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FUNCTIONAL OUTCOME OF OPEN REDUCTION AND INTERNAL FIXATION OF POSTEROMEDIAL TIBIAL PLATEAU VIA POSTERIOR APPROACHES IN A TERTIARY CARE CENTRE.

Orthopaedics

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ABSTRACT

Introduction: Tibia plateau fractures are complex knee injuries and have been classified by Schatzker's. The objective of treatment remains anatomical reduction, and limb alignment with stable fixation.This article is used in posteromedial tibial plateau fractures to evaluate the functional and radiological outcome using posteromedial approach in prone position. **Methodology:** A quasi-prospective review of 22 patients with postero-medial proximal tibia condyle fractures from June 2021 to December 2022 and were followed up for 1 year. Variables assessed included patient age, type of fracture according to Schatzker's classification, functional and radiological outcome according to Rassmussen's scoring system. **Results:** 6 patients out of 22 patients with type IV fracture had a mean radiological score of 18 points while 9 patients with type V fracture had 14 points. 11(91.47%) of them had excellent score and 1 of them (8.3%) had good score, out of 12 patients with Schatzker type IV fracture. 3 of them (50.0%) had excellent score while the other 3(55.6%) had good scores, Out of 6 patients with Schatzker fracture type V. Of the 4 patients with type VI fracture, 1(25%) had excellent score and 3(75%) had a good score. **Conclusion:** The posteromedial approach in prone position (Lobenhoffer approach and Burks and Schaffer approach) is considered a safe and efficient approach. The approach allows anatomical reduction of the posteromedial fragment using the posterior buttressing plate while protecting the neurovascular bundle.

KEYWORDS

proximal tibia; Schatzker; posterior approach; prone; buttress plating; internal fixation

INTRODUCTION:

Correcting the position of the posterior column in a tibial plateau fracture is essential for restoring anatomical joint line (Barei et al., 2008). If the reduction is inadequate, there are increased chances of surgical failure(Higgins et al., 2009; Lansinger et al., 1986).

CT technology with 3D Reconstruction dramatically increased attention to proximal tibial fractures. These fractures are commonly caused by high velocity injuries that frequently result in incongruent joint surfaces, metaphyseal and diaphyseal separation and damage to the soft tissues.

Mechanical axis restoration of the knee has been found to be the most important prognostic outcome in treatment of tibial plateau fractures(Rademakers et al., 2007; WEIGEL & MARSH, 2002). Coronal alignment is most discussed, but realigning sagittal column mechanical alignment is also crucial.

Anteriorly translated distal fragment with the posterior sagging of the femur condyle and a posteromedial tibia plateau fragment is best addressed with posterior reduction and buttress plate fixation. Therefore, approaches that allow access to these fragments are important to joint congruity and stabilization.

Reduction is achieved in various ways (Frosch et al., 2010; Garner et al., 2015; Solomon et al., 2010; Weil et al., 2008). One is the posteromedial approach in the prone position. The lazy lateral position has also been described which gives access to the anterior and anterolateral plateau and may still give access posteriorly(Weil et al., 2008). However, reduction in a supine position can be challenging if the fracture line is too posterior. Positioning the patient prone provides visualization of the posteromedial and posterolateral tibial plateau. The posterior approaches we did for fracture fixation have been described in detail.

The posterior approach for posteromedial tibial condyle plateau fractures was first spoken about in a German article published in 2003. It provides good visibility and allows for proper alignment of the posteromedial bone fragment without exposing the neurovascular bundle(Hake & Goulet, 2016b).

We have assessed patients' clinical outcomes and radiological results after reducing the fracture with a buttress plate.

MATERIALS & METHODS:

This quasi-prospective study here involves a total of 22 patients (17 males and 5 females) with closed postero-medial tibial plateau fractures who underwent surgical fixation in the time period of June 2021 and December 2022. This literature protocol was submitted to the Institutional Ethics Committee and was approved.Written and informed consent was taken from the patients. Patients were fully informed about their diagnosis, the proposed treatment, and the possible complications in their own language.All patients with posteromedial tibial plateau fractures were reduced and fixed using a buttress plate or screws via posteromedial approaches in prone position.

With ages ranging from 20 to 56 years, the average age of the patients at the time of surgery was 36.6 year and we followed up each patient up to one year. According to the Schatzker's classification, there were 12 cases (54.5%) with type lV fracture, 6 cases (27.3%) with type V fracture and 4 cases with type VI fracture (18.2%). Out of these, 13(59.1%) were operated via Burks and Schaffer approach and 9 (40.6%) were operated via Lobenhoffer approach.

