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Original Article

Tibial plateau fractures: four years review at B&B Hospital

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Abstract
Background: Tibial plateau fractures involve the articular surface of the tibia resulting from a combination of axial loading with varus or valgus stress. Inadequate and inappropriate treatment may result in significant functional loss. **Objective:** The purpose of this study was to determine the outcome of our treatment modalities and to compare with the results of comparable studies. **Methods:** The results of treatment of 81 knees were reviewed over the period of five years (1997 to 2002). There were 62 men and 18 women, with an average age of 37 years (15 years to 75 years) at the time of initial evaluation. One patient had bilateral involvement. Fractures were classified according to Schatzker. Seven patients were treated conservatively. Sixteen patients (17 knees, one had bilateral involvement) were operated with closed reduction and percutaneous cannulated screws fixation. Thirty one patients' required open reduction and internal fixation with cannulated screws. Fifteen fractures were plated, and in eleven cases, external fixators were used. Follow up period ranged from six months to three years. **Results:** Results were graded as excellent, good, fair and poor on the basis of functional outcome. Forty- three (54%) patients (44 knees) had excellent, twenty-two (26%) had good, five (6%) had fair and ten (14%) had poor results. Poor results were associated with high energy fractures, late presentation, and inadequate physiotherapy follow up. Eight patients (10%) had complications. One had common peroneal nerve palsy, six had wound infection and one patient demonstrated early arthritic changes. **Conclusion:** Tibial plateau fracture is a challenging fracture to manage. Restoration of articular congruity and early range of motion should be the primary goal. Proper and adequate preoperative planning is mandatory. Well maintained articular congruity with stable fixation helps early mobilization and better functional outcome.

Key Words: Plateau, Axial load, Varus, Valgus, Articular congruity, Functional outcome

Introduction:
Tibial plateau fractures involve the knee joint and usually result from axial loading in combination with varus/valgus stress forces [1]. Most common causes are fall from a height and road traffic accident. In our set up the latter has been the primary cause for the fracture.

Of the numerous classification systems of the fracture Schatzker's [2] is more widely used **(Fig 1, 2).**

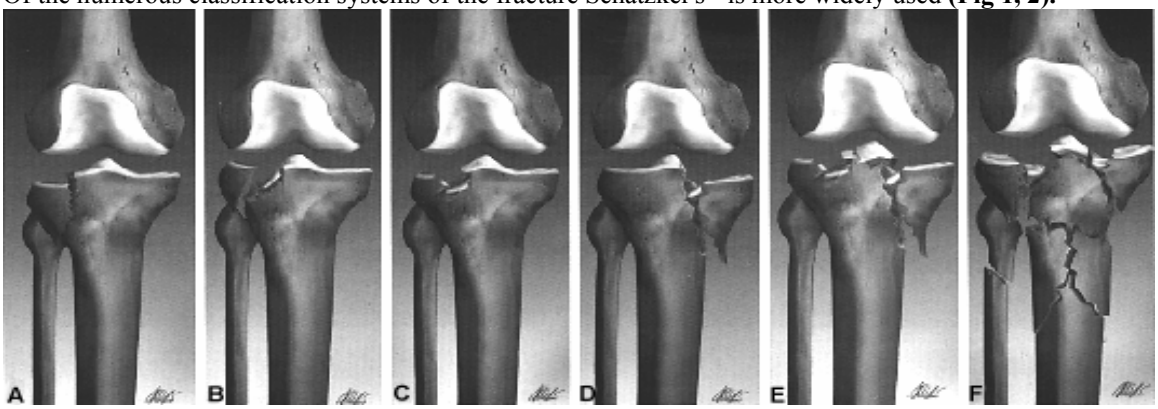

Fig.1 *– Schatzker's classification of Tibial Plateau Fracture.(Courtesy:Rockwood and Green's Fractures in Adults. 4th Edition. Lippincott-Raven Publishers.)*

