

Minimally Invasive Plate Osteosynthesis (MIPO) for Proximal and Distal Fractures of the Tibia

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ABSTRACT

Introduction: The treatment of fractures of proximal and distal tibia is challenging, because of the possibility of soft tissue complications. The treatment of choice remains controversial and it depends on the fracture morphology, displacement and presence of comminution. Options for the management of these fractures vary from closed reduction and cast application to open reduction and fixation with plate. Open reduction and plate osteosynthesis is associated with extensive dissection and soft tissue complications in post-operative period. We conducted a case series on management of these fractures by using Minimally Invasive Plate Osteosynthesis (MIPO) technique, which has the advantage of preservation of osseous and soft tissue vascularity.

Methods: We conducted a prospective study on closed reduction and percutaneous plating by MIPO technique in 30 cases (mean age 42.5 years; 23 males and 7 females) of closed fractures of tibia. 22 cases had proximal tibial fractures and eight had distal tibial fractures. The mean time from injury to surgery was 7.6 days.

Results: Mean time for radiological union was 18 weeks (range: 14-24 weeks). Two patients had superficial operative site infections, which were managed with oral antibiotics and regular dressings. One patient with proximal tibia fracture developed a non-union, which was treated with bone grafting.

Conclusions: In closed peri-articular fractures of the tibia, favourable results can be achieved by MIPO technique. Principles of MIPO technique like minimal soft tissue dissection, closed and indirect reduction, biological fixation and early mobilization have to be followed for a favourable functional outcome.

Keywords: Comminution, Fractures of Tibia, Minimally Invasive Plate Osteosynthesis (MIPO).

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INTRODUCTION

The goal of proximal and distal tibial fracture fixation is to obtain early union with good articular reduction, and to attain early and complete range of motion. There has been an increase in number of cases of periarticular tibial fractures due to an increase in high-velocity road traffic accidents. Treatment modalities for fractures of tibia include closed reduction and cast application, closed reduction and external fixation, closed reduction and internal fixation with Minimally Invasive Plate Osteosynthesis (MIPO) technique and open reduction and internal fixation with plate with each method having its own advantages and disadvantages. Management of these fractures with closed reduction and cast application usually leads to problems related to prolonged immobilization, malunion and joint stiffness. Open reduction and internal fixation with plating frequently lead to soft tissue

complications and infection, delayed union and non-union. Management of overlying soft tissues is the single most important factor in treatment of these periarticular fractures. Blood supply is one of the most important factor in normal bone healing.¹ Care should be taken to maintain the vascular support of the bone with minimum soft tissue exposure while attempting internal fixation for such fractures.

Therefore, in recent times emphasis is being placed on biological and relative fixation and maintenance of vascularity than on absolute reduction for fixation of these types of fractures. Biological plating techniques provides relative stability while preserving the vascularity. The aim of this study is to evaluate the efficacy of MIPO technique in management of closed periarticular tibia fractures.

MATERIALS AND METHODS

This prospective study was conducted from May 2018 to May 2019. 30 patients with acute fracture of the proximal and distal tibia were included in this study. Of which 22 had proximal tibia fractures and eight had distal tibia fractures. Exclusion criteria of this study were presence of compound fractures, impending compartment syndrome, neurovascular injury and pathological fractures. AO classification was used for fracture classification, Type A: Extra-articular (n=13); Type B: Partial-articular (n=10); Type C: Complete-articular (n=7).

Patients who met the inclusion criteria and willing for being included in the study underwent pre anaesthetic check-up and X-rays in AP and Lateral View. After written informed consent, the patients underwent surgery under spinal anaesthesia. All cases were done after application of a tourniquet at upper thigh. Once the fracture site was assessed, the tibia was exposed through MIPO incisions proximally and distally. Fracture was reduced by indirect reduction techniques such as pointed reduction clamps, bone hooks, temporary external fixator.

