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## INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/18641

DOI URL: <http://dx.doi.org/10.21474/IJAR01/18641>



### RESEARCH ARTICLE

#### A STUDY OF FUNCTIONAL OUTCOME IN THREE COLUMN FIXATION OF COMPLEX TIBIAL PLATEAU FRACTURES

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#### Manuscript Info

##### Manuscript History

Received: 28 February 2024

Final Accepted: 31 March 2024

Published: April 2024

##### Key words:-

Womac, Tibia Plateau, Modified Rasmussen

#### Abstract

**Introduction:** The treatment of complex tibial plateau fractures (TPF), especially those caused by high-energy trauma, remains a challenge in many respects. Tibial plateau fractures are one of the commonest periarticular fractures. These fractures include 1% of all fractures and 8% of fractures in elderly. Motor vehicle accidents account for the majority of these fractures in younger individuals with good bone stock, but in elderly individuals these fractures may result from simple fall due to osteopenic bone. Conservative methods may result in malunion and articular congruity cannot be restored. Surgical treatment can regain articular congruity and restore mechanical alignment, and can allow early range of motion. Open reduction and internal fixation techniques had been associated with wound complications.

**Aim Of The Study:** To evaluate functional outcome in patients of complex tibial plateau fractures treated by three column fixation.

**Materials and Methods:** In our institution 20 patients with displaced tibial plateau fractures with posterior column involvement were selected for the study. This is a prospective study done from AUGUST 2023 to APRIL 2024(9 months). Patients were evaluated with X rays (AP and lateral views) and Computed Tomography (axial, coronal, sagittal with 3D reconstruction views). Fractures classified based on 3 column concept classification. Mean follow up period was 6 months. Functional and radiological outcome was assessed using functional knee score, modified rasmussen score and WOMAC score.

**Inclusion Criteria:** 1. Patients admitted with complex tibial plateau fractures involving medial, lateral and posterior column of tibia. 2. Both sexes 3. Age 20-60 yrs.

**Exclusion Criteria:** 1) Bad skin status of the fractured site. 2) Patients with co morbidities not fit for surgery. 3) Patients with neurovascular deficit. 4) Patients not willing for surgery.

**Results:** In our study, 70% of the patients were in active productive age group (30-50 years). 85% of the patients were male. The fractures were left sided in 75% patients. 85% patients in study sustained injury due to road traffic accident. 80% cases in the study were type 5 schatzker type 5 fractures and all the cases included in the study were 3 column fractures. 8 cases out of 20 cases in the study required epidural analgesia instead of a repeat spinal as the duration of the surgery was longer.

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**Conclusion:** To conclude, 3 column fixation in high energy displaced tibial plateau fractures with three column fractures resulted in Good clinical and radiological outcomes.

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### **Introduction:-**

The treatment of complex tibial plateau fractures (TPF), especially those caused by high-energy trauma, remains a challenge in many respects. Tibial plateau fractures are one of the commonest periarticular fractures. These fractures include 1% of all fractures and 8% of fractures in elderly. Motor vehicle accidents account for the majority of these fractures in younger individuals with good bone stock, but in elderly individuals these fractures may result from simple fall due to osteopenic bone. These fractures are associated with high energy violence and extensive soft tissue injury. Each fracture type has its own morphology, treatment considerations and prognosis. Conservative methods may result in malunion and articular congruity cannot be restored. Surgical treatment can regain articular congruity and restore mechanical alignment, and can allow early range of motion. Open reduction and internal fixation techniques had been associated with wound complications. Open reduction and internal fixation can be achieved by various approaches, including – Mercedes Benz, anterolateral, posterolateral, anteromedial, anterolateral, single anterior midline incisions, posteromedial, posterolateral and posterior approaches. Bicondylar tibial plateau fractures require good exposure which can be achieved either by single (Mercedes Benz, Single anterior midline) or double (anterolateral and posteromedial) incisions. Study conducted by Raykov et.al stated that Mercedes Benz incision had high rates of wound necrosis<sup>3</sup>. Tibial plateau fractures are managed with single anterolateral or dual plating. In high energy tibial plateau fractures involving posteromedial fragment dual plating is better than single plating.<sup>12</sup> To achieve satisfactory fixation of the tibial plateau fractures it is mandatory to know the fracture morphology, soft tissue and ligament status of the injury. Luo CF et al stated Three column classification concept provides excellent inter-observer reliability than conventional schatzker classification and AO/OTA classification and allows better understanding of the fracture morphology and detection of posterior column fractures which guides in pre operative planning<sup>4,5,6</sup>. Isolated Posterior tibial fractures best fixed in prone position than supine position<sup>7,8</sup> and in multiplanar fractures involving the posterior column and combination of posterior and anterior-lateral approaches is a safe and effective way to have direct reduction and satisfactory fixation in supine or combined supine and prone positions<sup>9</sup>. Intraoperative repositioning of patient, skin preparation and draping is time consuming and prolongs surgical time thus dual plate fixation in supine position can also be done<sup>10</sup>.