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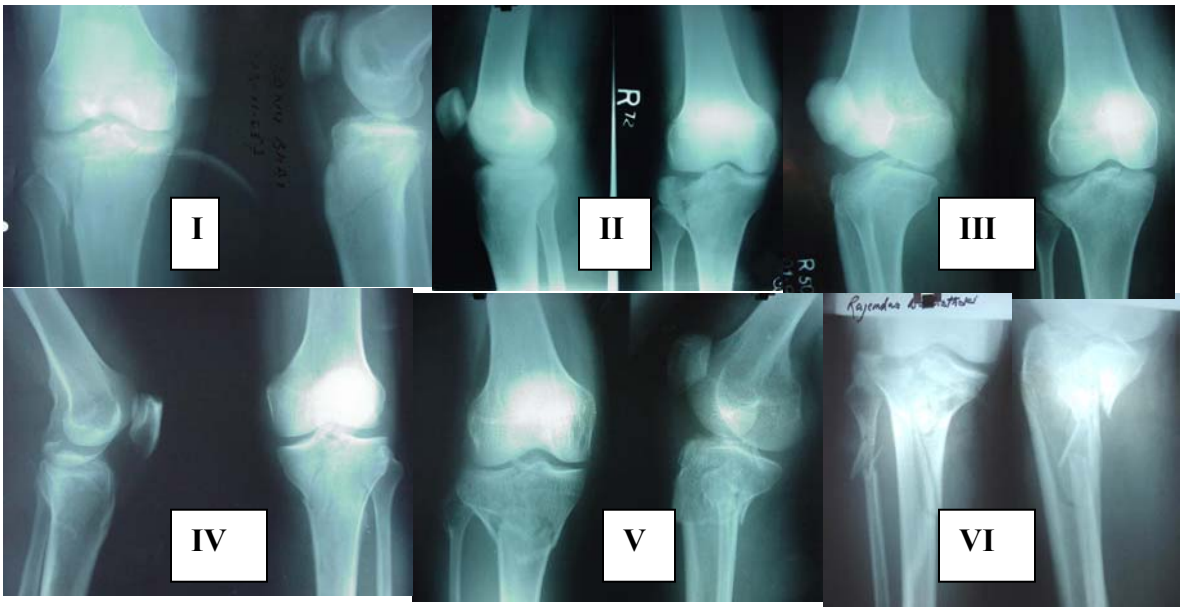


Fig. 2 *- Tibial plateau fractures classified according to Schtzker system – Type I to Type VI*

The primary goal in the treatment of proximal tibial articular fracture includes restoration of articular congruity, axial alignment, joint stability, and functional motion [1].
The main objective of this study was to determine the functional outcome of various types of treatment provided to different types of Tibial plateau fractures and to compare our results with comparable series in the international literature.

Methods and Materials:
This is a prospective study of 91 Tibial plateau fractures treated at our centre between July 1997 and July 2002. Eleven patients were lost during follow up, thus only 80 patients with 81 knees were studied. One patient had bilateral involvement. Patients were followed up in two week, six week, three months, and one year. All were subsequently followed up every year. Home visits were conducted by our hospital physiotherapist.

There were 62 males and18 females with the ratio being 3.4:1(male: female). Average age was 37 years (Chart 1, 2). Fractures were classified according to Schatzker into type I to type VI. There were 11 type I, 13 type II, 24 type III, 12 type IV, 7 type V and 12 type VI fractures. 25% were bicondylar, 19% were isolated medial condyle and 56% were isolated lateral plateau fractures.93% of the fractures were closed type and 7% were open. Open fractures were classified according to Gustilo's classification.