A submuscular tunnel was made with a Cobb's elevator. The plate was passed through this tunnel and fixed with screws on either side under fluoroscopic guidance (Figure 2). Wound was closed in layers. Standard pre and post-operative antibiotic policy was followed as per our institute guidelines. Static quadriceps exercises, knee and ankle range of movement exercises, and non-weight bearing ambulation were started from post-operative day one. Wound inspection and dressing was done on the second post-operative day and sutures were removed on the 14th post-operative day. Oral antibiotics were continued in cases of

superficial infection. Check radiographs were done to see for progress of union at 6 weeks and 12 weeks and patient was started on partial and full weight bearing ambulation on respective follow-up. Patients were assessed for pain at fracture site, tenderness, range of movement at knee and ankle, at each follow up and classified according to SJ Lam criteria.²

RESULTS

In our study, 30 patients of proximal and distal tibial fractures were treated with closed reduction and internal fixation with MIPO technique. There were 23 males and 7 females with age ranging from 17 to 68 years with a mean age of 42.5 years. There were 12 cases of left sided fractures and right sided in 18. 22 cases had proximal tibia fractures while eight cases had distal tibia fractures; 21 cases were caused by road traffic accident, five cases of domestic fall, and five cases of physical assault. Mean time from trauma to surgery was 7.6 days. Mean time for radiological union was 18 weeks (Range: 14-24 weeks). All patients were followed up for a minimum of one year postoperatively.

There were two cases of superficial wound infections, which were treated by regular dressing and oral antibiotic. One patient had delayed union for which bone grafting was done at 14 weeks and the fracture was united at 24 weeks.

Bony and functional results were classified into four categories ranging from excellent to poor according to SJ Lam criteria (1964).²

In our study, 19 patients (63.3%) had excellent outcome, 9 patients (30%) had good outcome and 2 patients (6.7%) had fair outcome.

Table I: Outcome classification based on SJ Lam criteria²

Excellent	Range of movement of adjacent joints 80-100 % of normal. No pain in performing daily activities.
Good	Range of movement of adjacent joints 60 -80% normal. Pain not enough to cause any modification of patient daily routine.
Fair	Range of movement of adjacent joints 30–60% normal. Pain enough to cause restriction patients daily activities
Poor	Range of movement of adjacent joints less than 30% of normal. Pain enough to cause severe disability or non-union.



Figure 1: Pre-operative radiograph



Figure 2: Follow-up after 6 weeks



Figure 3: Follow-up after 6 months

DISCUSSION

Decision of management of proximal and distal tibia fracture is individualised per case. Non-operative treatment is best for minimally displaced non-comminuted stable fractures, but significant complications such as malunion, non-union and stiffness in adjacent joints have been reported.³

Open reduction of distal tibia fractures and internal fixation with plate gives anatomical reduction of the fracture but has the disadvantage of need for extensive soft tissue dissection and periosteal stripping leading to complications like infection^{4,5}, delayed union and non-union.^{6,7} In open reduction, the fracture haematoma is drained leading to delayed and non-union.⁸ These complications can be avoided by a balance of reduction and soft tissue dissection. In recent times, the emphasis has shifted from absolute mechanical stability to biological concept of indirect reduction and relative stability through minimal soft tissue injury.⁹ MIPO technique reduces the soft tissue injury and maintains a favourable environment for fracture healing.¹⁰

We preferred early surgical fixation in our study with majority of patients being operated within the first 10 days of injury. Delayed fixation can lead to difficulty in indirect reduction due to soft callus formation. Average time of union in our patients was 18 weeks, which is comparable to other studies in literature.^{10,11}

Complication rates in our case series was low with two cases of superficial infection, which recovered with conservative management, and a case of delayed union, which was treated by, bone grafting. In our study, there was an absence of deep infection and majority patients had excellent and good results. These favourable results were achieved due to maintenance of the fracture haematoma through indirect and closed reduction and early post-operative mobilization.

LIMITATIONS

Our study was limited by the restrictions of a small sample size and lack of a control group.

CONSENT

A written, informed consent was obtained from all the patients authorising the treatment, radiological and photographic documentation. They were informed and consented that the data would be submitted for publication.

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