

Original Research Article

A prospective study to analyse the outcome of locking compression plating by minimally invasive percutaneous plate osteosynthesis technique in proximal tibial fractures

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ABSTRACT

Background: The proximal tibial fractures are one of the commonest intra articular fractures majority are of high energy fractures. We did the study to measure the outcome of locking compression plating by minimally invasive percutaneous plate osteosynthesis technique in proximal tibial fractures.

Methods: Study comprises 20 cases of proximal tibial fractures, which have been managed by MIPPO technique during the period December 2014 to August 2016.

Results: The sex distribution in our study was 18 males and 2 females with 30 to 57 years age. The most common mode of injury in this study was road traffic accident. Type V Schatzker tibial plateau fractures were the commonest in 8 patients. 70% of our patients had excellent and good results in the functional outcome. In our study the average functional knee score was 22.40. The average range of movement achieved was 120 degrees. The average time taken for fracture healing was 16.52 weeks. In conclusion, MIPPO technique gives good to excellent results even in high energy tibial condyle fractures (70% cases in our study). Those who were treated with early fixation and early mobilization were found to have a better functional outcome irrespective of the fracture type. No secondary bone grafting was required.

Conclusions: The study reports that MIPPO technique is an effective method of treating proximal tibial fractures due to its overall good functional outcome.

Keywords: Proximal tibial fractures, Locking compression plating, Minimally invasive percutaneous plate osteosynthesis technique

INTRODUCTION

Fractures of the proximal tibia are the results of high-energy injuries, because damage is usually extensive and open fractures, compartment syndromes and vessel injuries are commonly associated.¹ Conventional methods like early open reduction and internal fixation have been associated with high levels of morbidity, substantial soft tissue complications such as wound breakdown and deep infection.² To overcome these complications, treatment using hybrid or circular wire external fixator is better opt,

but drawback like malunion, nonunion and pin track infections are common.³ The concept called minimally invasive plate osteosynthesis (MIPO) technique has been evolved to improve the rate of fracture healing and also to limit soft tissue elevation at the fracture site.^{4,5} MIPO technique will be performed on the lateral side and hence it doesn't cause no further damage to already injured medial soft tissue and periosteum. If the open wound is on the lateral side of the tibia, it is thought to be difficult to perform primary MIPO.⁶ During high proximal tibial fractures, it is often difficult to secure 3 or more screws

with a lateral plate. This may limit immediate knee motion and early weight bearing and may result in late angular deformity. The MIPO is highly useful, but it is difficult as conventional plates needed to be accurately contoured to achieve good fixation, osteoporosis also posed the same problem of poor fixation with conventional plates.⁷ The less Invasive Stabilization System (LISS) has been developed to treat proximal tibia fractures, although its usage in some countries has been strongly limited by the high cost. The LISS is characterized by anatomical design, minimal bony contact and unicortical locking screws, and may be the ideal MIPO implant.⁸ The current study designed to study the outcome of locking compression plating by minimally invasive percutaneous plate osteosynthesis technique in proximal tibial fractures.

METHODS

This is a prospective study comprising of 20 patients with tibial condyle fractures who were treated by Minimally Invasive Percutaneous Plate Osteosynthesis at Narayana medical college and hospital, Nellore during the period of december 2014 to august 2016. These patients were reviewed periodically both clinically and radiologically for a minimum of 6 months following operative fixation.

Inclusion criteria

Inclusion criteria were age 25-60 years and Shatzker type 2 – type 6 fractures.

Exclusion criteria

Exclusion criteria were open fractures, pathological fractures, associated with neurovascular injuries, associated with ipsilateral fractures, Shatzker type 1 fractures

Initial treatment

All our cases underwent initial stabilization as per the ATLS guidelines. Patients with closed tibial plateau fractures associated with a tense haemarthrosis underwent aspiration of the joint under aseptic precautions. The limb was immobilized either in an above knee slab or through skeletal traction using a distal tibial or calcaneal pin traction on a Bohler Braun splint until definitive fixation was carried out.

In cases complicated with excessive swelling and blistering, definitive fixation was delayed until the swelling/ blistering subsided. The patients were thoroughly evaluated from the systemic point of view and received appropriate treatment for existing co-morbidities like hypertension and diabetes prior to and after surgery.

