

# Surgical Management of Tibial Plateau Fractures by Various Modalities

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## Abstract

**Background:** Increasing population to acceleration of traveling system have been accompanied by increasing road traffic accidents which increase in number and severity of fractures and those of long bones too like tibial plateau fractures showing higher incidence. Fractures around the knee joint very crucial for surgical management especially tibial plateau fracture management is paramount importance. The study was aimed to identify the role of surgical treatment of tibial plateau fractures, its functional outcome, and complications.

**Methods:** A total of 20 cases of tibial plateau fractures treated by various modalities were studied from January 2014 to January 2016 at Mahatma Gandhi Memorial Hospital, Warangal, and followed for minimum 6 months.

**Results:** The selected patients evaluated thoroughly: Clinically and radiologically, were taken for surgery, after the relevant lab investigations. The indicated fractures were treated as per the Schatzker's types accordingly with closed reduction and internal fixation, with percutaneous cannulated cancellous screws, open reduction and internal fixation with buttress plate with or without bone graft. Early range of motion started soon after the surgery. No weight bearing up to 6-8 weeks. The full weight bearing deferred until 12 weeks or complete fracture union. Immobilization in insecurely fixed fractures continued for 3-6 weeks by plaster of Paris cast. The knee range of motion was excellent to very good, gait and weight bearing after complete union was satisfactory. Redepression in 1 case, malunion in 2 cases, knee stiffness in 2, wound dehiscence in 1 cases, and non-union in none of our cases.

**Conclusion:** Surgical management of tibial plateau fractures will give excellent anatomical reduction and rigid fixation to restore articular congruity, facilitate early motion and reducing post-traumatic osteoarthritis and hence to achieve optimal knee function.

**Key words:** Tibia, Proximal, Condyle, Plateau, Locking plate, Schatzker's classification

## INTRODUCTION

Tibial plateau fractures are one of the most common intra-articular fractures resulting from indirect coronal or direct axial compressive forces. Fractures of tibial plateau constitute 1% of all fractures and 8% fractures in the elderly.<sup>1</sup> These fractures encompass many and varied fracture configurations that involve the medial condyle

(10-23%), lateral condyle (55-70%), or both (11-30%) with differing degrees of articular depression and displacement. In case of improper restoration of the plateau surface and the axis of the leg, these fractures could lead to the development of premature osteoarthritis, injury in ligaments, as well lifelong pain and disability.<sup>2</sup> Tibial plateau fractures may be accompanied by meniscal and ligamentous injuries to the knee too.<sup>3</sup>

For assessment of the initial injury, planning management and function and prediction of prognosis, orthopedic surgeons widely use the Schatzker classification system, which divides tibial plateau fractures into six types. Each increasing numeric category specifies increased level of energy imparted to bone thereby increasing severity of the fracture.<sup>4</sup> First four are unicondylar and Type V

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and VI are bicondylar. Each fracture's pattern in Schatzker classification helps to direct orthopedic surgeons to adopt appropriate treatment modality.<sup>5</sup> The aim was to study the surgical management of intra-articular fractures of proximal tibia to obtain a stable, pain-free, mobile joint, to prevent the development of osteoarthritis, and to correlate the radiological findings with the type of fracture and the functional result.

**METHODS**

The cases studied were included from inpatients of Mahatma Gandhi Memorial Hospital, Warangal, Telangana, India, during January 2014-January 2016. A total of 20 cases were studied. The average age of the patient was 45 years with the oldest patient 65 years and youngest was 21.

**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: <18 years
- b. Patients who are medically unfit for the surgery
- c. Compound tibial plateau fracture.

The consent of the patient for anesthesia and surgery and institutional ethical clearance was obtained.

Drain was removed 2<sup>nd</sup> day. Sutures removed on the 10<sup>th</sup> day. All the patients were taught and advised to do static quadriceps exercises and dynamic exercises with a quadriceps board as much as possible and throughout the day. Partial weight bearing was delayed until 6-8 weeks and full weight bearing allowed after 12-16 weeks.

