

## **Operative Treatment of 111 Tibial Plateau Fractures Skims Medical College Study**

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*To Assess The Long-Term(1-15yr) Functional And Radiological Results Of Surgically Treated Tibial Plateau Fractures*

*Design: Retrospective Study Setting: Medical College Hospital Affiliated To SKIMS University.*

### **I. Introduction**

Although Tibial plateau fractures comprise 1% of all fractures, a unified treatment has not been established. Additionally long term outcome after various treatment protocols is not yet clear, despite the voluminous discussion of different treatment protocols in the literature.[1-31]. Recent studies assessing only surgically treated patients by means of internal fixation (ORIF) show good results but have relatively small patient groups or short term follow-up[7,10,13,16,20,29,32,33]. The primary aim of this study was to evaluate the functional and radiological long term results of surgically treated [ORIF] tibial plateau fractures. The secondary aim was to analyse characteristics that had a significant influence on the results.

### **II. Material Methods**

Between 2001 to 2016, 111 patients were treated with ORIF at our institution. All patients were followed-up for a minimum of 1 yr follow-up and according to AO fracture documentation, all patients were physically healthy before trauma. Table 1 presents fracture type and mechanism of injury. There were 42 males and 19 females. The mean age at the time of injury was 42.36. Forty eight patients had isolated fractures and thirteen patients had multiple fractures.

In 61 of 111 patients, a long-term follow-up was performed. 3 patients died, 25 patients refused participation in research study and 22 were untraceable, leaving 61 pts. The median hospital stay was 5 days.

### **Operative Technique**

All patients were treated by ORIF. Indications for surgical treatment were a displacement of tibial plateau of at least 5mm or a fracture-related clinical instability of at least 5 degrees.

Surgey was done in supine position, with the freedom to bring the knee to 90 degrees of flexion. For unicondylar fractures, a straight parapatellar incision was used. After arthrotomy and thorough washing the knee joint was inspected for fracture pattern and injury of ligaments and meniscus. The anterior horn of the meniscus was released to improve exposure and reattached after fixation of the fracture. No meniscectomy was done. Pure split fractures were fixed by screws and antisliding washers. When additional support of the fracture area was essential, an L, T or semitubular plate was used for buttressing. Impaction fractures were treated by elevating the fragments from below with a bone impactor introduced through the fracture or through a small cortical window. The remaining bony defect was filled with autogenous cancellous bone graft taken from ipsilateral iliac crest, supported by screw fixation through a buttress plate.

In bicondylar fractures, an additional medial incision was made to facilitate anatomic reduction and buttressing of the medial fragment. Thereafter, the lateral condyle could be adapted to the anatomically reduced medial condyle. Exceptionally, an osteotomy of gerdy tubercle or fibula head was used to reduce posterolateral impression fractures [31]. ROM was started early to avoid knee stiffness. Fig 1,2,3 showing preoperative xray, 3D CT Scan, and Post-operative radiograph.



