

## A retrospective study on the functional outcome of internal fixation in tibial plateau fractures

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### Abstract

The tibial plateau is a crucial structure in the knee anatomy. Any fracture of the tibial plateau will affect knee biomechanics and function. The aim of such fracture treatment is restoration of joint congruity and to achieve a good functional range of motion. Surgical treatment of such fractures require careful assessment of the skin condition, odema and presence of neurovascular deficits. We conducted a retrospective study on a total of 50 patients who had undergone internal fixation for tibial plateau fractures, aged between 18-60 years. The functional evaluation was assessed by using Rasmussen's functional scoring system and patients were evaluated at 6 weeks, 12 weeks and 6 months postoperatively. Out of 50 patients, 20 patients were operated by percutaneous cancellous cannulated screws and 22 by ORIF with Plating. Acceptable results were found in 82% of the cases and in addition we had 12% fair and 6% poor results. We found good to excellent results by internal fixation in our study.

**Keywords:** Tibial Plateau, Internal Fixation, Functional Outcome

### Introduction

Tibial Plateau fractures vary from being simple undisplaced fractures to severely comminuted fractures with compartment syndrome. The tibial plateau is a crucial load-bearing area in the human body. These fractures affect knee biomechanics significantly.

They were classically called "bumper" or "fender" fracture.<sup>(1)</sup> Majority of these fractures are due to high energy trauma like road traffic accidents and fall from height.<sup>(2)</sup> The magnitude, direction, location of the force, limb position at the time of injury, determine the fracture pattern, location, and amount of displacement.<sup>(3)</sup> Mostly they involve lateral tibial plateau (55% to 70%), medial tibial plateau being rare (10% to 23%) and both plateau are involved in 10% to 30%.<sup>(4)</sup> Fractures of tibial plateau occur due to a valgus or varus force with axial loading.<sup>(5)</sup>

The main aim of the treatment is to achieve good articular congruity, anatomic and stable fixation with good functional range of motion. However sometimes there is a controversy regarding the timing of surgery and the cost of implants.

Earlier due to non-availability of good implants and fear of infection, most of these fractures were managed conservatively. However, with current knowledge about knee biomechanics, availability of good implants including locking plates and introduction of minimally invasive techniques, soft tissue management and antibiotics there is a trend towards operative management. Non operative treatment can lead to complications like stiffness, malunion and prolonged immobilization. Closed/Open reduction and internal fixation includes use of cannulated cancellous screws, buttress or locked plates including LISS and MIPPO to achieve union and optimal knee function.

Soft tissue-friendly approaches and MIPPO or LISS techniques have lead to significant improvement in outcomes after these fractures.

Crucial points in management of such fractures include:

1. Extent of damage in tibial plateau fracture is often greater than what is seen on x-ray.
2. Malunion is more common than non-union.
3. Post traumatic stiffness and arthritis are possible complications.

In this study we evaluated the functional outcome after treatment of tibial plateau fractures by internal fixation.

### Materials and Method

**Study Design:** Retrospective study.

**Study Population:** This retrospective study was conducted on 50 patients who had undergone surgery for tibial plateau fractures over a period of 3 years. The patients of age between 18-60 years of either sex were included in study. All patients were briefed about purpose of study and their written, valid, informed consent for surgery were taken.

**Data collection method:** The study was on post operative tibial plateau fractures and aim was to assess the functional outcome. So all patients who were operated for this fracture were followed-up according the evaluation.

**Inclusion Criteria:** Patients with following criteria were selected for this study

1. Patients age between 18-60 years of either sex.
2. Patients consent for the same.
3. Radiological diagnosis of fracture with classification based on Schatzker's classification

### Exclusion Criteria

Patients with following criteria were excluded from study.

1. Patients with open fractures and ligamentous injury.
2. Patient with ipsilateral tibia shaft, ipsilateral distal femur and ipsilateral patella fracture.

**Preoperative planning:** Type of fracture was decided according to Schatzker classification. Line of treatment was decided according to the type of fracture, degree of displacement and depression, and general condition of the patient. All displaced, depressed fractures were operated upon to achieve anatomical reduction, rigid internal fixation and early mobilization.

