

International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(1): 1055-1058
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www.orthopaper.com
Received: 08-11-2019
Accepted: 11-12-2019

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Retrospective analysis of functional and radiological outcome of tibial condyle fracture treated by internal fixation

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i1n.1960>

Abstract

Introduction: Tibial plateau is one of the most critical load bearing areas in the human body; Fractures of the plateau affects knee alignment, stability, and motion. These fractures constitute about 8% of all fractures in elderly and 1% overall. Plateau fractures cover a broad spectrum of injuries with differing degrees of articular depression and displacement. Published studies have shown that the majority of injuries affect the lateral plateau (55%–70%). Isolated injuries to the medial plateau occur in 10% to 23% of cases, while involvement of both plateaus, the so-called bicondylar lesions, is found in 10% to 30% of reported series.

Aim: To analyse functional and radiological outcome following internal fixation of tibial plateau fractures based on modified Rasmussen's Clinical and Radiological criteria.

Materials and Methods: The study was undertaken at yenepoya medical college and hospital, mangalore. Ethics committee clearance was taken for the study and Patients who were diagnosed to have tibial plateau fractures and underwent internal fixation for the same in the year 2019, x rays/CT scans were analysed and tibial plateau fractures classified according to Shatzker's classification, retrospectively functional and radiological analysis was done according to modified Rasmussen's Clinical and Radiological criteria at 3 to 6 months of follow up, all the patients were followed up upto 6 months.

Results: 21 patients were studied with mean age of 40.95, majority being males -17 and females being 3, highly significant association of this study is with male patients. Majority of the age group were of 2nd to 4th decade. Out of 21 subjects studied 17 of them had sustained road traffic accident and 4 of them had history of fall from height. Majority of them had left sided involvement-13, and 8 had right side tibial plateau fractures. Schatzker's type 2 was the type of fracture in majority and rest distribution of type of fracture as shown below. 6 cases were managed with cannulated screws +buttress plating, 1 case with percutaneous cc screw fixation, 8 were managed with Buttress plate, 3 by Buttress plate along with Bone graft and 3 cases with locking plate. All fractures united with in expected time not a single nonunion was noted in our study series, however 2 patients had knee stiffness and 2 patients experienced occasional pain, no cases had infection or wound problems. Mean Rasmussen score at final follow up was 23.05 (range 18 to 30) and the mean radiological score at the end of follow up was 7.5 (range 5 to 10).

Conclusion: To manage different types of tibial plateau fractures depends on good clinical judgement. The surgeon should have sound knowledge about personality of the injury and clear understanding of the knee examination and, imaging studies and should be Familiar with the variety of techniques available at present for treating tibial plateau fractures.

Keywords: Tibial plateau fracture, Schatzker's classification, Rasmussen's criteria

Introduction

Tibial plateau is one of the most critical load bearing areas in the human body; Fractures of the plateau affects knee alignment, stability, and motion. These fractures constitute about 8% of all fractures in elderly and 1% overall. Plateau fractures cover a broad spectrum of injuries with differing degrees of articular depression and displacement. Published studies have shown that the majority of injuries affect the lateral plateau (55%-70%)^[1]. Isolated injuries to the medial plateau occur in 10% to 23% of cases, while involvement of both plateaus, the so-called bicondylar lesions, is found in 10% to 30% of reported series^[2].

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Young adults, they are the result of high-energy trauma, while in the elderly bicondylar tibial plateau fractures usually occur in a bimodal age distribution. In young patients, high-energy trauma; most commonly road traffic accidents (RTAs) results in comminuted fractures and severe soft tissue damage, whereas in older patients, comminution and soft tissue injury arise mainly from poor bone quality and thin skin, usually follows domestic falls. Low and high-energy tibial plateau fractures usually result from axial loading in combination with varus/valgus stress forces.

The spectrum of injuries to the tibial plateau is so great that no single method of treatment has proven uniformly successful. Unfortunately, there is no gold standard management approach for various types of tibial plateau fractures; therefore, different methods have been employed depending on the type of fracture. Surgical fixation of bicondylar tibial plateau fractures is challenging because of geographic complexity and compromise of the soft tissue envelope. High-energy tibial plateau fractures remain a challenge to orthopedic surgeons, with the bicondylar type (Schatzker type V) and the reduction and internal fixation, especially done through injured soft tissues have been associated with major wound complications. Treatment goals include preservation of soft tissues, restoration of articular congruity, and correction of anatomic alignment in the lower extremities.