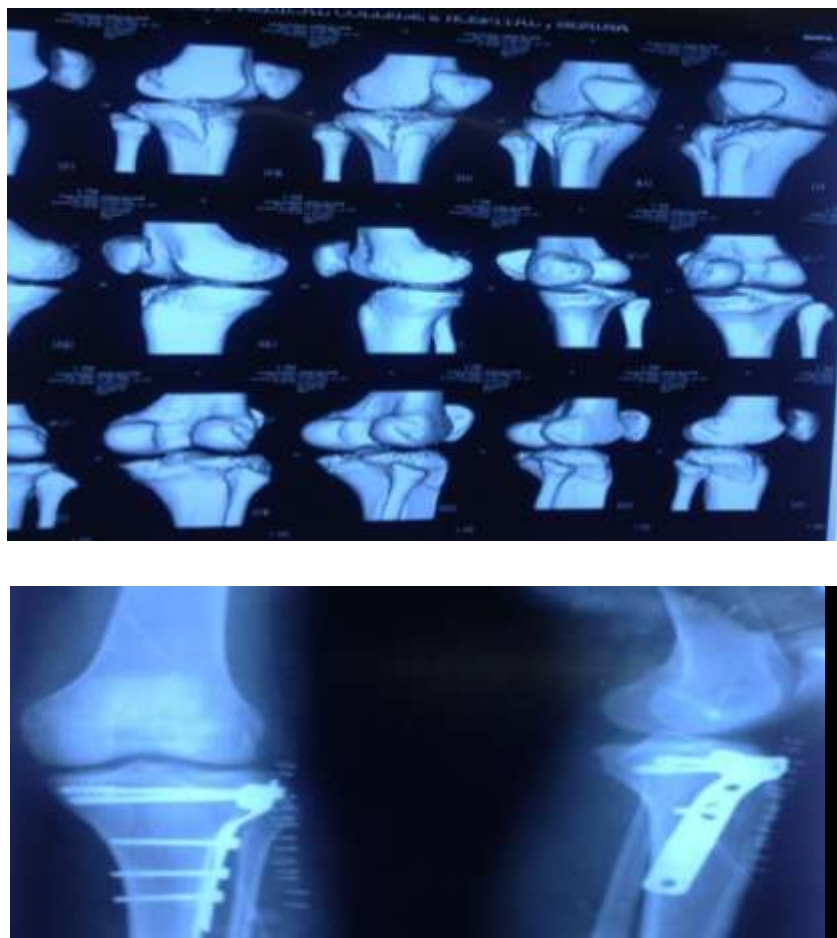


Fig 1-3 showing preoperative photograph,CT Scan and Post-operative radiograph

### Followup

61 patients were treated in the outpatient clinic;they were asked to fill in a questionnaire(Neer,and HSS-knee score),a physical examination was performed,and X rays were made(full-length standing views;Ap,Lateral and Oblique).Radiographs were classified according to both the AO and Schatzker classification [27].Functional evaluation at the follow-up was done using the Neer score [34] and HSS Knee score [35].The Ahlback score [36] was used for radiological evaluation.Assessment of radiographic alignment and joint congruency was performed manually by analysis of both left and right 3-directional x-rays.A malunion was defined as unacceptable axial alignment(varus/valgus>5 degrees,rotation>10degrees,shortening>2 cm) after full consolidation.Follow-up radiograph of a patient at 11<sup>th</sup> year follow-up(fig 4)



Fig 4

**Table 1: Fracture Characteristics**

Fracture type	Mechanism of injury			Domestic Total(%)	
	Road Traffic Accidents	Pedestrian	Sports Injury		
41 B3	12	7	1	13	33 (29.7)
41 C1	11	3	1	1	16 (14.4)
41C2	8	2	1	0	11 (9.9)
41 C3	4	0	2	1	7 (6.3)
Total (%)	45 (40.5)	15 (13.5)	16 (14.4)	35 (31.5)	111 (100)

### III. Results

At 1 year follow-up, 105 of the 111 patients (94.5%) had an uneventful consolidation of fracture, and 6 (5.4%) had a complication of fracture healing (non-union or malunion). The mean ROM was 127 degrees (10-140).

#### Complications

6 patients (5.4%) developed wound infection and required thorough wound lavage and debridement. Four patients fully recovered. In the remaining 2 patients, recurrent infection led to impaired fracture healing (non-union) and were treated by bone grafting and Ilizarov fixation.

In 4 patients (3.6%), a malunion of the fracture developed. 3 patients decided not to be treated. In one patient, there was a progressive valgus malalignment, with secondary osteoarthritis. Corrective osteotomy [37] was performed in this case.

One patient with severe secondary osteoarthritis received a total knee replacement.

Long-term results of 61 patients

#### Functional Results

The mean ROM was 130 degrees (0-140). 50 patients (81.9%) showed no anteroposterior laxity (<5mm); 10 patients (16.3%), a clinical laxity of 5-10mm; and one (1.6%), a laxity of greater than 10mm. In 57 patients (93.4%), no collateral instability was found (<5 degrees), and in 4 (6.5%) clinical instability measured between 6 and 9 degrees.

Neer Score. The mean Neer Score was 86.7 points (54-100 points). 42 patients (68.8%) were rated as excellent, 15 (24.5%) good, 2 (3.2%) fair, and 2 (3.2%) poor.

HSS knee Score. The mean HSS knee score was 82.4 points (17-100 points). Thirty nine (63.3%) were rated as excellent, 14 (22.9%) good, 7 (11.4%) fair and one (1.6%) poor.

#### Roentgenographic Results

Forty two patients (68.8%) showed no signs of secondary osteoarthritis (grade 0); 13 (21.3%), slight signs (grade 1), 5 (8.1%), moderate signs (grade 2); and one (1.6%), severe signs (grade 3).

### IV. Discussion

Optimal treatment of tibial plateau fractures has been an issue of discussion for several decades [1-31]. Lot of research has been done analysing functional and radiologic results for conservative as well as operative treatment. Conservative management is recommended for minimally displaced fractures. Operative treatment is advised for fractures with greater than 5mm displacement or greater than 5 degrees instability with varus or valgus stress. Studies analyzing surgically treated tibial plateau fractures have shown good results. [7, 10, 13, 16, 20, 29, 32, 33]. However, because these studies often were small groups of patients or relatively short-term follow-up, a clear prognosis on long term outcome cannot be provided. In the present study, the evaluation of long term functional and radiographic results of surgically treated tibial plateau fractures was done.

