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Original Research Article

Management Of Proximal Tibial Fractures with Different Modalities

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Conflict of interest: Nil

Abstract:

Background: Fractures of proximal tibia have always been difficult to treat because of the subcutaneous location of its anteromedial surface. These days significant attention has been paid to the condition of soft tissue envelopes.

Aims: To evaluate the end results of tibial plateau fractures treated and different modalities of the treatment and their complications in our hospital.

Methodology: A prospective study was conducted on 30 patients with proximal tibial fractures at the Orthopaedic Department of MGM Medical College and Hospital, Navi Mumbai**.**

Results: The mean age was 35.2 ± 10.73, and there were more men (70%) than women (30%). According to the radiological Schatzker classification, I fracture (33.3%) and III fractures (23.33%) were the most prevalent among the study population. The next most prevalent were types 2 and 4. Right proximal tibia fracture (66.7%) was the most common diagnosis among the study population, followed by left (33.3%). The study population's most often used treatment methods were locked plates (33.33%), buttress plates (5%) with bone grafting, and (5% without). The study population's most frequent early complications were pain (26.7%), limited knee mobility (41.3%), infection (10%), delayed union (51.6%), and malunion (3.3%). 56.7% of the study population had excellent outcomes, 26.7% had good outcomes, fair in 13.3%, and poor outcomes 3.3%.

Conclusion: To consistently provide great and positive outcomes, the surgeon needs to have a solid understanding of the type of proximal tibia damage and be conversant with the range of current procedures available for treating these fractures.

Keywords: Proximal, Tibia, Fracture, Orthopedic.

Introduction

Tibial plateau fractures account for approximately 1% of all fractures. To understand and treat proximal tibial fractures, we must consider not only the anatomy of the knee but also the patient's age, general condition, and activity level. Recently, more attention has been paid to the condition of the soft tissue envelope before surgical intervention. Soft tissue-friendly approaches, delayed internal fixation and minimally invasive techniques have all recently improved outcomes following these injuries. [1]

This type of fracture usually occurs in two different groups:

• Young patients after high-energy trauma or

•Elderly osteopenic patients after low-energy injuries.

In the latter, a depression component is often associated. The main trauma mechanism in this fracture type is pure abduction force or valgus combined with axial load. Soft tissue injury, bone quality, patient's age, redisplacement, and posttraumatic arthritis are important factors influencing the outcome of proximal tibia fractures [2]. Tibial plateau fractures (TPF) are caused by both low-energy or high-energy excessive varus or valgus forces combined with axial stress on the knee. High-energy fractures are commonly the result of traffic accidents, falls, or sports-related injuries. Low-energy fractures are mainly seen in older individuals due to reduced bone mineral density and are typically associated with a depression of the articular surface [3]

Fracture classifications help surgeons to make their decisions on treatment and prognosis. Among available classifications for tibial plateau fractures, the Schatzker classification is the most widely used tool. The AO and the Hohl& Moore systems are still in use. These fractures caused by high-energy mechanisms may be associated with neurological and vascular injury, compartment syndrome, deep vein thrombosis, contusion, crush injury to the soft tissues, or open wounds. [4]

Tscherne and Lobenhoffer emphasized the importance of distinguishing between the "pure" plateau fracture pattern and the fracture-dislocation

pattern. They found 67% of meniscal injuries occurred in plateau fracture patterns, whereas 96% of cruciate injuries and 85% of medial collateral ligament injuries occurred in fracture-dislocation patterns. Peroneal nerve injury was twice as common in fracture-dislocation patterns. [5]

Complex fractures involving the femoral and tibial articular surfaces had a 25% incidence of vascular injury and a 25% incidence of compartment syndrome. In complex fractures with severe soft tissue injury, vascular injury occurred in 31%, compartment syndrome in 31%, and peroneal nerve injury in 23%. Accurate determination of fracture pattern and soft tissue injury is necessary when developing a treatment plan. Proximal tibial articular fractures can be caused by motor vehicle accidents or bumper strike injuries; however, sports injuries, falls, and other less violent traumas frequently produce them, especially in elderly patients with osteopenia. [6]

Schulak and Gunn related the frequency of the type of fracture produced and the frequency of collateral ligament injury to the type and mechanism of forces applied to the knee. Considering the "pure" fracture patterns, ligamentous injuries occur more frequently in minimally displaced, local compression, and split compression fractures, and it is wise to obtain stress radiographs of the knee to evaluate these structures.