Various other methods of treatment have been described by various authors, each with its own merits and demerits. Tibial plateau fixation with non-locking buttress plates has been widely used in the recent years. Non locked unilateral buttress plating with lag screw fixation has the advantage of less stripping of soft tissue. However, poor bony purchase by lag screws due to comminution and the natural characteristics of cancellous bone lead to further widening of the joint surface and displacement of fragments.

Locking compression plate by this method, due to its less invasiveness, not only seems to cause a significant decrease in side effects but also reduces the length of hospital stay.

Materials and Methods

The study was undertaken at yenepoya medical college and hospital, mangalore. Ethics committee clearance was taken for the study and Patients who were diagnosed to have tibial plateau fractures and underwent internal fixation for the same in the year 2019, x rays/CT scans were analysed and tibial plateau fractures classified according to schatzker 's classification, retrospectively functional and radiological analysis was done according to modified Rasmussen's Clinical and Radiological criteria at 3 to 6 months of followup, all the patients were followed up upto 6 months.

Schatzker's classification [3]

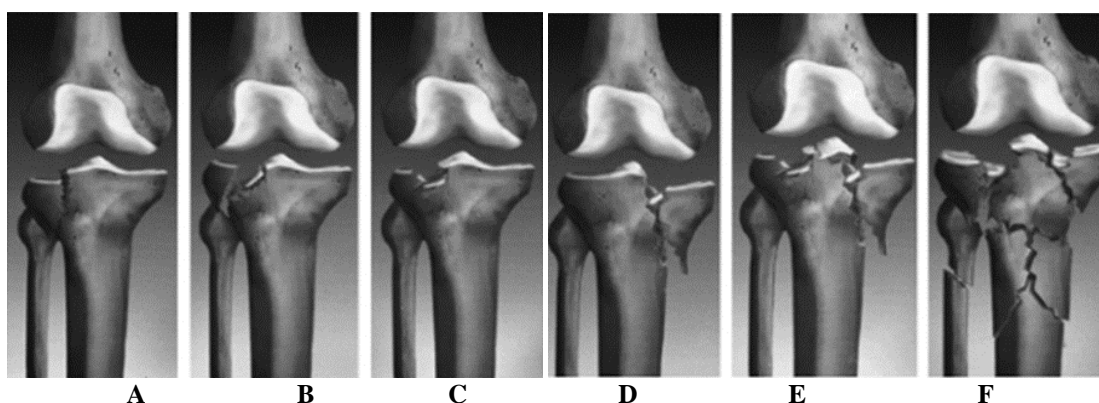


Fig 1: Schatzker's Classification

Table 1: Schatzker's classification

Type I:	Lateral plateau, split fracture
Type II:	Lateral plateau, split depression fracture
Type III:	Lateral plateau, depression fracture
Type IV:	Medial plateau fracture
Type V:	Bicondylar plateau fracture
Type VI:	Plateau fracture with separation of the metaphysis from the diaphysis

Source: data/sample size

21 Patients who were diagnosed to have tibial plateau fractures and underwent internal fixation for the same in the year 2019 were included in the study.

Inclusion criteria

- Patient who has been diagnosed as closed tibial plateau fractures.
- Age group of 20-50 years of both sexes.

Exclusion criteria

- Skeletally immature individuals.
- Open fractures of tibial plateau.
- Fractures associated with knee dislocation.

- Patients with associated ipsilateral femur, tibia and foot fractures.

Observation and Results

21 patients were studied with mean age of 40.95, majority being males-17 and females being 3, highly significant association of this study is with male patients. Majority of the age group were of 2nd to 4th decade. Out of 21 subjects studied 17 of them had sustained road traffic accident and 4 of them had history of fall from height. Majority of them had left sided involvement-13, and 8 had right side tibial plateau fractures. Schatzker's type 2 was the type of fracture in majority and rest distribution of type of fracture as shown below.

