

STUDY OF PLATE OSTEOSYNTHESIS OF TIBIAL PLATEAU FRACTURES

Dr. BabulReddy^{1*}, Dr. Shiv Sandeep S.V², Dr. SAMA VIVEK³

^{1*}Associate Professor, Orthopaedics TRR Institute of Medical Sciences

²Associate Professor, Orthopaedics TRR institute of medical sciences

³Assistant Professor, Orthopaedics, TRR institute of medical sciences

***Corresponding Author:** BabulReddy

*E-mail: babulortho@gmail.com

Abstract:

Background: Management of tibial plateau fractures remains challenging because of their number, variety and associated soft tissue injuries that further augment their complexity. Comparison of operative results in recent reports has been difficult due to a lack of standard fracture classification scheme and uniform standardized objective criteria for evaluating results. This study is to analyze the functional outcome of surgical management of tibial plateau fracture in adults with buttress plate, Cannulated Cancellous screw.

Methods: Thirty patients with closed tibial plateau fractures were treated operatively and followed up for a minimum period of 6 months. Fractures were classified according to Schatzker's staging system and results were evaluated using modified Rasmussen's 30point clinical grading system and Rasmussen's radiological evaluation.

Results: Type I was the most common fracture type (11 cases) followed by type II and type V (7 cases each). The mean age in our study was 37.1 years with male predominance (90%). There were 20% excellent and 46.67% good functional results with only 2 patients having unacceptable results due to severity of injury and old age. The mean Rasmussen's functional and radiological score were 22.83 and 7.2 respectively.

Conclusion: Anatomical reduction and rigid internal fixation followed by early knee motion and partial weight bearing during bone healing are the cornerstones in the treatment of tibial plateau fractures. Functional outcome is better in operatively treated tibial plateau fractures in adults, because it give excellent anatomical reduction and rigid fixation to restore articular congruity and early motion thereby preventing knee stiffness.

Key words: Distal tibia fracture, Shatzker classification, Buttress plate, Cannulated Cancellous Screw (CCS), Rasmussen Functional and Radiological Grading.

Introduction:

Around one per cent of fractures in adults involve the tibial plateau (Moore 1987).¹ In men, these fractures occur at a younger age and tend to be the result of high energy trauma, such as motor vehicle accidents.² In women, the fractures often occur later in life as a result from lower energy trauma reflecting underlying osteoporosis.² Tibial plateau fractures have been studied and reported extensively in literature but still controversy exists over its management, whether surgical or conservative.³⁻⁷ Excellent results have been published in both groups. On one hand, we have got a group of surgeons who says that most of the tibial plateau fractures (85%) can be managed by conservative treatment and on the other hand, other group says conservative treatment means therapeutic nihilism and except for undisplaced fracture every tibial plateau fracture should be

operated upon to achieve anatomical reduction and rigid internal fixation.⁸⁻¹³ Even undisplaced tibial plateau fractures should be operated, so that early mobilization of knee is possible.

Fractures of the upper tibia are difficult to treat, apart from the usual problems of confining patients to bed. Conservative treatment at any age may be complicated by knee stiffness, mal-union, and non-union.¹⁴ Open reduction and internal fixation has been advocated using various implants including buttress plate, cancellous screw, external fixator etc to achieve good fracture union and optimal knee function.^{15-18,19} Fractures of tibial plateau are serious injuries that frequently results in functional impairment. The emphasis in treating displaced fractures is an anatomical restoration of articular surface, repair of soft tissue injuries and rigid internal fixation to obtain a stable painless knee joint with normal range of motion controlled by well functioning muscles.²⁰ We conducted this study to evaluate the functional outcome of tibial plateau fractures and to study the complications of this fractures.

