Short term outcome analysis of proximal tibia fractures treated with minimally invasive plate osteosynthesis

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Abstract

Introduction: Proximal tibial fractures caused by high-energy mechanisms are associated with neurovascular injuries, compartment syndrome, deep vein thrombosis, contusion, crush injury to the soft tissues and open wounds. Management of proximal tibia fractures are difficult considering the limited soft tissue cover over the shin of tibia and vascular compromise following injury. Open reduction and internal fixation in oedematous vascular compromised skin will end up in complications like infection and wound dehiscence. Management of proximal tibia fractures using minimally invasive plate osteosynthesis reduces damage to surrounding soft tissues and helps in improved fracture healing without complications. Analysis of functional and radiological outcome along with the complications of proximal tibial fractures treated by minimally invasive plate osteosynthesis using Knee Society Score.

Materials & Methods: We have analysed 20 cases of proximal tibial fractures treated surgically using minimally invasive plate osteosynthesis admitted in our Institute between January 2016 and December 2017. All patients were preoperatively assessed radiologically and classified and managed by MIPO technique and outcome was analysed by Knee Society score.

Results: Majority of injured patients were male (90%) and the highest number of patients were in their 4th decade (60%). Road traffic accidents was the most common mode of injury (80%). Type VI fracture is the most common type in 60% patients. Early complications like wound gaping, skin necrosis were treated. Average time from injury to surgery was 10 days. All of our patient’s results were excellent and good. The average knee society score in our study with 20 patients was 81. All fractures united after an average of 20 weeks. The mean time to full, unprotected weight bearing was 16 weeks.

Conclusion: Proximal Tibial fractures treated surgically using minimally invasive plate osteosynthesis technique gives early functional ability and early mobilisation of knee joint. Minimally invasive plate osteosynthesis technique offers improved fracture healing without any risk of soft tissue complications when compared to conventional plating by open reduction and internal fixation.

Keywords: Proximal tibia fractures, MIPO technique, knee society score

Introduction

Proximal tibial fractures caused by high-energy injuries may be associated with neurovascular injuries, compartment syndrome, deep vein thrombosis, contusion, crush injury to the soft tissues, or open wound [1-3]. Management of proximal tibia fractures is difficult while considering the limited soft tissue cover and vascular compromise following injury. Open reduction and internal fixation in oedematous vascular compromised skin will end up in complications like infection and wound dehiscence [4, 5]. Management of proximal tibia fractures using minimally invasive plate osteosynthesis reduces damage to surrounding soft tissues and helps in improved fracture healing without complications.

Aim of the study

Short term analysis of functional and radiological outcome along with the complications of proximal tibial fractures treated by minimally invasive plate osteosynthesis evaluated using Knee society clinical rating score.

Materials and methods

We have analysed 20 cases of proximal tibial fractures treated surgically using minimally invasive plate osteosynthesis admitted at Institute of Orthopaedics & Traumatology,
Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai from January 2016 to December 2017. Average time from injury to surgery was 10 days. All patients were evaluated with standard anteroposterior, lateral radiographs of the affected bone and joint and 3D CT scan. Fractures classified using Schatzker classification [6]. Image intensifier was used for all the patients to assess the reduction and position of the plate. All the patients were operated in the supine position with sand bag under the knee for selective patients. The patients were operated by the standard medial and lateral approaches using Proximal tibial locking plates. Commonly used plates are precontoured anatomical locking plates, hockey stick shaped locking plates, buttress locking plates [7].

Fracture reduction was done using Tibial distractor, Schanz pin, point reduction forceps and temporary fixation with K-wires. The minimum follow-up period was one year and maximum follow up period was two years. Radiological evaluation of fracture union was observed by serial X-rays.

**Inclusion criteria**
1. Age more than 18 years.
2. Both extra-articular and intra-articular fractures of proximal tibia.
3. All closed fractures of proximal tibia.
4. Compound proximal tibia fractures upto Grade IIIA and without any infection.

**Exclusion criteria**
1. Compound fractures not having adequate soft tissue coverage.
2. Associated neurovascular injury.
3. Associated head injury.

**Operative technique**
All the patients were operated in supine position with spinal anaesthesia. Precontoured anatomical locking plate, hockey stick shaped locking plates, buttress locking plates were used of appropriate length. Ipsilateral iliac crest was prepared to harvest bone graft for needy patients. Incision of size 2 cm was made over the proximal (medial and lateral) aspect of tibia. Closed reduction of fractures were done under C arm guidance and fixed temporarily with K-wires. Plates were slidened without damaging the soft tissues using minimally invasive plate osteosynthesis technique from proximal to distal direction. Screws were placed in the distal end by stab incisions. Fracture reduction and plate position was checked under image intensifier in both coronal and sagittal planes and then screws were applied. Strength of the fixation was assessed intraoperatively by gentle movement of the knee joint. Skin incisions were closed in layers.

