

Results of proximal tibial fractures managed with periarticular locking plates: A series of 34 cases

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ABSTRACT

Background: Proximal tibia fractures are complex injuries associated with a high incidence of soft tissue complications. Conventional methods used to treat these fractures have their shortcomings. Precontoured locking plates have been introduced which offer angle stable fixation with minimal soft tissue compromise.

Objectives: To evaluate the results of periarticular locking plate system for proximal tibial fractures in Indian population with emphasis on functional outcome, soft tissue complications, rate of infection and time to union.

Methods: It's a retrospective study carried out at a tertiary care hospital in an urban setting. Thirty four patients with proximal tibia fractures treated with periarticular locking plates were reviewed with a minimum one year follow up. The final outcome was assessed using the Rasmussen's score.

Results: Median age of the patients was 42 years. The average time to union was 17.6 weeks. Rasmussen's score was good to excellent in 82.3% of cases. Infection was seen in two cases and malunion in one case.

Conclusion: Locking plates were found to be a reliable method to treat these injuries and have a low complication rate.

Key words: tibia plateau, locked plating, locking compression plate

INTRODUCTION

Fractures of proximal tibia are common yet serious injuries involving major weight bearing joint surface of the knee. If not treated well, it results in significant functional impairment. With increasing high velocity trauma, the surgeon has to deal with complex injuries with severe soft tissue compromise.

High energy fractures are associated with complex fractures patterns, intra-articular involvement, severe comminution and displacement where as wedge depression and pure depression type are seen in the low energy group.¹ These fractures are also predisposed to complications like compartment syndrome and injury to the neurovascular structures and soft tissue envelope. The objective of treatment is to attain fracture union with a stable knee joint with a functional painless range of motion. Conventional treatment modalities to achieve the desired result have included non-operative modalities like cast, braces and traction; percutaneous wires with external/hybrid fixators and single or dual plating methods. Each of these methods has its limitations prompting the search for better techniques and implants. The

introduction of locking plates has added a new dimension in the treatment of these injuries.² Locked-plate fracture-fixation techniques and designs continue to evolve, from LISS (Less Invasive Stabilization System) to the Periarticular Locking Compression Plate(LCP) system.^{3,4,5} Data regarding the use of these plates and their functional outcome in Indian population is scarce which necessitates this study.

METHODS

From Jan to Dec'2010, patients with proximal tibia fractures managed with periarticular locking plate system were included in the study. They were followed up for a minimum of one year. Patients with active or recent infection in the involved leg, extensive comminution, Gustilo and Anderson Type IIIC fractures and open fractures with extensive soft tissue damage and/or contamination were excluded.

Anteroposterior and lateral radiographs of the thigh and leg including the knee joint were taken to determine the fracture pattern, classifying the fractures according to the Schatzker classification

and for preoperative planning.⁶ Computed tomography (CT) scan was done in cases where more detailed fracture configuration was required.⁷ The patients were stabilized and local soft tissue condition assessed pre-operatively, else the surgery was deferred till the wrinkle sign appeared.⁸ Minimally invasive plate osteosynthesis (MIPO) was used wherever the fracture configuration and soft tissue condition permitted.⁹ Precontouring of plates was done wherever necessary to achieve optimal seating of the plate. Primary bone grafting was performed to fill bone defects only in case of depressed fractures.¹⁰

Post operatively, limb elevation was done and quadriceps exercises and ankle mobilization were started within 24 hours of surgery. The patients were given posterior splintage if protection of fixation was desired in comminuted fractures. Knee bending and toe touch walking with a walker was commenced on second or third postoperative day if the fixation allowed otherwise the patient was kept non weight bearing ambulation and a posterior splint. Intravenous antibiotics were continued for four days in closed injuries followed by oral antibiotics till suture removal after two weeks. In open fractures, intravenous antibiotics were continued till the wound condition necessitated the same.