Pre-operative instructions: Consent of the patient for anesthesia and surgery was obtained. Nothing By Mouth (N.B.M.) for 12 hours before surgery. Injection TT 0.5cc IM stat was injected. Pre-operative antibiotic was given. Post-operative instructions: Blood pressure temperature, pulse, and respiration were monitored hourly. Post-operative analgesia was given and antibiotics were prescribed for 7-10 days. Patients were watched out for bleeding. Foot end elevation was done. Post-operative X-ray was taken, preferably the next day.

**RESULTS**

Type of fracture, method of treatment, duration of immobilization, complications, and the remarks of different age groups in details as shown in Tables 1-5.

Two cases of infection and another case of severe metaphyseal comminution had to be immobilized for 8 weeks. Most of the cases had a good range of painless knee motion (0-130°), except for the last group where two patient developed knee stiffness (Table 6).

All fractures united within expected time. Not a single case of nonunion was noted in given series. Average time for union was 14 weeks (range 10-22 weeks).

**Table 1: Various surgical methods in 20 patients**

Methods of treatment	Number of cases (%)
Perutaneous cannulated cancellous screws	3 (17)
ORIF with buttress plate and screws	10 (50)
ORIF with locking compression plate	7 (33)

ORIF: Open reduction and internal fixation

**Table 2: Various types of tibial plateau fractures in number of cases**

Frequency of type of fracture	Number of cases (%)
Pure cleavage	2 (10)
Cleavage with depression	6 (30)
Central depression	1 (5)
Medial condyle fracture	3 (15)
Bicondylar fracture	5 (25)
Metaphysio diaphyseal dissociation	3 (15)

**Table 3: Immobilization duration**

Period of immobilization	Number of cases
Less than 10 days	5
3 weeks	10
Up to 6 weeks	5

**Table 4: Fracture incidence in various age groups**

Age in years	Number of cases (%)
21-30	7 (35)
31-40	8 (40)
41-50	1 (5)
51-60	2 (10)
>60	2 (10)

**Table 5: Sex incidence**

Sex	Number of cases	Percentage
Male	15	75
Female	5	25

**Table 6: Post operative complications**

Complications	Number of cases
Knee stiffness	2
Malunion	2
Infection and wound dehiscences	1

Out of 20 cases treated with surgical procedure, 9 cases gave excellent result and one case of poor result were seen, mainly due to the severity of the injury and infections. Retrospectively, it was found that high-velocity injuries (Type IV-VI) Figures 1, 2 and Table 7.

**DISCUSSION**

Tibial plateau fractures, one of the most common intra-articular fractures, are major traumatic injury occurring as a result of road traffic accidents, fall from height, violence, etc. It is sometimes associated with other bony or soft tissue injuries. Any fracture around the joint (especially weight bearing knee joint in the lower limb) is of paramount importance as it results in significant morbidity and adversely affects quality of life. Hence, the treatment of upper tibial fractures with intra-articular extension is a challenge for the orthopedic surgeons.

In this study, the majority of fractures occurred between the age of 20 and 60 years with maximum incidence in the productive age group of 31-40 years 40%. Honkonen<sup>6</sup> also showed age incidence 20-60 years with an average of 39.8 years which correlates with this study. Lee *et al.*<sup>7</sup> too showed that the average age of tibial plateau fractures in

patients was 42 years. Albuquerque *et al.*<sup>8</sup> observed that 71% of injuries occurred in those aged 30-60 years, with maximum frequency between 40 and 49 years. High energy injuries are more common in youngsters and low energy fractures in elderly patients.

The tibial plateau fractures are commonly seen in the active and productive age group especially in male patients as they engage in more activities and travels. In given study, males were more affected than females which were also reported by Albuquerque *et al.* (70.3%), Manidakis *et al.*<sup>9</sup> (58.4%), and Mehin *et al.*<sup>10</sup> (56%).

In given series, Schatzkar Type I and Type II dominated the total fractures making 50%. Similarly, Rademakers *et al.*<sup>11</sup> reported that 64% patients sustained a fracture of the lateral condyle (Schatzker 1/2/3). Mehin *et al.* reported about 30% of the injuries were high-grade Type VI tibia plateau fractures, whereas 35% were lower-grade Type III fractures (Table 8). Gardner *et al.*<sup>12</sup>, reported that the most frequent fracture pattern was a lateral plateau split-depression (Schatzker II).