Various studies have been carried out and different treatment modalities have been advised, but consensus has not been reached. The mobility and stability of the lower limbs mostly depend upon the integrity of the knee joint. To achieve a stable, well-aligned, mobile joint with minimum articular irregularities. Therefore, we attempted this study to evaluate different modes of treatment of fractures of the tibial plateau.

Aim of the study

1. To evaluate the end results of tibial plateau fractures treated in our hospital by various surgical modalities.
2. To evaluate different modalities of the treatment and their complications.

Materials and Methods

It is a prospective study of 30 patients of age more than 18 years and above of either sex who have fractures of the tibial plateau chosen among the outpatients at the Orthopaedic Department of MGM Medical College and Hospital, Navi Mumbai.

Inclusion criteria

a) Age: Patients above 18 years of either sex.

b) Radiological diagnosis of fractures with classification based on Schatzker's classification.

Exclusion criteria

a) Age: Less than 18 years.
b) Patients who are medically unfit for the surgery.
c) Compound tibial plateau fracture.

Data collection tools

The first section focused on obtaining participants' consent to participate in the research. It also included sociodemographic questions to gather information about age, gender, social status, occupation, education, and income.

The second section of the questionnaire addressed clinical history. Participants were asked about chief complaints, mode of injury, any associated injury, radiological confirmation of fracture according to Schatzker's classification, and diagnosis.

The third section of the questionnaire addressed surgical history, complications, and outcomes.

Additional information

On admission, the patient was thoroughly assessed clinically. The cause of injury was inquired; vitals parameters were checked; associated head, neck, chest, and abdominal injuries were looked for. On local examination skin condition was noted, fracture blisters, haemarthrosis, open or closed, distal neurovascular compromise, and any signs of compartment syndrome were noted. Any other associated limb injury or bony injury was noted. According to the general condition and vital parameters, intravenous access was sought and intravenous fluids were given accordingly. Other bony injuries were immobilized and appropriately treated.

Surgically Treated Group

The fractures were classified using the method of Schatzker's classification. In the prospective study of 30 cases, depression of more than 2-4 mm or split in either sagittal or coronal plane was the indication for surgery. Computerized Tomographic evaluation was done in cases which had more comminution and when the x-ray was inconclusive and MRI was done in suspected ligamentous and soft tissue injuries. All of the cases in this study were treated operatively as articular surface reconstruction was the main consideration. There was no strict surgical protocol followed in treating these cases. Most of the cases were operated within 2 days of admission. If articular cartilage and meniscal injuries were noted in MRI, then arthrotomy was undertaken. The patient was suitably anaesthetized-regional or general as the case may be. Surgery was performed in a supine position under tourniquet control. Incisions used were medial or lateral parapatellar, midline, or two separate for bicondylar fracture. The recommended A-O technique of fracture fixation was used.

Implants Used For Internal Fixation Of Tibial Condylar Fracture:

Buttress Plate: The widening ends of long bone consist of a large amount of cancellous bone. Such bone is comparatively weaker and has a tendency of axial deviation or bending under the effect of compressive or shearing force. A lag screw cannot prevent the deformity and to supplement the fixation a buttress plate is essential to prevent collapse.

Types: T plate, L plate, Hockey stick plate.

T plate has a horizontal and vertical limb. It is a thin plate and helps in preventing a thin cortex or defect in cancellous bone from collapsing. L plate is of 2 types left and right offset with a double bend to fit onto the plateau. The hockey stick plate is stout and stronger and the majority of the time used to buttress lateral plateau.