Patients were followed up clinically and radiologically in the outpatient clinic at monthly intervals till one year. Progressive weight bearing was allowed according to the callus formation as assessed in follow up radiographs. Full weight-bearing was permitted only after clinico-radiological evidence of union. Union was defined as bridging of three of the four cortices and disappearance of the fracture line on the plain radiographs for a patient who was able to bear full weight. Fracture in the process of union but not united at six months was considered as delayed union. Nonunion was defined as a fracture that did not heal within a year. At the end of one year, functional outcome score was analysed using the Rasmussen's knee score.¹¹

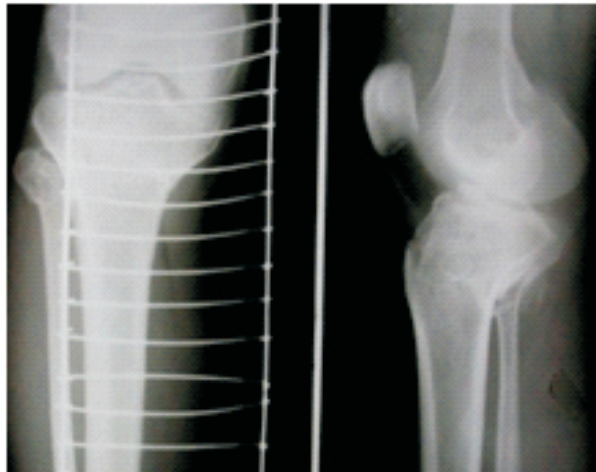


Figure 1a. Preoperative Schatzker Type VI fracture

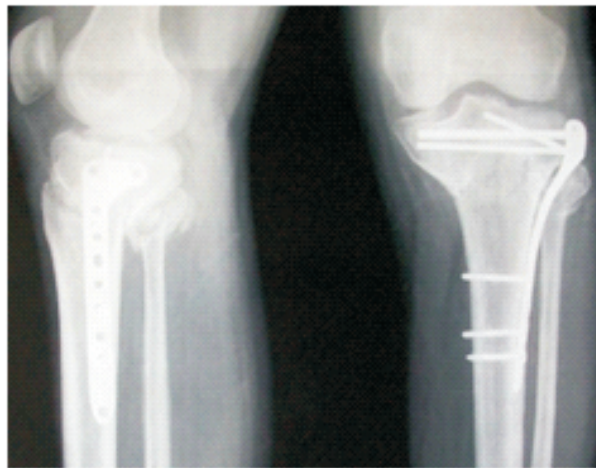


Figure 1b. Immediate post op radiograph showing unreduced medial fragment

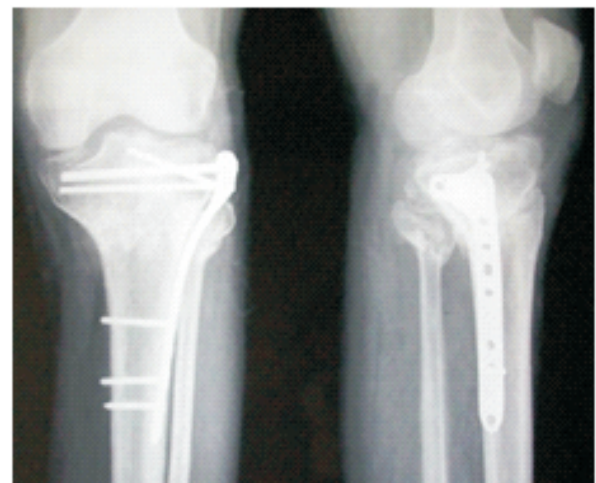


Figure 1c. Radiograph at twelve weeks showing malunion

RESULTS

There were thirty seven patients with proximal tibia fractures treated with periarticular locking plate system. Two patients were lost to follow up before one year and one died due to an unrelated cause therefore 34 patients formed the report of this study with a median age of 42 years. The mean follow up was 16 months (range 12 to 24 months). Twenty eight fractures were due to road side accidents and six due to domestic falls. There were five open fractures all of which were Gustilo and Anderson Grade III A injuries. The fractures were classified according to the Schatzker classification. Twenty eight out of 34 fractures were Type V or Type VI injuries signifying that majority of fractures in this study were comminuted intra-articular fractures. In our series, 14 patients had concomitant injuries to other systems with head injury observed in maximum number of cases (n=8). In eight cases, other long bone fractures were also present out of which ipsilateral femur fracture was present in four cases.

The operative intervention was performed within 24 hours of presentation in all except four cases who had closed fractures with extensive soft tissue edema and impending compartment syndrome. The average time for operative intervention in these patients was seven days (range five to ten days). None of these cases required a fasciotomy. MIPO technique was used in ten cases – eight cases where fracture reduction was easily achieved with indirect reduction and two cases where long plates were used for fractures extending into tibial diaphysis using the bridge mode. Primary bone grafting was done in two cases with depressed fractures – one with autologous bone graft taken from iliac crest and other with bone substitute (Chronos™). Contouring of the plates was required in majority of the cases to conform to patient's bone anatomy.