Table 2: Frequency of type of fracture

Schatzker's type	Frequency	Percent
Type 1	2	10.0
Type 2	10	50.0
Type 3	3	15.0
Type 5	1	5.0
Type 6	4	20.0
Total	20	100.0

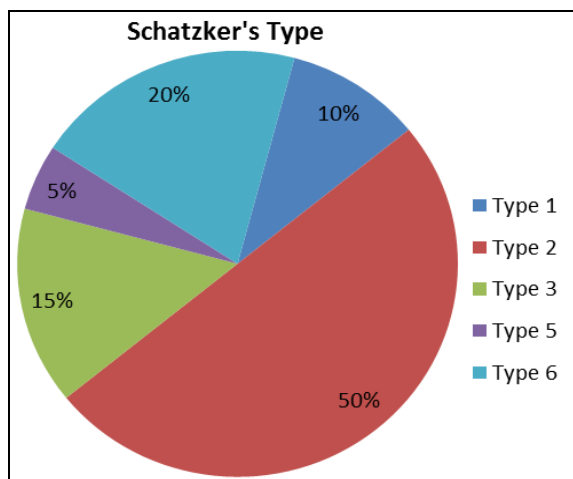


Fig 2: Frequency of type of fracture

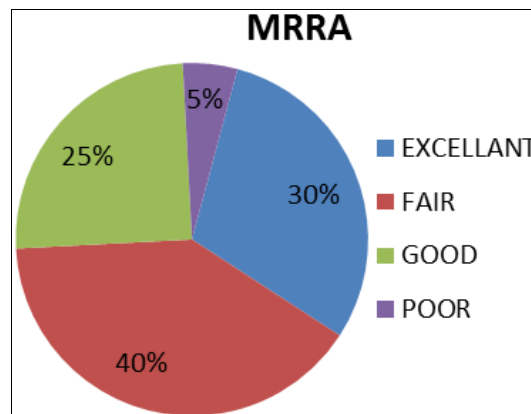


Fig 4: Radiological assessment

Methods of treatment

6 cases were managed with cannulated screws +butress plating, 1 case with percutaneous cc screw fixation, 8 were managed with Butress plate, 3 by Butress plate along with Bone graft and 3 cases with locking plate.

Complications

All fractures united with in expected time not a single nonunion was noted in our study series, however 2 patients had knee stiffness and 2 patients experienced occasional pain, no cases had infection or wound problems

Evaluation of clinical and radiological scoring

Mean Rasmussen score at final follow up was 23.05 (range 18 to 30) and the mean radiological score at the end of follow up was 7.5 (range 5 to 10)

Table 3: Clinical assessment

MRCA	Frequency	Percent
Excellent	2	10.0
Fair	6	30.0
Good	10	50.0
Poor	2	10.0
Total	20	100.0

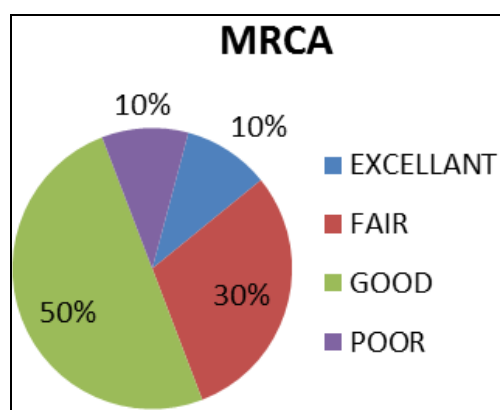


Fig 3: Clinical assessment

Table 4: Radiological assessment

MRRRA	Frequency	Percent
Excellent	6	30.0
Fair	8	40.0
Good	5	25.0
Poor	1	5.0
Total	20	100.0

Statistical analysis

The data was entered in the excel spread sheet. Descriptive statistics like frequency and proportions were used for qualitative data. Inferential statistics like Chi square test was used to test the significance between results drawn radiologically and clinically. The level of significance was set at 5%

Table 5: Corelation of clinical and radiological outcome

		MRRRA Result				
		Excellent	Fair	Good	Poor	Total
MRCA Result	Excellent	2	0	0	0	2
		10.0%	0.0%	0.0%	0.0%	10.0%
	Fair	0	5	1	0	6
		0.0%	25.0%	5.0%	0.0%	30.0%
	Good	4	2	4	0	10
20.0%		10.0%	20.0%	0.0%	50.0%	
Poor	0	1	0	1	2	
0.0%	5.0%	0.0%	5.0%	10.0%		
Total	6	8	5	1	20	
30.0%	40.0%	25.0%	5.0%	100.0%		
Yate's chi square - 8.747						
p value - 0.46						

Rasmussen's grading

It was also noted that clinical follow up had no significant correlation with the follow up radiological grading (yate's chi square test and p value 0.46)

Discussion

Aim of the study is to analyse the functional and radiological outcome of tibial plateau fractures treated with internal fixation in 21 cases. The analyses of the results were made with respect to age of the patient, sex of the patient, mode of injury, type of fracture, type of fixation, complications. Tibial plateau fractures were seen in 3 to 5th decade most commonly due to high energy injuries like road traffic accidents and fall from height. Closed fixation in these fractures would not be feasible mainly in the depressed fractures which needs open reduction and fixation with or without bone grafting. It is extremely important for stable fixation to achieve full range of motion and stability of the joint