ORIF leads to excellent functional and radiologic results as was depicted in our series. Continual observation of these patients made it possible to assess the progression of knee function closely. Majority of the patients have resumed their daily activities as before the injury and have regained almost full flexion and extension of the knee joint after 1 year follow-up. After an average follow-up of 15 years, excellent results were seen in most of these patients. In comparing short term to long term results, the knee function is not likely to change significantly after 1 year. Keeping this observation in mind, we believe that the results at 1 year are a good prognostic indicator for future knee function.

Several predictor variables influencing results after treatment have been described in the literature. Hsu [13] performed a study on 20 surgically treated patients with a mean age at trauma of 66 years and follow-up of 50 months. Using the modified Rasmussen score, they found satisfactory results in 90% of patients. Their conclusion was that for the elderly patients, the basic principles for surgical treatment are same as for young patients, though a more conservatively oriented rehabilitation programme is mandatory. Biyani et al [7] did a

similar study with 32 patients with a mean age at trauma of 72 years and a mean follow-up of 3.7 years. Using the Ramussen score, satisfactory results were observed in 90% of the patients. They concluded that satisfactory results can be obtained in carefully selected patients. In our study, no correlation was seen between age and function or radiographic results; excellent results were found in the majority of the patients through the entire age spectrum.

In the present series the fracture type significantly influenced the functional results ( $p=0.04$ ). Bicondylar fractures tend to show less favourable, though still good, results compared to monocondylar fractures. Only a relatively small percentage of the patients in the present series (12%) had the most complicated fracture pattern, AO type 41C3 or Schatzker type 6 fractures.

Previous studies reported the importance of stability of the knee after treatment of tibial plateau fractures as one of the most important predictors for future knee function [38]. This underlines the main goal of treatment with ORIF, namely to create a stable and painless knee joint. In our series majority of the patients showed good stability in the anteroposterior, as well as in the mediolateral direction.

The incidence of soft tissue injuries in tibial plateau fractures is high. In a prospective cohort study performed by Gardner et al [39], 103 patients with tibial plateau fractures were evaluated for soft tissue injuries by MRI. They found that only 1% showed complete absence of soft tissue injuries, and meniscal injuries were present in up to 91% of all patients. Shepherd et al [40] showed a high prevalence of soft-tissue injuries even in minimally displaced tibial plateau fractures.

The treatment of these soft-tissue injuries has been a debate for several decades. It has become commonplace to create a stable knee, ensuring early exercise and restoration of knee function and minimising the development of secondary osteoarthritis in the long term. Honkonen [41], in a 1994 article, described posttraumatic osteoarthritis to be present in 44% of 131 cases. Patients who underwent a meniscectomy showed a greater prevalence of posttraumatic osteoarthritis (74%) compared to those whose meniscus was reattached (37%), which furthermore implies the need for repair of soft-tissue damage.

Secondary osteoarthritis remains a problem after intra-articular fractures of the knee. Marsh et al [38] performed a review concerning the importance of anatomic reduction with respect to articular fractures. They found that there is little rationale for the premise that an anatomic reduction of the articular surface is associated with obtaining a good clinical outcome. They also stated that the cartilage injury sustained by the initial injury may be the most important factor that leads to joint degeneration despite accurate reduction. Furthermore, they underlined the fact that malalignment after treatment contributes to a poor outcome after tibial plateau fractures.

In the present series, a moderate to severe degree of post-traumatic osteoarthritis was present in 10% of all patients and varus or valgus malalignment was a good predictor variable for development of secondary osteoarthritis. Secondary arthritis developed in 9.3% of the patients with a near anatomic knee axis and in 21% of patients with a malalignment of 5 degrees or more ( $p=0.02$ ).

Our results also show a strong correlation between the development of secondary osteoarthritis and functional results at follow-up. Patients with no or mild secondary osteoarthritis had good to excellent functional results in most cases, whereas patients with a higher degree of secondary osteoarthritis have a greater risk of developing less optimal functional results. However, almost half of patients with a moderate to severe grade of secondary osteoarthritis still had good to excellent functional results.

Wound infections remain a serious problem in the treatment of tibia plateau fractures, with infection rates ranging from 3 to 32% [6,8,14,18,20,22,27,42-44]. Barei et al [45] performed a study analyzing the complications after ORIF with a 2-incision technique in patients with high-energy tibial plateau fractures. In 8.4% of 83 patients, a deep wound infection developed that required an average of 3.3 additional procedures to clinical resolution. They state that with proper timing of the internal fixation and precise tissue handling, high-energy tibial plateau fractures can be safely treated by dual plating. In the present study, it became apparent that when both the incision and amount of metal used were minimised, complications were not frequent. Less invasive surgery of tibial plateau fractures has been developed to overcome this problem and appears to show satisfactory early results, with infection rates between 3.7% and 13.3% [46-48].

The limitation of this study was retrospective nature but provides good information about long term results about ORIF of tibial plateau fractures.

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