

## To evaluate the effectiveness of the different modalities of the treatment and their complications for Tibial plateau fractures

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Received: 14-10-2021 / Revised: 23-11-2021 / Accepted: 21-12-2021

### Abstract

**Introduction:** Injuries and fractures have become so common in the present day, main reasons being increasing population, with increase in vehicles, and traffic congestion and also due to high speed motor transportation. The tibia being the most commonly fractured long bone as one third of its surface is subcutaneous, open fractures are more common in tibia than in any other major long bones and its fracture management has changed drastically from conservative to easy surgical management and its fracture management contributes significantly to the cost of orthopaedic care being provided worldwide. **Methods:** This is a study of surgical management of intraarticular fractures of proximal tibia was conducted in the Department of Orthopedics, Gitam Institute of Medical Sciences and Research from January 2018 to January 2021. During this period 70 patients were treated for tibial condylar fractures of which 14 patients were treated by closed reduction and internal fixation with percutaneous methods(cc screws) and 21 patients were treated by open reduction and internal fixation with buttress plate and screws with or without bone grafting. 25 were treated by open reduction and internal fixation with locking plate and screws.4 cases were treated with hybrid external fixator.6 cases were excluded, as they were lost during follow up. **Conclusion:** In our study we concluded that based on shatzker type of classification of fractures various modalities have shown good results

1. Type I&II:- CC screw fixation.
2. Type III &IV:-Buttress plating with or without bone grafting.
3. TypeV&VI:- Locking compression plate & Hybrid external fixator.

**Keywords:** Tibial plateau fractures, Gustilo Anderson type II, Schatzkers classification

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### Introduction

The luxuries of our life in the present time is at the cost of rapidly increasing industrialization, urbanization and mechanization so also the traumatic cases are on increase. crowded cities, irregular traffic arrangement, fast moving vehicles are the most important contributory factors causing bony injuries, particularly polytrauma, comminuted fractures and also the soft tissue injury. Tibial plateau fracture is one of them[1].

Tibial condylar fractures are specially challenging to the orthopaedic surgeons because of their number, variety, complexity, different concepts of management and injuries associated with it. As proximal tibia gives attachment to the various elements of knee stabilizers and being an integral part of the knee mechanism, alteration of anatomy caused by injury, results in functional impairment[2]. Though many articles were written over past 100 years addressing the problems of classification, indications and results of various modalities of treatment, still final answer is not yet reached[3].

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, malunion and nonunion[4]. Open reduction and internal fixation has been advocated using various implants including buttress plates, cancellous screws, hybrid external fixators to achieve good fracture union and optimal knee function[5].

In this study, we would like to assess the various surgical modalities in treating tibial plateau fractures.

### Material and Methods

This is a study of surgical management of intraarticular fractures of proximal tibia was conducted in the Department of Orthopedics, Gitam Institute of Medical Sciences and Research from January 2018 to January 2021. Clearance was obtained from hospital ethical committee. During this period 70 patients were treated for tibial condylar fractures of which 14 patients were treated by closed reduction and internal fixation with percutaneous methods (cc screws) and 21 patients were treated by open reduction and internal fixation with buttress plate and screws with or without bone grafting. 25 were treated by open reduction and internal fixation with locking plate and screws.4 cases were treated with hybrid external fixator.6 cases were excluded, as they were lost during follow up.

All the required data was collected from the patients during their stay in the hospital, during follow up at regular intervals and from the medical records.

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**Inclusion Criteria**

All patients with intraarticular fracture proximal tibia in the age group of 18-60 years including tibial condylar fracture, plateau fracture and comminuted fracture.

**Exclusion criteria**

- Fracture in children less than 18 years.
- Compound fracture Gustilo Anderson type II and type III.
- Associated with fracture of distal end of the femur (floating knee)

**Classification system**

The Schatzkers classification was used to classify these fractures. The patients were followed up for an average period of 12 -18months.

**Management**

The patients were first seen in the casualty. The history was taken followed by general and local examination of the patient. Concerned specialists undertook appropriate management of the associated injuries. Intensive care was given to those patients who presented with shock and immediate resuscitative measures were taken.

Once the patient's general condition was fit, relevant X-rays were taken. Higher investigations such as CT scan were not done for tibial plateau fractures due to financial constraints.

The treatment method was based on the type of fracture, the amount of displacement and the amount of depression of the tibial plateau. Minimally displaced fractures were reduced by traction and compression methods followed by cast application were treated with an above knee cast with the knee in 10° of flexion. Patients who presented with, extensively comminuted fractures, patients who were not fit for surgery and those patients with extensive skin problems were initially treated with skeletal traction followed by cast application. During the period of traction patients were advised isometric quadriceps exercises and active ankle and foot movements. At 8-12 weeks an X-ray was repeated and if showed signs of union, the cast were removed and the patients were advised non-weight bearing crutch ambulation with active knee movements. At 16

weeks a repeat X-ray was done and based on clinical and radiological evidence of union partial weight bearing was allowed which was gradually progressed to full weight bearing.