Wound Infection was observed in two cases. One was superficial infection in a patient with impending compartment syndrome which was controlled with an extended course of intravenous antibiotics. The other patient with deep infection

and positive culture had a Grade IIIA open fracture with extensive comminution and bone loss. This patient required two debridements – one in the same hospital admission and another after three weeks before the wound healed by secondary intention.

In our study, fracture nonunion was observed in one patient who had Schatzker Type VI fracture. Plate fixation was done in bridge mode and the patient showed nonunion at the diaphyseal site which was managed with bone grafting at one year resulting in healing of fracture. There was one case of malunion in Schatzker Type VI fracture where reduction of the medial condyle was not achieved intra-operatively (Figure 1a-c). The average time to union was calculated to be 17.6 weeks (range 14-24 weeks). In 50% of cases, fracture united in 14-16 weeks. Fracture union was found to be slower in open fractures with a mean of 21.2 weeks as compared to closed fractures.

In this study, Rasmussen's score was applied to analyse the functional outcome. After evaluation, it was observed that 28 (82.4%) of patients had good to excellent results while six patients (17.6%) had fair results (Table 1). The average range of motion in our study was from two degrees (range 0° – 15°) to 120° (range 60° – 140°).

Table 1. Rasmussen's score showing functional outcome at one year follow up

Score	Result	Number of patients	Percentage
27-30	Excellent	14	41.2
20-26	Good	14	41.2
10-19	Fair	6	17.6
<10	Poor	Nil	Nil

DISCUSSION

With the introduction of locking plates, many limitations of conventional plating have been overcome. The angle stable locking screws allow secure fixation of the opposite condyle with a single plate thus avoiding extensive soft tissue dissection.¹² Contact area between the plate and

the bone is minimal thus preserving periosteal blood supply. Our patient cohort represents the subset of population presenting with complex fracture patterns (Schatzker Type V and VI) accounting for 82.3% of cases which is due to high velocity trauma. A five to 27 year review from Netherlands by Rademakers et al., had only 14% fractures from the Schatzker V and VI types. This was attributed to excellent road safety measures which lowers the incidence of high velocity trauma.¹³

The mean time to union in our study was 17.6 weeks, with 50 % of fractures uniting in 14-16 weeks. This is comparable to contemporary studies with locked plating.^{3,14,15} In our study infection was observed in 6% cases (n=2). These are similar to rates of infection reported by Lee et al (8%), Gosling et al (6%) and Stannard et al (5.9%).^{3,12,14} A study by Phisitkul et al using LISS in 37 proximal tibial fractures reported an infection rate of 32% (n=12).¹⁶ The low incidence of infection in our study can be attributed to the fact that due care was taken to avoid complications by avoiding surgery in excessive soft tissue swelling, judicious use of MIPO and extensile approaches and contouring of the plates in order to match host bone anatomy.

An analysis of functional outcome using Rasmussen's score showed that 82.3% of patients had good to excellent results with average range of motion at the knee being two degrees (range 0°-15°) to 120° (range 60°-140°). In another study using LISS, the mean knee extension was 1° (0°-15°) and the mean knee flexion was 109.3° (60°-135°).¹⁷ A study of 27 closed tibial plateau fractures by Mathur et al treated with conventional plates showed excellent Rasmussen score in 37% (n=10) and good in 52% (n=14) of cases.¹⁸ However, their patient cohort had mainly low energy fractures with Schatzker Type V and VI fractures accounting for 18% of injuries (n=6) as compared to 82.3% in our

series. A subset of five patients in our series with fair Rasmussen score had lesser range of motion due to severe intraarticular comminution resulting in bone loss and hence prolonged immobilization.

This study further establishes the role of periarticular locked plates to treat the difficult problem of proximal tibia fractures. It offers clear advantages in complex comminuted fractures with decrease in soft tissue complications and improved union rates. Our study was a retrospective non blinded study with no control group. A study with better design and level of evidence will further clarify the role of these plates.

CONCLUSION

The treatment of proximal tibia fractures continues to evolve. Periarticular locking plates combined with biological techniques have improved patient outcomes with respect to union rates, soft tissue complications and functional outcomes. However, the basic principles to treat these injuries have to be adhered in order to avoid pitfalls.¹⁹ These include waiting for soft tissue envelope to heal prior to surgery, judicious use of surgical approach according to personality of fracture and restoration of articular congruity and metaphyseal – diaphyseal dissociation.

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