Chart 1 *- Study population*

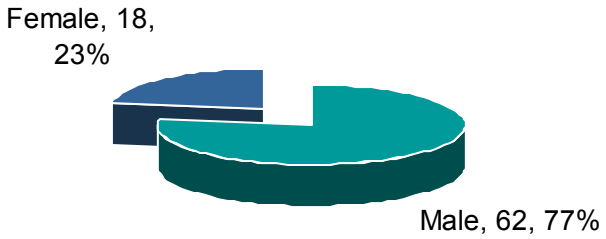
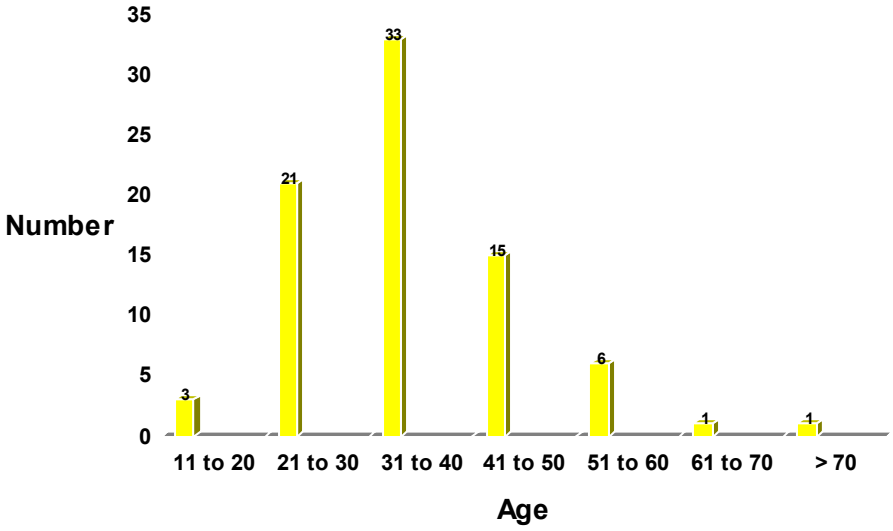
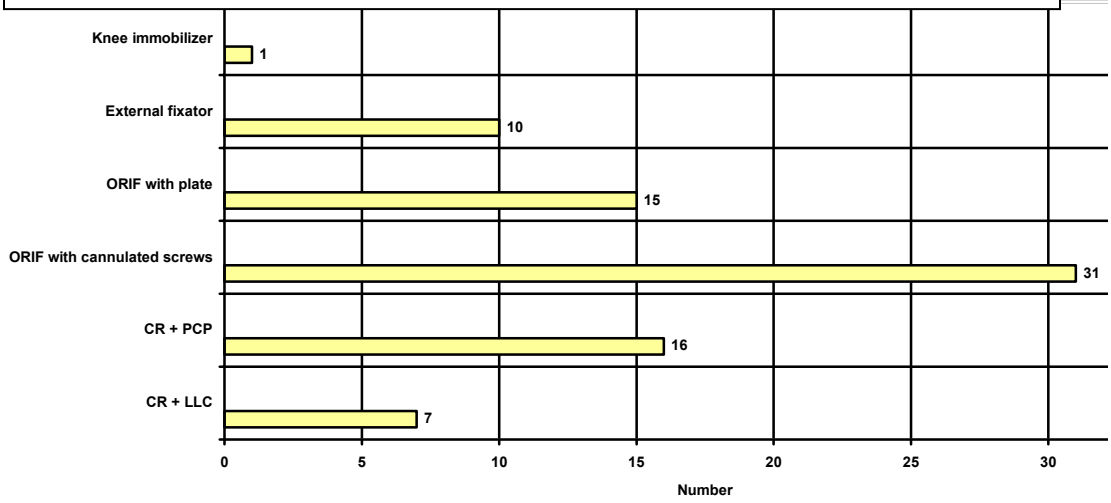


Chart 2 *- Age distribution of patients*



46 patients needed open reduction and internal fixation, out of which 31 patients were treated by percutaneous cannulated screw fixation. Remaining 15 were plated. Sixteen patients were treated with closed reduction and percutaneous cannulated screws under C- arm control. Ten cases were treated with external fixator. Closed reduction and long leg casting was done for 7 cases, whereas only a knee immobilizer was used in one case. Different modalities of treatment for different fractures were depicted in the chart **(Chart 3).**