Locking compression plate: Locking compression plates are indicated for certain high-energy bicondylar fractures, those with severe comminution, and osteoporotic fractures. The laterally based locking plate offers an alternative to an additional medial plate or external fixator for support of the medial column in bicondylar fractures [7] Interfragmentary compression cannot be achieved by locked plates; supplementary use of Interfragmentary screws may be required to prevent loss of reduction and to ensure adequate compression of the fragment [7]

SCREWS

1. Cortical screws - 4.5 mm diameter of various lengths
2. Cancellous screws: - 16mm, 32mm partially threaded and fully threaded.
3. Locking screws

Cortical screws have a thick core with narrow thread and are used for purchase in cortical bone.

Cancellous screws have a thin core with wide and deep threads and are used for purchase in the epiphyseal and metaphyseal areas of bone.

Full threaded screws act as a fastening device for the plate. Partially threaded screws are used as lag screws to achieve compression of the fractured articular surface.

Operative Protocols:

Central Depression Fracture: A window is made in the metaphyseal area below the depressed segment, the depressed fragment elevated, and the autogenous cortico cancellous bone graft packed beneath. An autogenous bone graft was harvested from the anterior aspect of the iliac crest. Fragment and graft were stabilized with cancellous screws or plate fixation.

Split And Depressed Fracture: Surgical intervention is necessary for a fracture of more than 2-4 mm spilt and depressed. The depressed fragment is elevated and autogenous bone grafts from the iliac crest are put split is reduced and reduction is held with Kirschner wires. The fragments are then fixed with suitable plates and cancellous and cortical screws.

Total Condylar Depression: Fracture of the medial or lateral condyle needs appropriate reduction as malunion may develop with varus or valgus malalignment. The depressed plateau is elevated, articular surface is reconstructed and fixed with the buttress plate.

Bicondylar Fracture: A midline or two-incision technique is used for the reduction of both the condyles. Arthotomy is done for inspection of ligament injury or meniscal injury. Menisectomy is done if indicated. Depending upon comminution fixation is done by L, T, or hockey stick plate or locked plates and cancellous screws. Dual plating can be done if the other side is unstable where collapse may occur.

Post-operative care

- In all the surgeries wounds were closed over suction drains. The drains were removed after 48 hrs. Above knee slab or removable knee brace with leg elevation given to decrease the pain and edema.
- Injectable antibiotics given for 3 to 5 days.
- Static quadriceps exercises and ankle pump exercises started on the second day.
- The patients with stable fixation were allowed intermittent knee mobilization once the wound pain subsided, early in type I, II, and III in 5 to 10 days and late in type V and VI in 14 days or later depending upon comminution of fracture.
- Stitches are removed in ten to twelve days and progressive muscle strengthing exercises along with passive exercises are instituted.
- Knee immobilization with a brace or above-knee cast was used in cases with ligamentous injuries for 4 to 6 weeks.
- Weight bearing was deferred until evidence of union is seen on x-rays (usual by 14 -16 weeks)
- The patient was followed up every 4 weeks for a period of one year.
- Partial weight bearing was started from 10- 14 weeks depending upon the fracture configuration and correlation with the x-ray. A full range of motion is expected at 8-10 weeks after discharge.

Data management: The extracted data were examined and encoded using IBM SPSS version 22 (SPSS, Inc., Chicago, IL). Sociodemographic factors, clinical and surgery-related components

were then subjected to descriptive analysis in the form of frequency and percentage. The study's findings were presented using tables and graphs.

Ethical consideration: The study received ethical approval from the Institutional Ethical Committee. Informed written consent was taken from the participant before enrolment in the study. Participants were explicitly informed of their right to decline participation at any time without the need to provide a reason.