Blokker *et al.* [3] in 1984 reviewed 60 tibial plateau fractures of which 75% patients had satisfactory results. According to them, the outcome of tibial plateau fractures was predicted by the adequacy of reduction. J. J. Dias *et al.* [4] (1987) recommended CT scanning for evaluation of the degree of comminution, for classifying and measuring the displacement of fracture Weil *et al.* [5] in 2008 described the posteromedial approach to tibial plateau to reduce and fix fractures of medial

condyle and bicondylar fractures. They concluded that their approach and antiglide plating provided the solution for posteromedial shear fractures of tibial plateau. Musahl V *et al.* [6] (2009) reviewed the available literature concerning complex tibial plateau fractures and concluded that dual incision bicolumn plating was indicated for fractures with posteromedial fragment, medial fracture dislocations and posterior metaphyseal fragments. In cancellous bone like proximal tibia, 3.5-mm screws are found to have pullout strength equivalent to 6.5-mm and 4.5-mm screws [7]. In a study by S. Patil *et al.* it has been shown that a raft of four 3.5 mm screws is biomechanically stronger than two 6.5 mm screws in resisting axial loads in osteoporotic bones [8]. This is supported by yet another study by Jabal Ameli *et al.* [9].

In our series' most of the subjects were males. This can be attributed with more involvement of RTA. in our study left sided predominance (13) seen than right sided (8), in our study majority of the fractures were type 2 schatzker's (10) that is cleavage combined with depressed fracture of lateral tibial plateau, type 5 was least in the study.

In our series 21 cases all were treated with surgical methods only. Different authors use different type of fixation methods for management of these fractures. Seppo E, Honkonen conducted 130 tibial fractures taking into consideration the following for the surgical management: condylar widening of >5mm, lateral condyl step off >3mm and all medial condylar fractures. In the study subjects same above mentioned indications were found to standardize.

In our study we found to have no standardized criteria was made to choose the type of internal fixation for different fractures for examples most of the type 2 fractures were treated with buttress plating and 2 cases were treated with percutaneous cannulated cancellous screws bone grafting was included in few cases (3 cases)

Major problem in the series were found to have knee stiffness and occasional pain in 3 subjects, these patients mainly were not complied with the follow up protocol and related with the type of the fracture (mainly type 5 and type 6 fracture). In spite of the complications we found to have good outcome overall functionally and radiologically (good to excellent outcome 90 percent clinically and good to excellent outcome in 85 percent radiologically) these results were comparable and at par when compared to other documented studies.

Comparison with other studies

Table 6: Comparing other studies

Study	Results
Rambold, 1992	93%
Seppo e, 1993	86%
Joseph schatzker, 1986	86%
Our study 2020	90%

Probably if we were less invasive in our surgical methods and still more rigid fixation and more aggressive in physiotherapy we would have not have face with the complications like knee stiffness and we would have achieved the best results in the study.

Conclusion

To manage different types of tibial plateau fractures depends on good clinical judgement. The surgeon should have sound knowledge about personality of the injury and clear understanding of the knee examination and, imaging studies

and should be familiar with the variety of techniques available at present for treating tibial plateau fractures

The conclusion of this study are

- The main aim of surgical treatment include accurate reconstruction of the articular surface with elevation of the depressed bone fragment, bone grafting, stable fragment fixation and allowing early range of motion.
- Displaced condylar fractures belonging to schatzker's type 1 and type 2 can be managed with closed percutaneous cannulated cancellous screw fixation/open reduction internal fixation with cannulated cancellous screws, results are good with this methods.
- Schatzker's type 3 fractures managed with buttress plate with bone grafting gives good to fair results in most of the cases, but one patient had poor result in this type with knee stiffness.
- In high velocity fractures type 5 and type 6 were managed with buttress plate, number of good to fair results were seen. This is due to adequate reconstruction of the articular surface during operative period and prevention of collapse.
- Complication seen in our patients were knee stiffness and occasional pain. No wound infection or wound dehiscence was recorded.
- Retrospectively it was found that high velocity injuries (shatzker's type 5 and type 6) had poor outcome compared to low energy injuries (shatzker's type 1 to type 4)
- It was found that there was no significant association in follow up radiographs with the clinical outcome

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