Chart 3 *– Different modalities of treatment for different types of fractures of Tibial Plateau*



Results were graded according to the standard Grading System[3] into excellent, good, fair, and poor on the basis of four parameters viz: extension lag, range of motion, varus /valgus instability and pain **(Table 2).**

Table 2. *Modified grading system for functional evaluation of the tibial plateau fracture management (Jensen DB et al JBJS Vol. 72-B, No. 1, Jan 1990, PP49-52)*

Grade	Lack of extension	ROM	Valgus/Varus instability	Pain
Excellent (All of the following)	**0**	**>/=120**	**< 5**	**None**
Good (Not more than on of the following)	**> 0**	**<90**	**> 5**	**Mild on activity**
Fair Not more than two of the following)	**>/=10**	**<75**	**> 5**	**Moderate on activity or intermittent at rest**
Poor	**All results worse than fair**			

Initially X-rays were ordered in two views only (Antero posterior and Lateral). CT and Arthroscopy was planned only when the operating surgeon thought that it was necessary. ***Illustrations of few cases:***

Case I *– Type I fracture. Closed reduction and Percutaneous Cannulated screw fixation*

Case 2 – Type II fracture*. Open reduction and cannulated screw fixation*

***Case 3 – Type III fracture**. Closed reduction and percutaneous cannulated screw fixation*

***Case 4 – Type IV fracture.** Open reduction and Cancellous screw fixation. Avulsed tibial spine is also fixed with a cancellous screw.*

Case 5 – Type V fracture. ORIF with plate fixation

Case 6 – Type VI fracture. External fixator applied

Results

43 patients (54%, 44 knees) had excellent function. Twenty-two (26%) had good, five (6%) had fair and ten (14%) had poor results ***(Table 3).***

Table 3 *– Overall results of treatment of the Tibial Plateau Fractures*

Type	**Total no.**	**Excellent**	**Good**	**Fair**	**Poor**
I	10	10	-	-	-
II	14	13	1	-	-
III	22	11	11	-	-
IV	15	8	7	-	-
V	7	2	2	2	1
VI	13	-	-	3	10
Total	**81**	**44**	**21**	**5**	**11**

In the closed reduction group 4 had excellent results, 2 had good and 1 had poor result. All 16 patients treated with closed reduction and percutaneous cannulated screw fixation had excellent results .Out of 31 patients in open reduction and cannulated screw fixation group, 14 had excellent, 14 had good, 2 had fair, and 1 had poor results. In open reduction and plating group, 8 patients had excellent, 2 had good, 3 had fair and 2 had poor results. Of the 11 patients treated with external fixator 1 had excellent, 4 had good and 6 had poor results.

Eight patients (10%) had complications. One had peroneal nerve palsy, one had post-traumatic arthritis and 6 had superficial wound infections. Recovery in peroneal nerve was not observed till one year follow up. There were two cases with compartment syndrome and emergency fasciotomy were performed in both the cases. Seven cases were associated with ipsilateral femoral shaft fracture.

Out of 10 type I fracture all had excellent results. In 14 type II fractures 13 had excellent and 1 had good result. In 22 type III fractures 11 had excellent and 11 had good results. In 15 type IV fractures 8 were excellent and 7 were good. Out of 7 type V fractures 2 were excellent, 2 good and two fairs with one poor result. Out of 13 type VI fractures, 3 had fair and 10 had poor results.

Discussion

The spectrum of injuries to the tibial plateau is so variable that no single method has proven uniformly successful. Numerous authors have reported satisfactory results using both nonoperative and surgical methods of treatment [4]. In our series 54 % of our patients had excellent results and this outcome may have been due to the injuries resulting from medium energy trauma, early appropriate treatment and intensive early and long-term physiotherapy. Our patients were on an average much younger (average age 37years) and this factor could also have better results.