Operative technique

The surgery was performed with the patient under general anaesthesia or spinal/ epidural anaesthesia. The patient

was placed supine on a radiolucent fracture table. A pneumatic tourniquet cuff with adequate padding was applied to the proximal thigh. The limb was thoroughly scrubbed primarily with betadine or chlorhexidine scrub solution, painted and draped.

The operative site and exposed portion was covered with a sterile towel and the limb exsanguinated with a sterile Esmarchs bandage and the tourniquet inflated, after which the operative site was painted with betadine and then with surgical spirit. With the help of an image intensifier closed reduction was achieved by ligamentotaxis using longitudinal traction. In certain cases percutaneous k-wires were introduced to aid in fracture alignment.

A proximal tibial locking plate or a T–Buttress/ L–Buttress locking plate of suitable length was taken. An incision was made as large as necessary either medially or laterally, to help insert the plate, which is carefully inserted in the submuscular plane, extraperiosteally. Utmost care was taken in handling soft tissue with as minimal dissection and judicious use of retractors as possible.

Normal valgus and rotational alignment was checked. Cancellous and cortical screws were appropriately used to secure the plate adequately proximally and distally. These were introduced percutaneously through small stab incisions centered over the plate holes.

A thorough wash with saline and betadine was given, a suction drain placed and the wounds closed. A sterile dressing was applied and the tourniquet deflated. The patient received intravenous antibiotics for a minimum of 5 days. They also received appropriate analgesics / anti-inflammatory drugs.

The limb was elevated on a Bolher Braun splint until swelling/edema subsided. Knee mobilization was started once the acute pain subsided. Non weight bearing walking was permitted from 3rd post-operative day with the help of a walker or axillary crutches.

Follow up

All patients were reviewed periodically after discharge at 6 weekly intervals for a minimum of 6 months or until complete radiological union. Knee movements were measured using a goniometer and the amount of extensor lag and flexion were recorded. Weight bearing was permitted only after radiological evidence of fracture union/adequate callus formation was present. At the time of follow up a functional assessment was done according to Rasmussen's scoring system

RESULTS

Total number of patients in our study was 20. Fractures and their Schatzker classification mentioned in Figure 1.

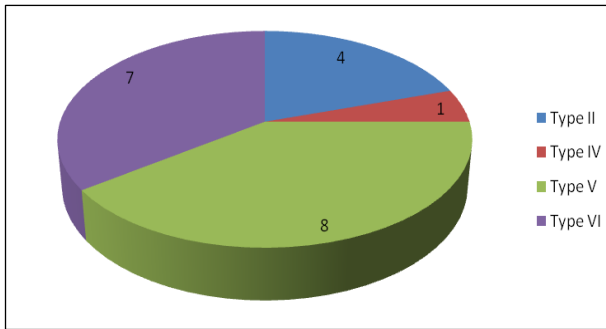


Figure 1: Type of fracture.

Road traffic accident in 14 patients and fall from height in 6 patients were recorded in mode of injury. The patients were in the age group of 30 to 57 years with mean 41.5 years. There were 18 male patients and 2 female patients.

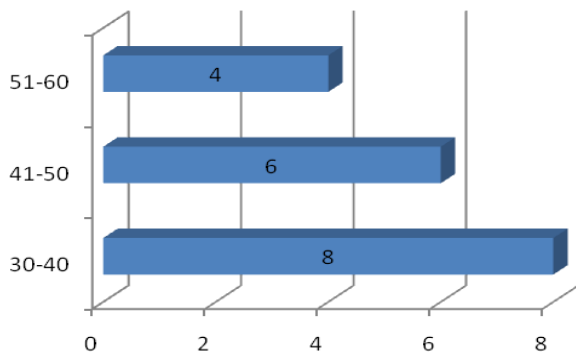


Figure 2: Age distribution.

There was a marginal predilection to the Right side in 12 patients were recorded.

In our study 12 patients were operated within a week from injury. 4 patients between 1-2 weeks, 3 patients between 2-3 weeks and 1 patient after 3 weeks. The most common reason for surgical delay was abrasions at or close to the operative site. Some of the patients presented late after taking initial treatment elsewhere.