Results

The mean age of patients was 35.2 ± 10.73 years. The most common age group amongst the study population was 20 to 30 years (33.3%) followed by 31 to 40 years (30%). There was a higher number of males (70%) as compared to females (30%). The most common occupation amongst the study population was farming (50%) followed by Students (33.33%).(Table 1)

Table 1: Sociodemographic characteristics of patients

Characteristics	Number	%
Age (years)		
20-30 years	10	33.3
31- 40 years	9	30.0
41-50 years	8	26.7
>50 years	3	10.0
Gender		
Male	9	30.0
Female	21	70.0
Occupation		
Clerk	2	6.7
Farmer	15	50.0
Labourer	3	10.0
Student	10	33.3

The most common mode of injury amongst the study population was due to road traffic accidents (80%). (Figure 1)

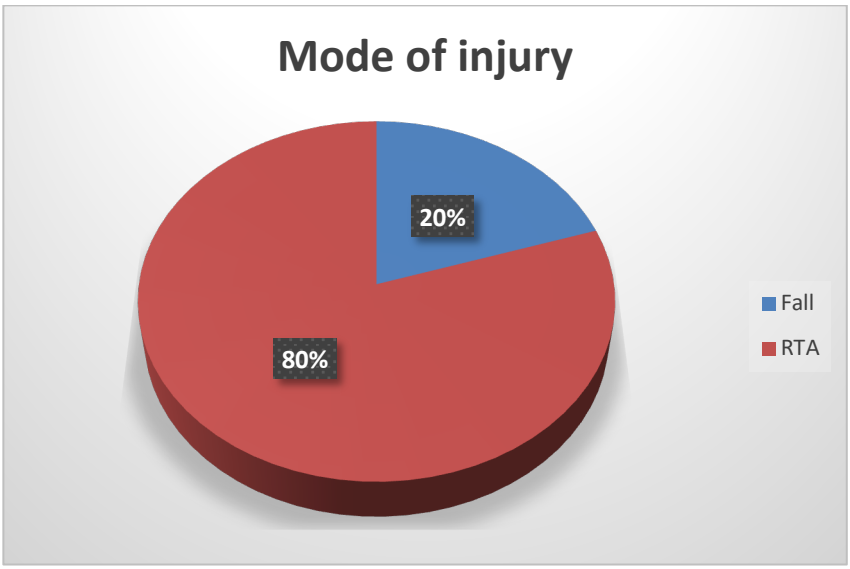

Figure 1: Mode of Injury

Pain, swelling, deformity, tenderness, and abnormal mobility were present in almost all of the study population. 83.3% of the study population had associated injury. On radiological Schatzker classification, the most common fracture type amongst the study population was I (43.3%) followed by III (23.33%). (Table 2)

Table 2: Clinical characteristics of patients

Characteristics	Number	%

Chief complaints		
Pain	30	100.0
Swelling	30	100.0
Deformity	30	100.0
Tenderness	30	100.0
Haemarthrosis	16	53.3
Crepitus	15	50.0
Abnormal mobility	30	100.0
Any associated injury		
Yes	5	16.7
no	25	83.3
Radiological Schatzker classification		
I	13	43.3
II	5	16.7
III	7	23.3
IV	5	16.7

The most common diagnosis amongst the study population was right Proximal tibia fracture (66 %) compared to left Proximal tibia fracture (33%) (Figure 2)

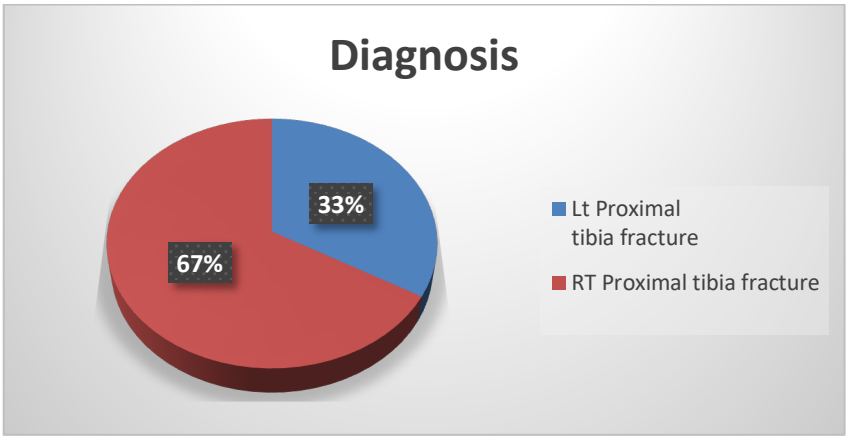

Figure 2: Diagnosis of patients

The most common treatment procedure amongst the study population was Buttress Plate and Locked plates (33.33 each %) followed by buttress plate and bone grafting and locked plates and bone grafting. (Figure 3)