Methodology:

This study was conducted in a medical college hospital. Thirty adult (age group 20-70 years) patients with closed tibial plateau fractures were included in the study. Children, open fractures, medically unfit patients were excluded from the study. After thorough clinical and radiological evaluation fractures were classified according to Schatzker's classification. Fractures were classified as unstable if there was depression of >4mm, displacement >10mm and instability >10°. Fractures were fixed either with percutaneous technique or by open reduction and internal fixation with Buttress plate and 6.5 mm Cannulated Cancellous Screws. Bone graft from ipsilateral iliac crest was used wherever necessary. The patients were followed up for an average period of 6 months.

The patients were advised static quadriceps exercises for initial 4 weeks followed by range of motion exercises with protected knee brace up to 6 weeks. Based on the clinical and radiological signs of union patients were allowed partial weight bearing and gradually progressed to full weight bearing. The patients were then followed up at 6 months, during which time the anatomic and functional evaluation was done using the modified Rasmussen clinical and radiological grading system.

Results: Out of 30 patients, 27 were males and 3 were females. The mean age of our study group was 37.1 years. Road traffic accidents were the major cause of injury with right sided predominance (60%). In our study, the majority of the fractures were found to be of type I with equal number of type II and type V fracture (Table 1). Various methods of fixation used as shown in Table 2. Fixation augmented with bone graft in 5 cases. Out of 30 cases, 16 cases gave excellent results, 14 cases came out with good results, fair in 8 cases and 2 cases had poor results, (Table 3). All fractures united within expected time except for 4 cases which were complicated with infection. (Table 4).

Discussion: Tibial plateau fractures, one of the commonest intra articular fractures, are major traumatic injuries occurring as a result of RTA, fall from height, violence, etc.^{5,6} The management of tibial plateau fracture has always been a subject of debate because of their variety and complexity. Any fracture around the joint (especially weight bearing knee joint in the lower limb) is of paramount importance as it would result in significant morbidity and quality of life may be affected. High energy intraarticular fractures of the tibial plateau cause ongoing management problems and remains challenging for orthopaedic surgeons even to date.^{8,10,13} In this study, we analyzed the functional outcome of osteosynthesis of tibial plateau fractures in 30 patients, the analysis of the results were made in terms of age of the patient, sex distribution, occupation, mode of injury, side of fracture, analysis of the types, modalities of treatment, complications associated injuries and the functional outcome.

Tibial plateau fractures are more commonly seen in the active age group (31-50 years) due to high-energy trauma.³ Closed treatment of these injuries has had little success in reducing depressed or displaced fracture fragments; this necessitates open treatment in most displaced and unstable

fractures.¹⁵ It is extremely important to do a stable fragment fixation in order to regain the complete range of motion. In our series majority of patient were males (90%).

Occupationally tibial plateau fractures were seen in people with high level of activity, movement and travel. It is most commonly seen with people who high mobility like employee (43.33%), labourers (20%). In our studies the mean age of patient is 37.1 years and majority of patients were in the productive age group of 20–50 years (86.66%). Cole PA et al. also found the majority of patients in productive age and average of 45 years, correlated well with the study of Ricci WM et al. and Stannard JP

et al. with average of 53 and 38 years respectively.²¹⁻²³

In our study, there was right sided predominance, compared to the left side with right side 60% and left side 40%. Different authors use different criteria for the surgical management of these fractures. Honkonen conducted a study of 130 tibial plateau fractures and indications for fixation being condylar widening of > 5 mm, lateral

condyle step off > 3 mm and all medial condylar fractures.¹⁹

In our study, the indications for the surgery were the same standard indications as for the tibial plateau fractures. 3 mm depression was considered as an indication for surgery in our series. Majority of the fractures were found to be of type I(36.64%) and equal no of type II and type V fractures(23.33%). Lateral condylar and bicondylar fractures we found to be more common than medial condylar fractures. Marwah V et al. and Ruslan GS et al. stated the same in their studies.^{24,25} We didn't have any type VI fracture.