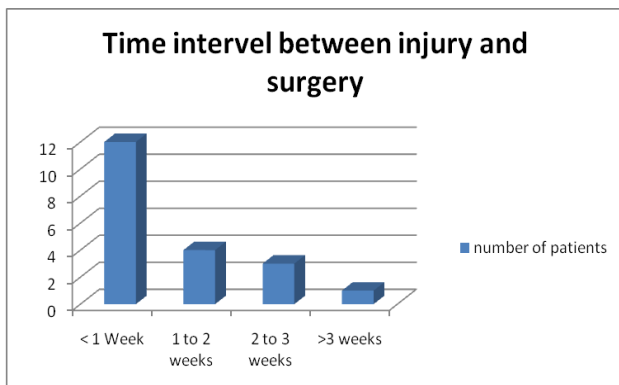


Figure 3: Time interval between injury and surgery.

Duration of follow up

All our patients were followed up periodically with a minimum follow up duration of 3 months and a maximum follow up duration of 6 months. Two patients are still on follow up due to poor range of motion.

The post-operative results were designated as excellent, good, fair and poor according to pain, walking capacity, range of motion and stability of the knee using Rasmussen’s grading system. In our study the average functional knee score was 22.40. Rasmussen’s score does not consider articular congruity while assessing the functional outcome of the knee.

Functional outcome

In this study, 10 patients (50%) had excellent results, 4 patients (20%) had good results, 3 patients (15%) had fair result and 3 patients (15%) had poor result.

Fracture union

All fractures in this study healed without requiring any additional procedures such as bone grafting. The average time taken for fracture healing was 16.52 weeks.

- 12-16 weeks: 14 patients
- 17-20 weeks: 3 patients
- 21-24 weeks: 1 patient
- > 25 weeks: 2 patients

Range of motion (ROM)

The average range of movement achieved was 120 degrees. 5 patients achieved slightly more than 130 degrees of flexion, 5 achieved almost 130 degrees, 5 achieved almost 120 degree, 3 achieved approximately 110 degrees and 2 patients had movement less than 90 degrees of flexion. One patient with less than 90 degrees of flexion had an ipsilateral fracture shaft of femur, surgery was also delayed as there were abrasions over the operative site. The other patient with less than 90 degrees of flexion had skin necrosis and wound dehiscence.

Complications

The various complications encountered in the study as listed in the Table 1.

Table 1: Complications.

Type of complication	No. of patients	Percentage (%)
Knee stiffness	6	30
Delayed union	3	15
Infection	1	5
Wound dehiscence	1	5



Figure 4: (A) Case 1: pre operative; (B) Case 1: post operative; (C) Case 2: pre operative; (D) Case 2: post operative.



Figure 5: (A) Postop one month follow up x-ray; (B) Exposed implant; (C) Postop fascio-cutaneous flap; (D) 10 days postop fascio-cutaneous flap.

DISCUSSION

Tibial condyle fractures especially those due to high energy mechanisms (Schatzker type IV,V) and those separating the tibial metaphysis from the diaphysis (Schatzker type VI) are inherently unstable injuries associated with fracture comminution, displacement, severe soft tissue injury and a higher incidence of complications.

In the present study, the mean age of patients was 41.5 years. This fracture occurred more commonly in middle age group. Whereas age group was recorded as 41.3 years in Patil et al, 42.31 years in Chintwar et al and 36.5 years in Sharma et al.⁹⁻¹¹

In our present study of 20 patients, the incidences of proximal tibial fractures are most common in males when compared to females. Results were compared with other studies conducted by Patil et al, Chintwar et al and Sharma et al.⁹⁻¹¹

In the present study, right side is more commonly involved than left side (60%). These results were compared to other studies.^{10,11}

In the present study mode of injury for proximal tibial fractures, are mainly due to road traffic accidents and fall. 70% of the injuries are due to road traffic accidents and the remaining 30% are due to fall. These results are compared to other studies conducted by Patil et al, Weil et al and Barei et al.^{9,12,13}

Closed treatment of these complex fractures have resulted in a high percentage of unsatisfactory results (upto 70%) as seen in long term follow up in other study.¹⁴ The most widely used method for treatment of displaced tibial plateau fractures has been open Reduction and Internal Fixation. The main focus on this modality was restoration of the articular surface to as near anatomical position as possible and to maintain the reduction while early knee joint mobilization is commenced. This rigid fixation is however possible only after extensive soft tissue dissection. Due to the association of soft tissue injuries with these fractures, additional soft tissue stripping involved in open reduction and internal fixation often render bony fragments avascular and also significantly increase the chance of infection. Moore et al, in his series reported a 23% incidence of infection after ORIF in these complex fractures.¹⁵ Gaudinez et al, encountered 4 of his 5 cases being infected after ORIF for such fractures.¹⁶ In our study, only one patient had superficial infection which was subsided with intravenous antibiotics and regular dressings infection. As far as infection is concerned it did not alter the functional and radiological outcomes.