Surgical method of treatment was mainly based on the type of fracture and amount of displacement or depression and the degree of instability. The patients were taken for surgery at the earliest possible time depending on their medical condition, skin condition and the amount of swelling. All surgeries were done under C-arm image intensifier control. Fractures were fixed either with percutaneous technique or by open reduction and internal fixation. The fixation devices consisted of T Buttress plate, L Buttress plates, locking compression plate (hockey) 4.5 mm cortical screws and 6.5 mm and 7.0 mm cannulated and non-cannulated cancellous screws, hybrid external fixator(rings, connecting rods, shanz pins, guide wires). Bone grafts were used in depressed and comminuted fractures. The source of bone graft was ipsilateral iliac crest or femoral condyles.

Postoperatively patients were immobilized with an above knee posterior slab or a compression bandage. The sutures were removed on the 10th postoperative day. Antibiotics were given till suture removal. The patients were advised quadriceps exercises, knee mobilization and non-weight bearing crutch walking, on discharge. An immediate postoperative X-ray was also done.

**Results**

Observation and analysis of results was done in relationship to age, sex, laterality of fracture, type of fracture, method of treatment, complications and the remarks of different age groups in details as follows. The youngest being 19 years and the eldest being 70 years.

This study was done to find out the age incidence in our set up and to know the type of fracture incidence and outcome as different age groups present and different response to fracture healing. The tibial plateau fractures are commonly seen in the active and productive age group in our setup as they engage in more activities and travels. The type of fracture and fracture pattern depends on many factors like amount of force, age, degree of knee flexion, rate of loading of force, valgus/varus stresses, etc.

**TABLE 1:- Age distribution.**

Age distribution	No of patients	Percentage
19-30	19	29.68
31-50	28	42.75
51-70	17	26.57
Total	64	100

This incidence of sex versus upper tibial fractures can be attributed to an over-whelming large proportion of male patients, because in our Indian setup, the female population largely working indoors or in the agricultural fields and do not indulge themselves in travelling or out door activities.

**Table 2: Sex incidence**

Sex	No of patients	Percentage
Male	40	62.5
Female	24	37.5
Total	64	100

In this series, the majority of the patients treated are due to road traffic accidents or automobile accidents. Upto the extent of 62.50%.

**Table 3: Mode of violence**

Mechanism of injury	No of patients	Percentage
Rta	40	62.50
Fall from height	14	21.87
Other modalities	10	15.63
Total	64	100

In our series, there is a slight right sided predominance, compared to the left side.

**Table 4: Laterality of fractures**

Side of injury	No of patients	Percentage
Left side	29	45.32%
Right side	35	54.68%
total	64	100%

**Table 5: Type of fracture and percentage of cases : Schatzker's classification**

Schtazkar classification	Age		Total	Percentage
	Male	Female		
Type 1	5	3	8	12.50%
Type 2	4	2	6	9.38%
Type 3	9	5	14	21.87%
Type4	9	7	16	25.00%
Type5	8	3	11	17.19%
Type6	5	4	9	14.06%
total	40	24	64	100%

**Table 6: Methods of treatment**

	Age of patient			Total no of patients	Percentage%
	19-30	31-50	51-70		
CC screws	06	05	03	14	21.87%
Buttress plate	07	09	05	21	32.82%
LCP	06	10	09	25	39.06%
Hybrid external fixator	000	04	00	04	06.25%
Total				64	100%

**Table 7: Early complication of surgery**

Complication of surgery	CC screws	Buttress	LCP	Hybrid	Total
Infection	00	02	01	00	03
Loss of reduction	00	01	01	00	02
Peroneal nerve injury	00	00	00	00	00
Compartment syndrome	00	00	00	00	00

**Table 8 : Late complication of surgery**

Late complication	CC screw	Buttress	LCP	Hybrid external fixator	Total
Post traumatic osteoarthritis	00	04	02	00	06
Knee instability	00	00	00	00	00
Knee stiffness	00	03	01	00	04
Malunion	00	01	01	00	02

**Table 9: Period of immobilisation**

Period of immobilisation	No of patients
<10 days	36
Upto 3 weeks	24
Upto 6 weeks	4

None of the patients were immobilized when secure, rigid fixation was done. When there was doubt about rigidity of fixation, associated ligament injury or osteoporosis the immobilization extended preferably in above knee cast upto 3 weeks

**Table 10: Clinical results**

Clinical result	No of cases	Percentage
excellent	20	31.25%
Good	33	51.50%
Fair	8	12.50%
Poor	3	4.75%
Total	64	100.00%

## Discussion

Tibial plateau fractures, one of the commonest intra articular fractures, are major traumatic injury occurring as a result of RTA, 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 would result in significant morbidity and quality of life. Hence the treatment of upper tibial fractures with intra articular extension have become a challenge for the orthopaedic surgeons.