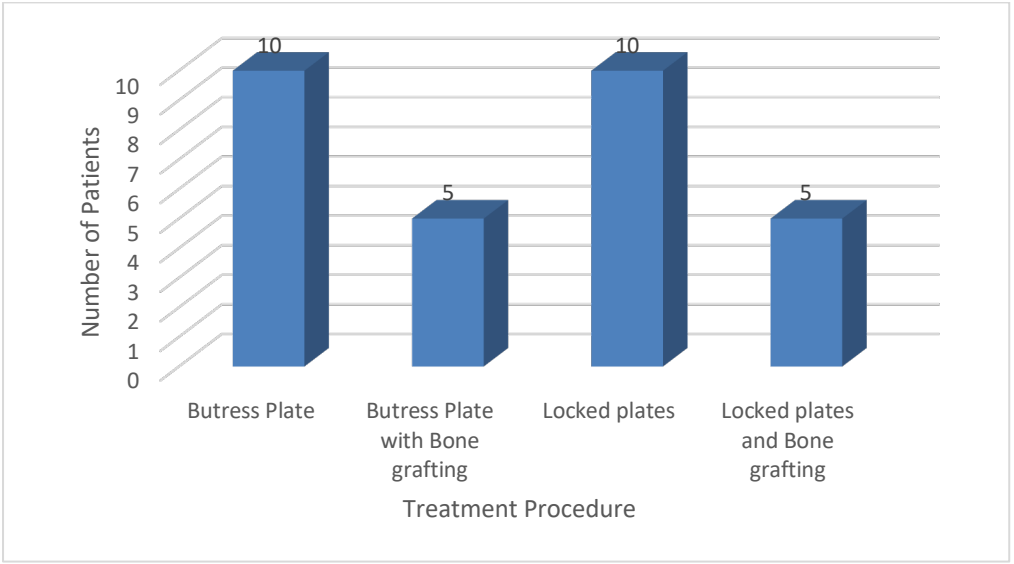

Figure 3: Treatment procedure

The most common early complication amongst the study population was pain (26.7%) followed by limited knee motion (13.3%). the most common late complication amongst study population was Infection (10%) followed by the delayed union (16.7%) and malunion (3.3%) (Table 3)

Table 3: Complications

Complications	Number	%
Early		
limited knee motion	4	13.3
Pain	8	26.7
Late		
delayed union	5	16.7
Infection	3	10.0
Malunion	1	3.3

17 (56.7%) of the study population had excellent outcomes, 8(26.7%) had good outcomes, fair in 4 (13.3%) and poor outcomes in 1(3.3%) (figure 4).

Figure 4: Functional outcome at the end of follow-up

Discussion

This prospective study was conducted on 30 patients with tibial plateau fractures admitted to MGM Hospital, Kamothe to assess the outcome of different modes of treatment for fractures of tibial plateau.

Tibial plateau fractures are difficult to treat because of their intra-articular nature, cancellous bone involvement, and proximity to a major weight-bearing joint. Despite many advances in the care of intra-articular fractures, management of these fractures remains challenging for orthopedic surgeons [8] even in the present day. Open reduction and stable internal fixation are required for depressed or displaced and unstable fractures to regain the early and complete range of motion. Proper physiotherapy and compliance of patients are equally important to achieve good results.