The menisci were not visualized and no meniscal injuries were treated operatively in our study. During follow up none of our patients have residual abnormalities of the

menisci like laxity when compared to the non injured knee.

In this study patients were closely observed for compartment syndrome and deep vein thrombosis. They were encouraged to do static exercises and breathing exercise to prevent complications. To limit the extent of soft tissue damage in addition to the soft tissue damage associated with these complex fractures, minimally invasive biological fixation procedures have evolved over the last couple of decades. Among these procedures, minimally invasive percutaneous plate osteosynthesis potentially has become a good option in the treatment of these complex fractures.

In the present study, 70% of excellent and good results in the functional outcome. These results were attributed to patients who underwent early surgery and early mobilization.

We fortunately encountered only a single case of skin necrosis and wound dehiscence in our study (5%). This patient on follow up after one month of surgery showed exposed implant at the proximal site of plate. The plate was removed and a fascio-cutaneous rotation flap was done to cover the wound and PTB was applied. There were no signs of infection. Krettek et al reported one case of infection for which he did a wound debridement and resuturing and leaving the implant in situ.¹⁷

We encountered knee stiffness in six of our patients. One of these patients had a head injury, an ipsilateral fracture shaft of femur and abrasions over the operative site and was hence immobilized for a longer period of time prior to and post surgery. This prolonged immobilization and delay in surgery were probably contributory to the development of knee stiffness. One patient on follow up after one month presented with skin necrosis and wound dehiscence and exposed implant which was treated with removal of implant, facio-cutaneous rotation flap and PTB cast application. Of the other four, one presented to us ten days after the injury having taken treatment elsewhere in the form of POP cast application. The remaining three patients were highly uncooperative to initial range of motion exercises. Patients with terminal 10 degrees restriction of movement on comparison to the normal side were not considered to have stiffness. Krettek et al had no complications of knee stiffness probably due to the short time interval between injury and surgery.¹⁷

We encountered three cases of delayed union in our study. Two cases however went into union without the necessity for any subsequent procedure such as bone grafting. There was no incidence of non-union in our study. In our present study the functional outcome was analyzed at the last follow up using the parameters of post-operative resumption of function and radiological findings. In our study comprising of 20 patients, 10 patients (50%) had excellent results, 4 patients (20%) had

good results, 3 patients (15%) had fair result and 3 patients (15%) had poor result.

The Rasmussen's score described in 1973, considers complaints like pain, and walking capacity and clinical signs of knee extension, range of motion and stability, our mean Rasmussen's score was 22.4 and was compared to other studies conducted by Raza et al, which was 25.3.¹⁸ The mean Rasmussen's score for study conducted by Sonkar et al, was reported as 26.38.¹⁹

Our study results showing good outcome based on the parameters taken into consideration for the Rasmussens scoring system. The Mean Rasmussen's Score is 22.4 in the current study. Whereas it was 25.3 in Raza et al and 26.38 in Sonkar et al.^{18,19}

Out of 20 patients, none of them complained of functional instability in terms of varus and valgus deviation. Lee et al conducted a study on proximal tibial fractures treated by MIPO and reported one case with varus angulation more than 5 degrees.²⁰ Oh et al conducted a study on proximal tibial fractures treated by MIPO and reported two cases with varus angulation more than 5 degrees.²¹ Cole et al conducted a study on proximal tibial fractures treated by less invasive stabilizing system and reported 7 cases with varus angulation more than 5 degrees.²²

CONCLUSION

MIPPO technique gives good to excellent results even in high energy tibial condyle fractures (70% cases in our study). Our patients were able to achieve a good functional range of movement, averaging 120 degrees. Those who were treated with early fixation and early mobilization were found to have a better functional outcome irrespective of the fracture type. No secondary bone grafting was required. The average time taken for fracture healing was 16.52 weeks. Although our study comprises only a small group of patients, we can confidently say that MIPPO technique is an effective method of treating proximal tibial fractures due to its overall good functional outcome.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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