Keeping our aims of the study at high, we presented the clinical study of surgical treatment of 64 tibial plateau fractures. The analysis of the results were made in terms of age of the patient, sex distribution, mode of violence, laterality of the fracture, analysis of the types, modalities of treatment, complications associated injuries and the functional outcome.

We have endeavoured to present the various types of tibial plateau fractures in our Indian setup. It is found that the zeal for modernisation, mechanization and industrial development made more automobile accidents due to increase in the number of population and

automobiles.

The majority of fractures occur between the age of 19 and 70 years with maximum incidence being involving the productive age group 31-40 years. Boune in 1981 also found that the majority of the patients are aged between 15-55 years with an average of 38.5 years, correlates well with the study[6]. Seppo also showed age incidence 20-60 years with an average of 39.8 years which correlates with the present study[7]. In our series majority of the patients were males 62.5%. This can be attributed to our Indian setup where the female population largely work indoor or in agricultural fields and do not travel much. So, the significant proportion of tibial plateau fractures related sex distribution were not available to comment on them. Occupationally tibial plateau fractures were seen in people with high level of activity, movement and travel. In our study, the commonest mode of injury being the automobile accident (62.50), next common being fall from height (21.87%) and followed by other modalities (15.63%). There was not much difference in the laterality of the fracture. The right tibia was affected in 54.68% and left tibia in 45.32% of cases. In this series, we studied 64 cases of simple tibial

plateau fractures treated only by surgical methods. Different authors use different criteria for the surgical management of these fractures [8]. Seppo E. Honkonen conducted 130 tibial plateau fractures taking into consideration of Condylar widening of > 5mm, Lateral condyle step off > 3mm. All medial condylar fractures for the surgical management [9]. In our study, the indications for the surgery were the same standard indications as for the tibial plateau fractures 3mm depression was considered as an indication for surgery in our series. We have not formulated the stringent criteria as to particular method of fixation for particular type of fracture. So each case was individualized and treated accordingly as it needs. Most of the type I, some type II were treated with percutaneous cancellous screw fixation. The split fracture, of >3mm displacement was treated by ORIF with buttress. Bone grafting was included along with ORIF with Buttress plate and screws in type II, III, IV and V wherever necessary. Most of type III, IV, V and osteoporotic /poor bone quality are treated with ORIF/CRIF with LCP. Type V, VI with comminution are treated with hybrid external fixator. The period of immobilization was again individualized depending on the security of rigid fixation and other circumstances demand. The benefits of early knee motion include reduce knee stiffness and improved cartilage healing (regeneration). However, these benefit are to be cautiously balanced by risks, including loss of fracture reduction, failure of internal fixation and compromised ligament and soft tissue healing. Schatzker, Robert McBroom in 1978, Magonhobi, Steven and Gauswitz in 1984 stated that the prognosis is given by the degree of displacement, type of fracture, method of treatment and quality of postoperative care [10-13]. Patients in whom operation could not be carried out and in patients who have <3mm articular step off are treated conservatively which are not included in our study. The major problem faced by us during the study was infection and wound dehiscence, hence immobilization was more in these patients. One patient had to undergo muscle flap cover and healed well later. The infection might be attributed to nosocomial infection. In spite with all these associated bony fractures ligament injuries and complications, we are able to achieve 31.25% excellent result 51.50% good results (overall 82.75% acceptable results) with our standard surgical care using various standard fixation methods. In addition we have 12.5 fair and 4.75% poor results in terms of functional outcome. These results are comparable and on par with other documented standard studies.

#### Conclusion

Hence, to conclude, the surgical management of tibial plateau fractures is challenging and gives excellent anatomical reduction & rigid fixation to restore articular congruity, facilitate early knee motion by reducing post-traumatic osteoarthritis and thus achieving optimal knee function. In the background, it reminds us to remember the remarks given by Hohl at the presidential guest lecture at the Chicago Orthopaedic Society. In our study we concluded that based on Schatzker type of classification of fractures various modalities have shown good results

1. Type I&II:- CC screw fixation.
  2. Type III &IV:-Buttress plating with or without bone grafting.
  3. Type V&VI:- Locking compression plate & Hybrid external fixator.
- Osteoporotic bone most preferably LCP rather than buttress plate is advised in type III, IV, V, VI.

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**Conflict of Interest: Nil Source of support: Nil**