### **Aim Of The Study:-**

To evaluate functional outcome in patients of complex tibial plateau fractures treated by three column fixation.

### **Objectives:-**

1) To evaluate the outcome of fracture union clinically by knee scoring system. 2) To evaluate the outcome of fracture union radiologically. 3) To assess the knee joint range of movements for improvement.

### **Materials and Methods:-**

In our institution 20 patients with displaced tibial plateau fractures with posterior column involvement were selected for the study.

This is a prospective study done from AUGUST 2023 to APRIL 2024. Patients were evaluated with X rays (AP and lateral views) and Computed Tomography (axial, coronal, sagittal with 3D reconstruction views). Fractures classified based on 3 column concept classification. Mean follow up period was 6 months. Functional and radiological outcome was assessed using functional knee score, modified rasmussen score, WOMAC score

### **Center Of study:**

The study was conducted in the Department of Orthopedics, GOVERNMENT HOSPITAL, JAGTIYAL, TELANGANA

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### **Inclusion Criteria:**

1. Patients admitted with complex tibial plateau fractures involving medial, lateral and posterior column of tibia. 2. Both sexes 3. Age 20-60 yrs

**Exclusion Criteria:**

1) Bad skin status of the fractured site. 2) Patients with co morbidities not fit for surgery. 3) Patients with neurovascular deficit. 4) Patients not willing for surgery.

**Pre-Operative Planning:**

Clinical examination knee aspiration x ray knee AP view, lateral view CT knee with 3D reconstruction, complete blood picture, Blood sugar, urea, creatinine, viral markers, electrocardiogram for anaesthetic Assessment

**Pre-Operative Management:**

Stabilisation of fracture with AK slab Control of co morbid conditions – diabetes and hypertension

**Time Interval Between Injury And Surgery:**

7 patients were operated between 3 to 7 days. 11 patients were operated between 8 to 14 days. 2 patients were operated between 14 to 21 days. The mean time interval between injury and surgery was 10.3 days.

**Implants And Instruments:**

Proximal tibial locking plates T/L buttress plates Postero medial and posterior tibial locking plate, 6.5,5mm cancellous screws (locking, non-locking) 4.5,5mm cortical screws (locking, non-locking)

**Surgery:**

Anterolateral Plate Osteosynthesis Postero Medial Plate Osteosynthesis(Lobenhoeffer) Posterolateral Plate Osteosynthesis(Frosch)

**Anaesthesia:**

SPINAL + EPIDURAL IN 8 patients SPINAL ALONE IN 12 patients POSITION: Supine position or prone position depend on the approach used to fix the fracture. SURGICAL APPROACHES: POSTEROMEDIAL APPROACH TO THE MEDIAL TIBIAL PLATEAU: SUPINE POSITION, POSTEROLATERAL APPROACH: minkoff et al -Patient in prone position,ANTEROLATERAL APPROACH

**Surgical Technique:**

After careful preoperative evaluation the fracture morphology surgical approach and patient position planned. In our study we used combination of anterolateral and posterior medial in all the cases with few exceptions where we used a combination of posteromedial and posterolateral approach

**Postoperative Followup:**

Patients were treated with i.v. antibiotics for 5 days postoperatively. Aseptic wound dressing was done on POD 2, 5, 8 and POD 10. Sutures removal done on based on wound status with the earliest done on POD 10 and the longest was POD 15. Patients were mobilized as early as possible. Ankle pump and quadriceps exercises were performed from second POD. Knee bending exercises were started after the pain subsides and as tolerated by the patient. Partial weight bearing using walkers started after 6 weeks and full weight bearing was allowed after 3-4months depending upon the union of the fracture site. Physical therapy was continued until range of motion and muscle strength was regained. Postoperatively patients were evaluated with x-ray AP and lateral views at 6 weeks, 6 months and 1 year.

**Observation and Results:-**

20 patients with tibial plateau fractures with displaced 3 column fractures admitted were included in this study. All the patients were treated with three column fixation in supine or prone position was done after assessing fracture morphology with CT scan and three column classification and surgeon's preference on positioning the patients. Follow up period was 6 months. Follow up analysis was made using Functional knee score, Modified Rasmussen score, WOMAC SCORE In our study, 70% of the patients were in active productive age group (30-50 years). 85% of the patients were male. The fractures were left sided in 75% patients. 85% patients in study sustained injury due to road traffic accident. 80% cases in the study were type 5 schatzker type 5 fractures and all the cases included in the study were 3 column fractures. 8 cases out of 20 cases in the study required epidural analgesia instead of a repeat spinal as the duration of the surgery was longer. 16 out of the 20 cases in the study, a dual approach was used, the approaches were either a lobenhoeffer + anterolateral approach or frosch + lobenhoeffer. The average drain quantity from the wound site was 42.5 ml. All the cases in the study were given a triple antibiotic keeping in consideration about the environment the patients stay, the level of hygiene of the patients in the institute.