Fractures of the tibial plateau make up 1% of all the fractures and 8% of fractures in the elderly. Published studies have shown that majority of the injuries affect the lateral tibial plateau (55-70%). Isolated medial plateau fracture occurs in 10-23% of the cases, while bicondylar lesion is found in 10-30% of reported cases[5]. The pattern of fractures in our series compares similarly with these published results.

Pre-operative planning is an important part of management. X-rays of opposite knees serve as a useful template .In displaced fractures, traction x-rays reduce overlap of fragments and allow better visualisation of the comminuted fragments. The surgery is performed on paper before being carried at in the operating room. If executed properly this surgical tactic shortens operative time, minimizes intra operative decision making and improves results[5]. In our series only routine anteroposterior and lateral X-rays were taken. Miller has suggested a 15-degree caudal tilt view, varus / valgus stress views, Computed Tomography (CT) and Magnetic resonance imaging (MRI) [4]. Arthroscopy was done in one patient in our series as a follow up measure and he demonstrated sign of fibrocartilage build up of the articular surface. Few literatures suggest its value in tibial plateau fracture[4] .CT and MRI were done in 2 cases only because these patients had high energy severely comminuted type VI fracture. In 3 cases varus and valgus tests were done preoperatively. We prefer doing these at the time of operation when the patient is under general anaesthesia.

No universal agreement exists on the amount of articular depression that can be accepted varying from 4mm to 10mm [6]. At our centre we critically review any articular depression of more than 5mm.Decision to operate is made through collective discussion and merit of each case.

Brinker has suggested that resultant metaphyseal defect should be filled with graft material to prevent collapse of the articular surface. Type I, IV and V don't need grafting[7]. In our series also only type III fractures were grafted. Grafts were taken from the ipsilateral iliac crest. Graft site morbidity has been a problem with our patients.

Six fractures in our series were of Gustilo IIIb. After wound debridement intravenous (IV) Cephalosporin was used for 5 days and then oral antibiotics were continued for 6weeks. Aminiglycosides and Metronidazole were also added intravenously for 5 days to cover for spores and gram negative organisms which are potential causes of serious contamination[5].In closed fractures after open reduction and fixation we use Cephalosporin IV for 48 hours and then oral antibiotics for 14 days. With this protocol we are having no serious wound complication .Six patients had superficial wound infection after surgery but they all healed.

When fixation is stable a continuous passive motion (CPM) has been recommended [8].In our series no CPM were used. Early range of motion was begun following internal fixation in our series. Weight bearing were permitted only 12 weeks post operatively or after the evidence of clinical and

radiological healing. Radiological healing was judged on the basis of healing of the cortices in two views.

We had one peroneal nerve palsy in a type VI injury that did not recover. Peroneal palsy is a rare complication of tibial plateau fracture. Infection is one of the most common and devastating complications with serious consequences. Ill timed surgical intervention through contused skin with extensive dissection for the placement of implant contributes to early wound complications.

In the swollen knee with fracture we have waited up to 2 weeks before surgery was embarked upon.

Posttraumatic arthritis can occur either as a result of residual joint incongruity or as a result of cartilage damage sustained at the time of initial injury. We had one case with this complication. Long term post traumatic arthritis is a matter of concern for most cases of tibial plateau fractures (Schatzker type III, IV, V, VI).

Nonunion is rare after low energy fracture, owing to the predominance of cancellous bone and its rich blood supply. It is most commonly seen in Schatzker VI at metaphyseal diaphyseal junction [9].We had no non-union in this series.

Conclusion

The surgical management of tibial plateau fracture is a difficult and challenging task. The techniques demand considerable skill and mature judgment on the part of the surgeon. The use of implants and instrumentation doesn't guarantee a favourable outcome. 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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