Original Article

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Functional Outcome of MIPPO Technique in Lower Third Tibia Fractures in Patients at GAIMS, Bhuj, Kutch

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Abstract

Fractures of the shaft of tibia is the most common fracture of long bones and are usually associated with severe soft tissue compromise. Conventional plating technique applied to such a multi fragmentary fracture, requires anatomic reduction, wide surgical exposure and soft tissue stripping. Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO) is a method in which a percutaneously inserted plate is fixed at a distance proximal and distal to the fracture site through minimal exposure. 30 cases of closed lower one third tibia fractures treated with internal fixation using MIPPO technique at Gujarat Adani Institute of Medical Science, Bhuj, Kutch were followed for a period of six months. AO type A 1.2 was the most common type of injury. The mean union time for fractures fixed with MIPPO technique is 20.3 ± 2.8 weeks. Incidence of complications was relatively less, with delayed union and deep infection occurring in 2 cases. The functional outcome which was measured by Mazur score was excellent or good in 60% of the cases which is comparable with rates in literature. MIPPO technique for fractures of the lower end of tibia has minimal complication rate and has good functional outcome.

Keywords: Bhuj; Fractures; Tibia; Functional Outcome.

Introduction

Fracture shaft of tibia is the most common fracture of long bone and usually results from high-energy axial compression and rotation forces. Lower one third fractures accounts for 37.8% of all tibia fractures [1]. Tibia being subcutaneous throughout its length, open fractures are more common and is associated with severe soft tissue compromise [2,3]. Hence treatment of tibia fractures is very challenging [4,5]. Delayed union, non-union and infection is relatively common.

There are several methods for treating lower tibia fractures, which include non-operative treatment, external fixation, intramedullary nailing and internal fixation. Non-operative treatment is reserved for closed, stable, isolated, minimally displaced fractures caused by low energy trauma. Operative treatment is indicated for most tibia fractures caused by high energy trauma. External fixation is useful in open fractures with soft tissue injury. To achieve primary bone healing, exact anatomical reduction and strict rigid fixation are essential. This can be obtained in conventional plating, only with significant dissection of the fracture and the surrounding soft tissue. These contributes to the variety of complications like delayed union, non-union, infection and subsequently implant failure. Intra medullary interlocking nailing has been reported with higher rate of malunion because it is difficult to achieve two distally locking screws.

Biological methods have been developed with an aim to reduce the surgical dissection, preserve the

blood supply to bony fragments and preserve the fracture hematoma. MIPPO (Minimally Invasive Percutaneous Plate Osteosynthesis) is one such method in which a percutaneously inserted plate is fixed at a distance proximal and distal to the fracture site through minimal exposure [6,7]. MIPPO reduces iatrogenic soft tissue injury, damage to the vascularity of bone and preserves the osteogenic fracture haematoma, which is essential for early fracture healing to prevent potentially severe complications.

The objectives of the present study are (i) To study the functional outcome and results of MIPPO technique in lower third tibia fractures and to compare the results of present study with those in literature. (ii) To study the complications associated with MIPPO technique in lower third tibia fractures.

Materials and Methods

Present study was performed at department of orthopedics, Gujarat Adani institute of medical science, Bhuj, Kutch, Gujarat. Ethical clearance was taken from the institutional ethics board and informed consent was obtained from all the participants. 30 cases of closed lower third tibia fractures in patients aged between 18 and 60 years and treated by MIPPO technique at Department of Orthopaedics were included in the study. Patients with open fractures, intra articular fractures and patients below 18 and above 60 years of age were excluded from the study.

Patients were followed up every four weeks. At each assessment, they were enquired regarding pain, use of analgesics, stiffness, swelling, activities of daily living and use of walking aids. Their responses were noted in a proforma. Gait, local thickening, swelling, tenderness and range of motion of ankle were evaluated. Antero-posterior and lateral radiographs of leg were recorded.

Fracture was considered united when visible bridging callus is seen in at least three cortices in antero-posterior and lateral x-ray of leg and absence of pain on weight bearing clinically. Malunion was defined as Varus-valgus angulation more than 5 degree, anteroposterior angulation more than 10 degrees and shortening more than 15 mm. Functional outcome was assessed based on the Mazur 8 Scoring System. The longest period of follow up was 5 months.

Results

There were 17 males and 13 females in the study population. Majority belonged to the age groups 40 – 49 years and 50 - 59 years (8 patients each). Fall was the most common mode of injury (15 cases; 50%) followed by Road Traffic Accidents (10), sports injury (4) and assault (1). Right side was most frequently involved (17 cases; 57%). Fracture of distal radius was the most common associated fracture. Other associated injuries were fracture patella, fracture shaft of femur, fracture spine and head injury (1 case each). Hypertension and Diabetes Mellitus were the most common co-morbidities. AO most common type (13 cases, 43%) followed by A 2.2 (4 cases, 13%), type A 1.1(3 cases), type A 3.2(3 cases), type A 2.1(2 cases) type A 3.3 (2 cases). Types A 1.3, B 1.2 and B 1.3 with one case (3%) each were the least common types.

