%-50%	1 (10%)
c. 50%-75%	2 (20%)
d. >75%	0

DISCUSSION

Distal metaphyseal tibia fractures are one of the most problematic injuries to manage. Results of operative treatment are dependent on the severity of the initial injury, the quality and stability of the reduction. The mechanism of injury, status of soft tissues, the degree of comminution and articular damage affect the long-term clinical outcome. A variety of treatment options are available. But there is no consensus on the best treatment modality [1-3]. Options for surgical fixation include external fixation, intramedullary nailing and plate fixation. External fixators are used in open fractures with soft tissue injury where nail or plate fixation is contraindicated. Many complications are reported when external fixators are used for definitive management of distal tibia fractures. Review of literature report high rate of malunion (5-25%), nonunion (2-17%), loss of reduction and pin tract infection (10-100%) which makes it less preferred technique [3-5].

Open reduction and internal fixation lead to increased risk of infection and nonunion [6, 7]. Minimally invasive plating techniques reduce iatrogenic soft tissue trauma and damage to vascularity of bone fragments, as well as preserve the fracture hematoma resulting in uncomplicated union. Anatomical reduction of fractures should be done under image intensifier before fixation. Different methods for fracture reduction include calcaneal traction, external fixators or distractors, reduction clamps and interfragmentary screws through stab incision [3-5]. Fibula fractures when present also affect fracture reduction.

Distal tibia fractures are associated with gross swelling, skin injury and blisters because of subcutaneous location. Skin condition determines the timing of surgery. Wound dehiscence and infection are complications when surgery is done with poor soft tissue conditions. Immobilization by splinting, icepacks and delaying surgery help in limiting further soft tissue injury and better preoperative soft tissue condition. Surgery was done when the swelling subsided, and the wrinkle sign was seen. Dorsiflexion of the ankle is done while observing the anterior aspect of the ankle for skin creases; the absence of a skin crease or wrinkle suggests severe swelling [12, 13]. In our study 1 case weas operated after 3 days due to poor skin condition. There was no difference in union rates and complications in those who were operated before 3 days or after. Wound dehiscence and infection are of concerns when operated with locking plates. Guo JJ et al., reported more wound complications in LCP group (14.6%) compared to nailing group (6.8%) [14]. Lau et al., reported late infection rate of 15% in fixation with locking plates [15]. Average rate of infection in various literature available was 5-15%. In our study infection was seen in 3 cases (30%). Delaying surgery if limb is swollen and bruised, gentle soft tissue handling and reducing operative time helps in reducing infection rates [14-17].

Malunion is an uncommon complication after LCP. Rate of malunion in literature varies from 0-5%. Delayed union and nonunion has been reported to be 5-16% in various studies. Collinge et al., reported a reoperation rate of 5% which

included secondary procedure like bone grafting for delayed union [11]. Rate of secondary procedures for delayed union or non-union or change of hardware has been reported 3.8% to as high as up to 35%. Implant failure has been reported to be 2-6%. Plate bending or breakage is often associated with malalignment, delayed or nonunion [15, 17].

Pain over medial malleolus, hardware prominence and pain due to impingement of the implant on the skin was common. Gao et al., suggested polyaxially locking plates to gain adequate fixation and to achieve a perfect match between the plate and the distal part of the tibia [18], which in turn may further reduce tension in the soft tissue [14, 15].

The great saphenous vein and nerve injury can occur rarely. Careful identification during surgery and adequate drill sleeve placement usually suffices. We did not have any case of saphenous nerve or vein injury. Removal of LCP can be difficult and includes all general risks associated with surgical procedures. Complication rates of 20% have been reported. Stripping of screw head or threads occurs frequently. Screw extraction devices cannot be engaged to remove locking screws which makes the procedure cumbersome [14-18].

CONCLUSION

Effective stabilization of distal tibia fractures can be achieved by distal tibia locking plating through MIPO technique which not only helps in achieving reduction in difficult situations, but also in rapid union, because it facilitates preservation of the blood supply to the fragment and anatomical reduction of the fracture. It is a simple, rapid and straight forward procedure which has good results.

Conflict of interest

None of the authors declared any conflict of interest

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