**Post op protocol**
During post-operative period, all patients were given IV antibiotic injection Cefotaxime 1 gm plus IV injection Amikacin 500 mg 12 hourly for five days. Isometric exercises were initiated from first post op day. Gradual knee mobilization was started from third post op day. Suture removal was done at 10th post-operative day. Non weight bearing was advised. Patients were asked to perform straight leg raising exercises and knee flexion exercises. Patients were followed up every three weeks for first two months, thereafter every four weeks upto six months and thereafter every twelve weeks for one year. During follow up, patients were examined for skin condition, signs of infection, range of knee movements, rest and activity pain. Partial weight bearing was started 8 weeks after surgery when there were signs of callus on radiograph. Full weight bearing was allowed only after fracture union was seen on radiograph.
Minimally invasive plate osteosynthesis also offers advantage in Bicolumn plating for bicondylar tibial plateau fractures [21-23]. Usually in conventional methods, bicolumn plating involves two separate incisions which can lead to extensive damage to soft tissues, periosteum and sometimes the viability of the skin and soft tissues in between the incisions can be affected leading to postoperative complications.[24,25] Major limitations are: it is highly demanding and technically challenging in patients with complex proximal tibial fractures and in fractures requiring bone grafting which needs adequate exposure limiting the use of minimally invasive plate osteosynthesis [26,27]. Barring these, this technique can be considered for proximal tibial fractures which will give satisfactory functional and radiological outcomes without much soft tissue complications.

Results and observation

Majority of injured patients were males (90%) and the highest number of patients were in their 4th decade (60%). Road traffic accidents was the most common mode of injury (80%). No case with bilateral fractures was reported. Type VI fracture is the most common type in 60% patients. Early complications like wound gaping, skin necrosis were treated.

Table 1: Showing the distribution of cases and their outcome by knee society score

| S. No | Age/Sex | Type (Schatzker) | Knee society score | Outcome |
|-------|---------|-----------------|--------------------|---------|
| 1     | 42/M    | V               | 90                 | Excellent |
| 2     | 19/M    | IV              | 85                 | Excellent |
| 3     | 70/M    | VI              | 70                 | Good |
| 4     | 26/M    | VI              | 80                 | Good |
| 5     | 62/M    | VI              | 75                 | Good |
| 6     | 26/M    | V               | 85                 | Excellent |
| 7     | 35/M    | VI              | 80                 | Good |
| 8     | 38/M    | VI              | 80                 | Good |
| 9     | 60/F    | VI              | 75                 | Good |
| 10    | 42/M    | I               | 90                 | Excellent |
| 11    | 32/M    | V               | 90                 | Excellent |
| 12    | 40/F    | IV              | 85                 | Excellent |
| 13    | 30/M    | VI              | 70                 | Good |
| 14    | 44/M    | VI              | 80                 | Good |
| 15    | 42/M    | VI              | 75                 | Good |
| 16    | 45/F    | V               | 85                 | Excellent |
| 17    | 48/F    | VI              | 80                 | Good |
| 18    | 43/M    | VI              | 80                 | Good |
| 19    | 53/M    | VI              | 75                 | Good |
| 20    | 28/F    | I               | 90                 | Excellent |

Table 2: Shows the fracture type and its associated complications and its management

| Type (Schatzker) | No. of patients | Associated injuries | Complications | Initial management | Time of injury to surgery |
|-----------------|-----------------|---------------------|---------------|--------------------|--------------------------|
| I               | 2               | Nil                 | Nil           | AK Slab            | 5 days                   |
| IV              | 2               | Grade I, II wounds  | Nil           | Wound wash, Suturing, AK slab, Antibiotics | 5-7 days |
| V               | 4               | Grade I, II wounds  | Nil           | Wound wash, Suturing, AK slab, Antibiotics | 5-7 days |
| VI              | 12              | Grade I,II,III A wounds | Skin necrosis, wound infection | Wound wash, Suturing, Antibiotics, External fixation | 1-3 weeks |

Knee society clinical rating score was used to assess the functional outcome of our patients. In this scoring system, excellent result means 85-100 score, good result means 70-84 score, 60-69 score means fair result and <60 score means poor result. All of our patients results were excellent and good. The average knee society score in our study with 20 patients was 81. All fractures united after an average of 20 weeks. The mean time to full, unprotected weight bearing was 16 weeks.

Discussion

The aim of this study is to analyse the short term functional and radiological outcome of proximal tibia fractures treated with minimally invasive plate osteosynthesis technique. Proximal tibial fractures are usually associated with high energy trauma and soft tissue injury is common. Not only the closed fractures but also the open fractures can also be treated with success using minimally invasive plate osteosynthesis technique as a second stage procedure after initial emergency debridement and temporary external fixation.[8] This will provide rapid fracture healing, minimization of soft tissue complication and loss of function. In conventional methods of open reduction and internal fixation, surgical trauma devitalizes soft tissues, periosteum thereby resulting in wound dehiscence, deep infection and even non-union [9-15].

The time duration from injury to surgery also plays a major role in bringing the patient to early mobilization and near normal function [8,16-18]. Timing of surgery when the tissues are least oedematous ensures better outcome in terms of soft tissue healing, fracture healing and early mobilization without any complications like knee stiffness [19,20]. In our study, patients operated within 5-7 days of injury came up with excellent results when compared to patients operated after one week.

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Fig 2: A 42-year-old male patient who sustained Type V closed proximal tibia fracture left side in a road traffic accident. Bicolumn plating by primary minimally invasive plate osteosynthesis was performed which showed excellent result after one year follow up.

**Conclusion**

Proximal Tibial fractures treated surgically using minimally invasive plate osteosynthesis technique gives excellent functional outcome with early mobilisation of the knee joint. Minimally invasive plate osteosynthesis technique offers improved fracture healing without soft tissue complications when compared to conventional plating by open reduction and internal fixation. The satisfactory short term functional and radiological outcome without much soft tissue complications suggests that this technique is a better option for proximal tibia fractures irrespective of their severity.
Fig 3: A 19-year-old male patient, sustained Type IV closed proximal tibial fracture left side in a road traffic accident. Medial column plating by primary minimally invasive plate osteosynthesis was performed with bone grafting which showed excellent result.

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