Majority of the patients were operated upon within 5 – 7 days (17 cases; 57%). Pre-contoured locking distal tibia locking compression plate was the implant used in all cases. Associated fracture of the fibula was seen internally fixed in 50% of the cases. Deep infection and delayed union were the most common complications (2 cases).

The mean time for union was 20.3 weeks with standard deviation of 2.8 weeks within a range of 16-28 weeks. 40% of the cases showed union by 19-21 weeks and 33% cases by 16-18 weeks. Two cases which were complicated by deep infection took more than 24 weeks for union. Functional outcome based on Mazur Score was good in 14 patients (47%), fair in 9(30%), excellent in 4(13%) and poor in 3(10%).

Table 1: Functional Outcome of the patients

	Functional outcome	Percentage
80-90	Excellent	13
70-79	Good	47
60-69	Fair	30
<60	Poor	10

Discussion

The results of this study were comparable with other studies. In Ronga M series [10], the mean time was 22.3 weeks, Lau TW [11] series showing a mean time of 18.7 weeks and Gupta RK [12] series having a mean time of 19 weeks. Whereas Ahmed MA et al [13] reported a mean time of 27.7 weeks for union. Evidence suggests that delayed interventions make accurate surgical reduction more difficult in MIPPO technique [14].

Aksekili et al reports a mean duration of radiological union to be 20.7 weeks (range: 16–28 weeks) in open and 17.96 weeks (range: 10–36 15 weeks) in closed fractures [15]. While Shrestha et al reported an average duration of 18.5 weeks (range: 14–28 weeks) for the fracture segment union.

In studies of Helfet et al [17] and Hazarika et al [6], fracture union result was 100%. They used a two-stage procedure. In the first stage, an external fixator was used to convert open fractures to close fractures and in second stage MIPPO for the closed fracture fixation. In MIPPO, a locking compression plate applied subcutaneously by indirect reduction method and subcutaneous tunneling of the plate and application of locking screws with small skin incisions [18]. It prevents iatrogenic injury to vascular supply of bone. Unlike conventional plates, locking compression plate is a friction independent self-stable construct which provides both angular and axial stability and minimizes the risk of secondary loss of reduction through a threaded interface between the screw head and plate body [19,20]. Poly axial locking compression plate can be an option when supra malleolar anatomy does not match with pre-contoured plate. It can provide choice of screw trajectories according to fracture pattern [21].

MIPPO does not disturb the fracture hematoma or endanger periosteal blood supply. In addition, it provides a biomechanical stable construct. Previous clinical studies have established MIPPO as a biology friendly, technically sound method of fixation for lower tibia fractures. Most of these studies except by Ronga et al and Ahmad et al have included both open and closed fracture. Colling et al reported increased secondary procedure rate like bone graft for delayed union. In MIPPO surgery, the incidence of wound complication is around 15%, and skin irritation symptoms are common. Several studies reported rate delayed and non-union to be 5%-17%. Lau et al did not find fracture union time in MIPPO to be affected by presence of late infections.

In the present study, a total of 4 cases (13%) showed post-operative complications. One case each of superficial infection and ankle stiffness and two cases of both deep infection and delayed union were observed in this study. Non-union was reported in 1 and 3 case(s) of Ronga M series and Gupta RK series respectively. No cases of nonunion were reported in the present study. Ronga M. et al, Ahmed MA et al Lau TW et al and Gupta RK et al reported 3, 2, 8 and 1 case(s) of wound infection respectively. The present study reports 3 cases of wound infection, 2 deep and 1 superficial. Delayed union was reported in three cases of Ahmed MA series, five cases of Lau TW series and seven cases of Gupta RK series. The present study showed two cases of delayed union. Ahmed MA et al reported one case of implant failure. Lau TW et al reported one and Gupta et al reported two cases requiring secondary procedures. Gupta RK et al reported two cases of wound breakdown. Implant failure, secondary procedures and wound breakdown were not reported in our study. One case of ankle stiffness was observed. Hence in comparison with other studies, this study stands at par or better in terms of post-operative complications.

MIPPO therefore is preferably indicated for closed fractures in lower third tibia fractures. The contraindications are open fractures, associated neurovascular injury, compartment syndrome and intra articular fractures. Other options for treatment are external fixation, open reduction and internal fixation and inter locking nails.

The main limitation of this study was that different surgeons with personal variations in the technique operated upon the cases which could have altered the functional outcome and complication rates.

Conclusion

MIPPO technique for internal fixation of lower tibia fractures has an excellent union rate, low incidence of complications and good functional outcome in the majority of the patients and is a credible alternative to conventional internal fixation in fractures of the lower end of Tibia. The results of this study are comparable with that of the literature.

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