**Surgical procedures:** All patients were operated under suitable anaesthesia and tourniquet. In all patients, parapatellar approach (medial or lateral) was preferred. Once fracture site was exposed, depression and displacement was noted by elevating the meniscus.

Type I Fracture: Percutaneous cannulated cancellous screws under image intensifier guidance were used.

Type II Fracture: A lateral parapatellar approach was used. Articular congruity was restored by elevating the depressed fragment using autologous iliac crest graft. Anatomic reduction was obtained and fixed with screws, T or L buttress plates.

Type III Fracture: A lateral parapatellar approach was used. A cortical window was made and fragments were elevated using bone graft and fixed.

Type IV Fracture: A Medial parapatellar approach was used. Articular congruity was restored by elevating the depressed fragment using autologous iliac crest graft. Anatomic reduction was obtained and fixed with screws, T or L buttress plates.

Type V Fracture: A combination of anterolateral and posteromedial approaches with dual plating was used for these fractures.

Type VI Fracture: If the fracture involving the medial plateau was undisplaced or if the fragment is large a lateral locking plate was sufficient. However, in comminuted fractures dual plating using a combination of anteromedial and posterolateral approach was preferred.

**Post-Operative Care and rehabilitation:** Static quadriceps exercises were begun from second day followed by gentle knee range of motion exercises. Continuous passive motion was given for about 1 hour daily after pain and edema subsided. The patient was mobilized with non weight bearing walking. Monthly follow up was done and partial weight bearing was started from 6 to 9 weeks depending upon the progress of fracture healing both clinically and radiologically. Any complications, if found, were addressed accordingly.

### Clinical Evaluation

**Subjective:** A detailed questionnaire was completed with each patient to evaluate subjective factors such as

pain, functional limitations and occupational considerations.

**Objectives:** Objective examination included inspection knee and upper tibia for deformity, tenderness, measurement of knee range of movements, light touch and pin-prick sensibility.

**Radiological Evaluation:** The radiographic evaluation included serial anteroposterior and lateral X ray of knee and tibia.

Functional Evaluation

1. Knee Range of movements.
2. Ability to do day to day activities.

**Follow up Evaluation:** All patients underwent investigations of anteroposterior and lateral x-ray of knee and tibia. Functional evaluation was done by using Rasmussen's functional scoring system. Patients were followed up at 6 weeks, 3 months and 6 months post-operatively for clinical and radiological union.

**Data Analysis:** Total 50 patients were studied in this series.

- There were 18 (36%) patients in the age group of 21-30 years, 14 (28%) in the age group 31-40 years, 11 (22%) in the age group 41-50 years, 7 (14%) in the age group 51-60 years. Out of 50, 13(26%) were found to be females while 37(74%) were males.
- Out of total 50 patients, the proximal tibia of left side were 18(36%) and right were 32(64%) patients.

### Distribution as per Schatzker Classification of fracture

Table 1

Schatzker #	No. of	Percentage
I	12	24.00%
II	13	26.00%
III	10	20.00%
IV	5	10.00%
V	6	12.00%
VI	4	8.00%
Grand Total	50	100.00%

**Treatment and procedure:** Out of 50 patients, Screw fixation was used in 20 (40%) patients, ORIF with Plating in 22 (44%) patients and ORIF with Plating and bone grafting in 8 (16%) patients.

Table 2: Treatment and procedure

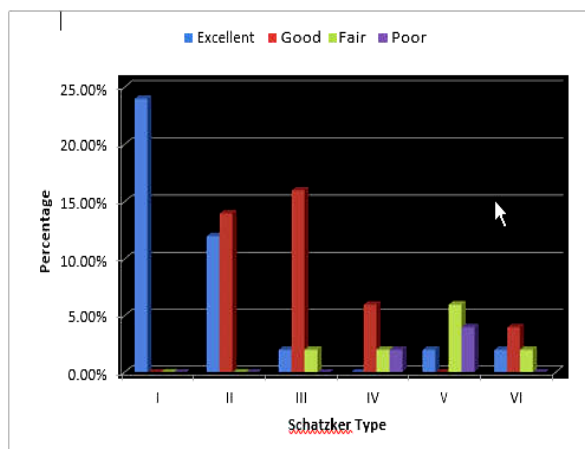
Treatment and procedure	No. of cases	Percentage (%)
CC Screw fixation	20	40.00%
ORIF with Plating	22	44.00%
ORIF with Plating and Grafting	8	16.00%
Grand Total	50	100.00%

**Results**

Out of 50 patients, 21 (42%) had excellent, 20(40%) had good, 6(12%) had fair and 3(6%) had poor functional outcome.