Patients were operated after administering spinal anesthesia. Patients were positioned prone and the proposed procedure was performed. Pre-op antibiotics were given before surgery and a tourniquet was applied over the proximal thigh.

Burks and Schaffer approach (Burks & Schaffer, 1990):

The patient was positioned prone. The skin incision was L-shaped with a straight incision along the popliteal crease of the knee which is curved vertically along the medial border of gastrocnemius (Figure 1). The dissection was extended to the deep fascia and then incised vertically over the medial gastrocnemius. The plane was developed between medial gastrocnemius and the semimembranosus tendon. This space was accessed by gently separating the tissues with a blunt instrument until the posterior joint capsule was reached. By pulling the inner part of the gastrocnemius muscle to the side, there was no direct tension on the nerves and blood vessels, and it protected the neurovascular structures as the capsule was exposed. (Figure *2*). Medial dissection of popliteal fossa is relatively safer.

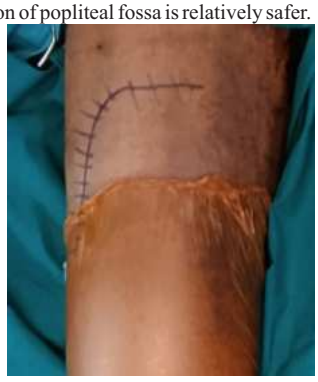

Figure 1: Skin marking depicting the Burks and Schaffer approach

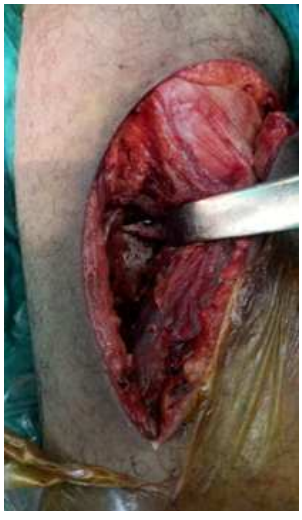

Figure 2: Plane developed between Semimembranosus tendon and Medial Gastrocnemius to approach the fracture site

Lobenhoffer Approach (Hake & Goulet, 2016a):
An incision of about 5-7 centimeters was made distally from the knee joint line along the medial border of medial head of gastrocnemius. The incision spared the popliteal space, which helps prevent scarring. Small saphenous vein was isolated. The fascia was cut, and the medial part of the gastrocnemius pulled away. The tendons in the pes anserinus group were identified and were released in some cases and resutured. The tissue between the medial part of the gastrocnemius muscle and the pes anserinus tendons were carefully dissected until the popliteus muscle was reached. The popliteus muscle was then gently released from the tibia, to expose the fracture site.

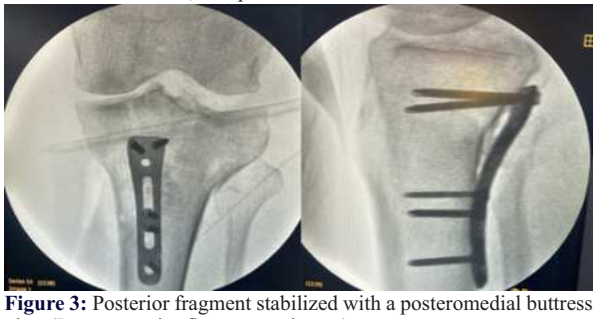

Figure 3: Posterior fragment stabilized with a posteromedial buttress plate (Intra-operative fluoroscopy image)

Using the Hohmann retractor to make more space for work, the periosteum was carefully cut and lifted to expose the fracture. Extension of knee with valgus force and if required axial traction was given, fracture fragment was pushed anteriorly and reduced anatomically. The reduction was confirmed with intraoperative fluoroscopy (Figure 3). Wound wash given and wound closed in layers. The radiological assessment of a type IV Schatzker injury is shown below. (Figure 4, Figure 5, Figure 6).

Figure 4: X-ray of a posteromedial tibial plateau fracture (Schatzker type IV)

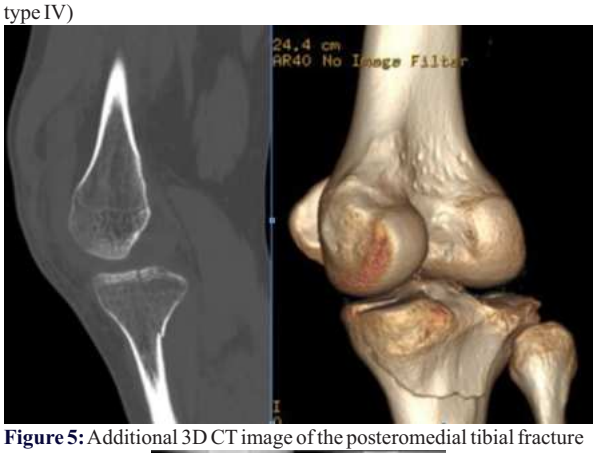

Figure 5: Additional 3D CT image of the posteromedial tibial fracture

Figure 6: Post-operative x-ray showing anatomical reduction of the posteromedial fragment