In this series, we studied 20 cases of simple tibial plateau fractures treated only by surgical methods. Different authors use different criteria for the surgical management of these fractures. In this study, 3 mm depression was considered as an indication for surgery.

**Table 7: Results after surgical intervention**

Excellent	9	45
Good	7	35
Fair	2	10
Poor	1	5



**Figure 1: Pre-operative and Post-operative Radiographs**



**Figure 2: Post-operative Images**

Schatzkar *et al.*<sup>13</sup> reported 70 cases of tibial plateau fractures of all types treated by conservative (56%) and surgical (44%) with average follow-up of 28 months. Acceptable results were obtained in 58% of cases of conservative group and 78% by open methods. In the early half of the 20<sup>th</sup> century, an author reported two studies having satisfactory percentage of good to excellent short- and long-term results with surgical method of the treatment.<sup>14,15</sup> Another published study of 159 cases of tibial plateau fracture of all types reported better “good-excellent” results in surgery (84%) than conservative (62%) methods.<sup>16</sup> Mehin *et al.* reported that “of 286 patients with tibial plateau fractures, of whom 77% were treated operatively.” Similarly, Pasa *et al.*<sup>17,18</sup> too reported that 30 % were treated conservatively and 70% by a surgical procedure.

We have not formulated the stringent criteria as to particular method of fixation for particular type of fracture. Hence, each case was individualized and treated accordingly as it needs. Most of the Type I, some Type II, and a case of Type V were treated with percutaneous cancellous screw fixation. The split fracture of >3 mm displacement was 79 treated by open reduction and internal fixation (ORIF). Bone grafting was included along with ORIF with Buttress plate and screws in Type II, III, V, and VI wherever necessary. Of 114 patients with proximal tibial fractures, Pasa *et al.* used fixation with a cancellous screw and washer

**Table 8: Schatzkar type fracture incidence in various studies**

Type of fracture (Schatzkar classification)	Schatzkar <i>et al.</i>	Albuquerque <i>et al.</i>	Manidakis <i>et al.</i>	Present study
I	4 (6)	20 (8.4)	31 (24.8)	2 (10)
II	18 (25)	84 (35.1)	42 (33.6)	6 (30)
III	25 (36)	21 (8.8)	21 (16.8)	1 (5)
IV	7 (10)	28 (11.7)	9 (7.2)	3 (15)
V	2 (3)	38 (15.9)	6 (4.8)	5 (25)
VI	14 (20)	48 (20.1)	16 (12.8)	3 (15)
Total	70	239	125	20 (100)

**Table 9: Final outcome of various studies**

Author result	Overall good in percentage
Schatzker <i>et al.</i>	86
Honkonen	86
Rademakers <i>et al.</i>	94
Manidakis <i>et al.</i>	69
Urruela <i>et al.</i>	76
Present study	80

in 25, and abutment plate in 27 patients. They also reported that better results were achieved in the treatment of intra-articular fractures of the proximal tibia by minimally invasive fixation with cancellous screws.

The benefits of early knee motion include - reduce knee stiffness and improved cartilage healing (regeneration). However, these benefits are to be cautiously balanced by risks, including loss of fracture reduction, failure of internal fixation, and compromised ligament and soft tissue healing. Schatzker *et al.* stated that the prognosis is given by the degree of displacement, type of fracture, method of treatment, and quality of post-operative care.<sup>13</sup> We achieved 45% excellent result 35% good results (overall 80% acceptable results) with our standard surgical care using various standard fixation 80 methods. In addition, we had 10% fair and 5% poor results in terms of functional outcome. These results are comparable and on par with other documented standard studies (Table 9).

## CONCLUSION

Tibial plateau fractures are increasing (especially the high velocity injuries) with the increase in automobile accidents. Surgical treatment when indicated (particularly in depressed and displaced fractures) is advantageous to get a stable knee. The surgical management of tibial plateau fractures is challenging and gives excellent anatomical reduction and rigid fixation to restore articular congruity, facilitate early knee motion by reducing post-traumatic osteoarthritis and thus achieving optimal knee function.

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