**Table 3: Functional outcome**

Functional results	No. of cases	Percentage
Excellent	21	42.00%
Good	20	40.00%
Fair	6	12.00%
Poor	3	6.00%
Grand Total	50	100.00%



**Fig. 1: Functional outcome according to schatzker type**

Treatment and procedure showing functional outcome:

- Cannulated Cancellous Screw fixation: 18(36%) had excellent, 1(2%) had good, 1(2%) had fair outcome
- ORIF with Plating: 3(6%) had excellent, 14(28%) had good, 4(8%) had fair, 1(2%) had poor outcome.
- ORIF with Plating and Grafting: 5(10%) had good, 1(2%) had fair, 2(4%) had poor outcome.



**Fig. 2: Schatzker type 1 fracture. Closed reduction and cannulated screw fixation**



**Fig. 3: Schatzker type 2 fracture. ORIF with Plating**



**Fig. 4: Schatzker type 3 fracture. ORIF with Plating**



Fig. 5: Schatzker type 4 fracture. ORIF with Plating

Table 4: Complications

Complications	Extensor lag	Infection	Stiffness
Screw fixation			1 (2%)
ORIF with Plating	3 (6%)	1 (2%)	2 (4%)
ORIF with Plating and Grafting		1 (4%)	2 (4%)
Grand Total	3 (6%)	2 (4%)	5 (10%)

### Discussion and Conclusion

Tibial plateau fractures are difficult to manage due to the nature of these fractures being intraarticular, associated with comminution, inadequate soft tissue cover, poor skin condition and risk of compartment syndrome. Even after the best of implants, antibiotics and techniques management of these fractures remains a challenging task.<sup>(6)</sup>

To achieve good radiological and functional outcome, emphasis should be laid on anatomical reduction, stable fixation and early rehabilitation.

In our study we assessed the functional outcome of tibial plateau fractures treated by internal fixation.

In surgically treated patient, acceptable results were obtained in 82% of patient (excellent 42% and good 40%), which corresponds to series of Palmer I. (1959), Rasmussen P.S. (1973).<sup>(7)</sup> Poor result was obtained in 3 patients. Patients were satisfied with the final result, and resumed their duties.

In spite of complexity and variety of fracture patterns, we had 82% acceptable results (42% Excellent and 40% good) with our methods of fixation, in addition we had 12% fair and 6% poor results. The functional evaluation was done using Rasmussen's criteria. These results were comparable with previously documented studies.

In our series 83.3% of our patients had good to excellent results and this outcome was possible due to proper preoperative planning, suitable timing of surgery, stable fixation, taking care of soft tissue and skin and early rehabilitation.

Table 5: Earlier studies with results

Our Study	82%
Schatzker et al <sup>(8)</sup>	78%
Blokker et al <sup>(9)</sup>	70%
Savoie et al <sup>(10)</sup>	87%
Lachiewicz et al <sup>(11)</sup>	81%
Chaix et al <sup>(12)</sup>	86%
Tscherne et al <sup>(13)</sup>	77%
Touliatos et al <sup>(14)</sup>	83%

Treatment of tibial plateau fractures is a difficult task. Restoration of articular congruity and early rehabilitation be the primary goal. Proper preoperative planning and adequate reduction will help to achieve early mobilization and optimal functional outcome. The techniques demand considerable skill and timely and proper judgment. The surgeon must have a thorough understanding of local anatomy, the mechanics of fracture fixation, and patterns of fracture healing after fixation if excellent results are to be achieved.

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