In our series we have not formulated any criteria as to particular method of fixation for particular type of fracture. So each case was individualized and treated accordingly as it needed. Two cases each type I, type II and type IV were treated with percutaneous cancellous screw fixation. The split fracture, of >3 mm displacement was treated by open reduction. Fixation was augmented with bone graft in 5 cases.

The period of immobilization was standardization to 4 weeks for all type of fracture. We also found that good range of movement at the knee was achieved in cases where knee mobilization was started early. Early movements were possible in cases where congruous articular surface and rigid fixation was achieved. Delay in mobilization resulted in peri-articular scarring and loss of movements. Thus in our study a direct relationship between congruous articular surface, early physiotherapy and resultant range of motion at the knee was found.

Lachiewicz and Thomas had stated that patients immobilized for > 3 wks had mean range of movements 14° less than those immobilized for shorter periods.¹¹ Rasmussen and Drennan et al. considered 6 wks to be upper limit of knee mobilization for restoring normal range of movements.²⁶ In our study patient mobilized after 6 weeks had fair range of movements between 70 and 110°.

In spite of all these associated bony fractures, ligament injuries and complications, we were able to achieve 20% excellent result, 46.67% good result with our standard surgical methods. In addition we have 26.67% fair and 6.6% poor result in terms of functional outcome. These results are comparable and on par with other documented standard studies like Hitin Mathur et al. who had 37% excellent and 51.85% good functional results with only 3 patients having unacceptable results.²⁷ The mean Rasmussen's functional score was 22.83 and mean Rasmussen radiological score was 7.2 which correlated well with the study of Hitin Mathur et al. with mean Rasmussen's functional score of 25.062 and mean radiological score of 15.33.²⁷ Moreover, clinical evaluation did not correlate with the follow up radiographs. We have employed conventional techniques though we had satisfactory results with the standard conventional methods. Probably, if we were less invasive at surgery, still more rigid in fixation and further aggressive in physiotherapy, we would not even have had these complications (stiffness & infection) and at the same time would have achieved these goals much earlier.

Conclusion: Displaced condylar fractures of tibial plateau belonging to Schatzker's type I and II, the treatment of choice is closed/open reduction with CCS results are excellent to good by this method. In Schatzker's type IV fractures which were managed by open reduction and Buttress Plating and bone grafting has fair to good results. The main aim of surgical treatment include precise reconstruction of the articular surface with elevation of the depressed bone fragment, bone grafting, stable fragment fixation allowing early range of movement. Schatzker's type III can be managed operatively with open reduction with Buttress plate and bone grafting gives good to fair results. In high velocity injuries belonging to Schatzker's type V the numbers of good to fair results were seen. This is mainly due to adequate reconstruction of the articular surface during operative period and prevention of collapse of reconstructed articular surface. Poor results were due to severity of injury.

Type of fracture	Number of patients	Percentage
Pure cleavage	11	36.64
Cleavage with depression	7	23.34
Central depression	1	3.34
Medial condyle fracture	4	13.34
Bicondylar fracture	7	23.34
Metaphysiadiaphyseal dissociation	0	0
Total	30	100

Table 1: Types of fractures distribution

Treatment	Number of patients	Percentage
Open reduction with CCS	7	23.35
CCS	7	23.33
Open reduction with BP	11	36.66
Open reduction with BP with BG	4	13.33
Open reduction with CCS with BG	1	3.33
Total	30	100

Table 2: Methods of fixation

CCS= Cannulated Cancellous Screw

BP=Buttress plate

BG=Bone graft

Clinical results	Number of patients	Percentage
Excellent	6	20
Good	14	46.67
Fair	8	26.67
Poor	2	6.66
Total	30	100

Table 3: Functional outcome according to Rasmussen grading system.

Complications	Number of patients	Percentage
Infection and wound dehiscence	4	13.33
Valgus and varus deformity	2	6.67
Knee stiffness	2	6.67
Normal	22	73.33
Total	30	100

Table 4: Complications of the fixation

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