The antibiotics were ceftriaxone+metrogyl+amikacin. The average time for suture removal was 11.45 days. In this study, the average functional knee score was 88.75. in modified Rasmussen criteria 14 patients out of 20 had excellent outcome and 5 out of 20 patients had a good outcome only a single case had a fair outcome and a no patients had poor outcome after the surgery. The average WOMAC score was 32.65. 4 patients out of the 20 had surgical site infections. The cases were treated according to the culture and sensitivity

### **Discussion:-**

Tibial plateau fractures, one of the commonest intra articular fractures, occurring as a result of RTA, fall from height, violence etc. The management of these fractures has always been in debate because of their variety of fracture pattern and soft tissue complications. High energy tibial plateau fractures have associated with more severe fracture pattern, ligament injury and severe soft tissue injuries. 3 COLUMN fractures are best treated with dual plating than single lateral plating with better anatomic reduction and rigid fixation and it also has soft tissue complications as well. There are many approaches for fixation of tibial plateau fractures each one has its own merits and demerits. Selection of approach and fixation for tibial plateau fractures is still a debate for better outcomes. In high energy tibial plateau fractures, posteromedial and posterior fractures are often not able to fix with anterolateral plate alone. Fractures of the posterior tibial plateau are not uncommon, especially in high-energy trauma. Fixation of posteromedial and posterolateral fractures are essential in obtaining excellent clinical and radiological outcome in the high energy tibial plateau fractures. Failure to fix the posteromedial fragment result in varus collapse and decreased range of motion and clinical outcome in displaced tibial plateau fractures and posterior tibial fractures are best studied and planned for fixation using the three-column fixation proposed by Luo CF et al. Posteromedial or posterior approaches either in prone or supine provides better visualization of the fractures and aid in better reduction and fixation and it also has the advantages of less soft tissue injury even when combined with anterolateral incision and it can also be used to fix the posterior cruciate ligament injury if present. Posterior Column fixation through these approaches with antiglide plate and medial and lateral column fixation with screws or lateral locking plates provides the accurate reduction of articular surfaces and rigid fracture fixation thereby has advantages of early mobilization, 86 reduced soft tissue complications, better range of movements, early mobilization than other modes of fixations. In this study functional and radiological outcome in displaced tibial plateau fractures with three column involvement of 20 patients treated by dual approach to reduce and address the fractures in all the three columns. Plateau fractures were studied with CT scan and classified and planned for approach and plating using three column classification. Post operative functional and radiological outcome was assessed by using knee society score, functional knee score, modified Rasmussen score, WOMAC score. In this study, tibial plateau fractures were more commonly seen in the active productive age group (31-50 years) due to high-energy trauma. Conservative management, external fixators and routine anterolateral plate osteosynthesis are difficult to reduce and fix the posterior column fractures especially in posteromedial fragment and coronal splitting Moore type I fractures. It is extremely important to adequately visualize the fragments, reduce the fracture, regain articular congruity and obtain stable rigid fixation. In our series majority of patients were male (85%) as they were involved mostly in road traffic accidents due to their occupation. There was significant difference in the side affected in this study (right – 5, left – 15 patients). In our study three column classification utilized to evaluate the fracture morphology and to plan for fracture fixation. Soft tissue complications are a major concern in the treatment of 3 column tibial plateau fractures with plates. No patient developed varus collapse in our study. There was no neurovascular injury, no implant breakage, no varus valgus deformity, no delayed union or non-union in our study. 90% of the patients attained good to excellent outcome in the follow up study. In our study also all the fractures were united between 3 to 4 months. The average functional knee score was 88.75. 70% patients had excellent outcome, 25% patients had good outcome, 5% patients had fair outcome with no case showing poor clinical or radiological outcome.

Limitations of the study: Limitations of this study includes – small sample size, short term follow up, surgery done by different surgeons.

### **Conclusion:-**

1) Posterior plate osteosynthesis improve the strength and stiffness of posteromedial fragment fixation and had a buttress effect preventing descent of the fragment under load than other modes of fixation. Hence, reduce the varus collapse and increase in range of movements by fixing the unstable posterior fragments. Rigid anatomical fixation without much soft tissue complication allows the patient to mobilize early and increase range of movement and functional outcome.

- 2) In high energy displaced tibial plateau fractures of 3 column fractures can be treated with dual plating with conventional lateral locking plate or screw fixation when combined with posterior antiglide plating effectively.
- 3) Posterior plate osteosynthesis of posterior column fracture fixation through posteromedial or posterior approach in either supine or prone position provides better visualization and rigid fixation of posterior tibial fractures without major soft tissue complications if the surgery is done once the soft tissue condition improves.

To conclude, 3 column fixation in high energy displaced tibial plateau fractures with three column fractures resulted in Good clinical and radiological outcomes.

**Conflict of Interest:-**

Nil

**Findings:-**

Nil.

**Ethical approval:**

Approved by Ethical committee government civil hospital, jagtiyal

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