In our study, the most common age group amongst the study population was 20 to 30 years (33.3%) followed by 31 to 40 years (30%) with a mean age was 35.2 ± 10.73 There was a higher number of males 21 (70%) amongst study population as compared to female 9 (30%). This can be attributed to our Indian setup where the female population largely works indoors and does not travel much. Similarly in the study conducted by Kulwinder Singh et al., 2013 [9], these fractures are more commonly seen in the active productive age group (31-50 years) and the majority of the patients were males (76.7%). In the given study males were more affected than females which was also reported by Lee et al., (65.71%) [10], Albuquerque et al., (70.3%) [11], Manidakis et al. (58.4%) [12] and Mehin et al. (56%) [13].

Occupation In our study was 2 clerks,15 farmers,3 labourers, and 10, students. In the present study, the most common mode of injury amongst the study population was due to road traffic accidents 24(80%) followed by falls 6 (20%). These findings correlate well with a study conducted by Kulwinder Singh et al., 2013 [9] in which road traffic accidents were the commonest mode of injury in 93.3% of cases, followed by fall in 6.7%. In a similar study conducted by C.V. Dasaraiah et al., 2016 [14] road traffic accidents (56.6%) were the most common mode of injury.

In the present study, pain, swelling, deformity, tenderness, and abnormal mobility were present in the study population. This has been reported by most of the studies.

In the present study, 5(16.7%) of the study population had associated injury similarly in the study conducted by Ramji Lal Sahu et al [15] 12.94% of patients had multiple fractures elsewhere in the body and17.05% of patients had associated fractures in the lower leg.

Radiological Classification In our study was Type1 -13 (43.3%); Type 2 -5(16.7%); Type 3 -7(23.3) and Type 4-5(16.7) In Ramji Sahu et al frequency of fractures was type 1 (27.05%) and type 2 (14.11%) type 3(5.88%) and type 4 (17.64%). In the study conducted by Kulwinder Singh et al frequency of type 1 and type 3 was (36.6%) and type 2 and type 4 was (16.6%)

In the present study, the most common treatment procedure amongst the study population was buttress plate and locked plates 10 each (33.33 %) and locked plates and bone grafting 5 (16.7%). In their study, Ramji Sahu et al treated 50% of their patients with a buttress plate with or without bone grafting and the other 50% with a Locking compression plate with or without bone grafting [15].

In the present study, the most common early complications were pain 8(26.7%) followed by knee motion knee motion 4 (13.3%) delayed union 5(16.7%) followed by infection 3 (10%) and malunion 1 (3.3%) were other most common late complications amongst study population. Infections were treated with antibiotics and regular dressings. Similarly in the study conducted by Kulwinder Singh et al 2013, [9] the incidence of superficial infection was 6.7%. Implant removal was not done in any case and there was no case of deep infection. One case developed varus malunion with stiffness at the knee. In a similar study conducted by C.V. Dasaraiah et al., 2016 [14] complications like limited knee motion (10%) followed by infection (6.8%) were observed.

In the present study, 17 (56.7%) of the study population had excellent outcomes, 8 (26.70%) had good outcomes, fair in 4 (13.3%), and poor outcomes in (3.3%) Similarly in the study conducted by Kulwinder Singh et al., 2013 [9] 33.3% had an excellent outcome and 50% good outcome. In addition, we had 13.3% fair and 3.3% poor results. In a similar study conducted by Girish H. Vasanad, [16] excellent and good outcomes was obtained in 88% of patients. Sharma C et al. [17] observed that out of the 36 cases treated surgically, 28 had satisfactory results (77.77%); and 8 (22.22%) had unsatisfactory results C.V. Dasaraiah et al. 2016 [14] observed excellent results in 83.4% of patients.

Conclusion

Utilizing sound clinical judgment is essential for managing proximal tibia fractures. If the surgeon is to implement a reasonable course of treatment, he or she needs to be well-versed with the nature of the injury, the knee examination, imaging studies, and the range of current therapeutic options for these fractures. It is recommended that open reduction and internal fixation with buttress plate and LCP plates with or without bone grafting where required is the preferred treatment for the management of proximal tibial fractures.

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