In case of bicondylar fractures, the patient was repositioned to supine and lateral column fixation was done. (Figure 7,8)

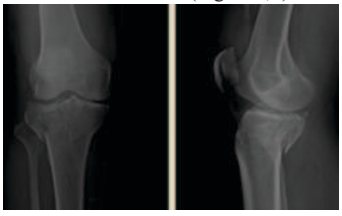

Figure 7: X-ray depicting proximal tibial bicondylar fracture (Schatzker type V)

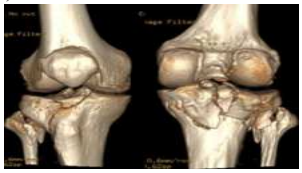

Figure 8: CT Scan Of The Same Case Depicting Schatzker's Type V Fracture

Postoperatively patients were started on active and passive range of movements with non-weight bearing for 6 -8 weeks.

Post-op stage:
Pain management was done with appropriate analgesia for 48-72 hrs, and with limb elevation and ice packs swelling was reduced. In type IV schatzker injury patients' passive movements on CPM was started on the second postoperative day. In cases of type V and VI Schatzker injuries range of motion was delayed for 2 weeks. Duration of hospital stay was 2 to 5 days following surgery and postoperative X-rays were obtained. (Figure 9)

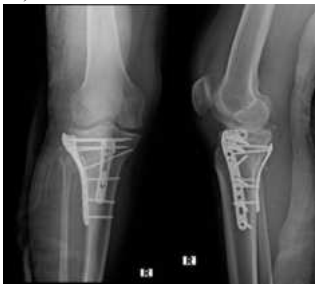

Figure 9: Immediate post-operative x-ray showing anatomical reduction of posteromedial tibial plateau

Follow up:
Follow-up visits were done for two weeks to assess the wound condition, sutures, and to assess for complications such as deep vein thrombosis and infection. Follow up was around 3 months post-op to assess the fracture healing. One-year post surgery functional and radiological outcomes was assessed using Rasmussen scoring system. (Figure 10)

Clinical Parameter	Points	Radiological Parameter	Points
Subjective		Depression	
Pain		None	6
None	6	<6 mm	4
Occasional pain, needs no medication	5	6-10 mm	2
Stabbing pain	4	>10 mm	0
Intense, activity-related	2	Condylar widening	
Night pain, at rest	0	None	6
Walking capacity		<6 mm	4
Normal	6	6-10 mm	2
Outdoors >1 h	4	>10 mm	0
Outdoors >15 min	2	Angulation (valgus/varus)	
Indoors only	1	None	6
Wheelchair/bedridden	0	<10°	4
Objective		10°-20°	2
Extension		>20°	0
Normal	6	Total (minimum)	
<10° loss	4		
>10° loss	2		
Total range of motion			
>140°	6		
>120°	5		
>90°	4		
>60°	2		
>30°	1		
0°	0		
Stability			
Normal	6		
Abnormal in 20° flexion	5		
Instability in extension <10°	4		
Instability in extension >10°	2		
Total			

Figure 10: Rasmussen Scoring System

The scores were assessed on a scale of 18 points as excellent, 12 to 18 points as good, 6 to11 points as fair, and poor as less than 6 points.

Statistical Analysis:
Descriptive stats were shown as mean with SD, number and percentages. The Chi-square test was to test the association between Schatzher categories and gender with clinical score outcome categories. Independent t test was used to compare the clinical score between male and female. Clinical score values were compared between Schatzher categories using analysis of variance, Bonferroni correction was used for multiple comparisons. P value lower than 5% was considered statistically significant. Entire analysis was done using SPSS version 29.0.

RESULTS:
This current article has 22 patients,of which 17 are males and 5 are females, with ages ranging from 20 to 56 years. The age during the time of the injury was 36.6 years, with a standard deviation of 9.2 years.

The Burks and Schaffer approach was used in 13 patients (59.1%). The Lobenhoffer approach was used in 9 patients (40.6%). (Table 1)

Table 1: Number Of Patients For Each Approach

Approach	Frequency(%)
Lobenhoffer	9 (40.6%)
Burks and Schaffer	13 (59.1%)

Correlation between Schatzker fracture types and the overall radiological score are evaluated. Average radiological score of 18 points was found in patients with Schatzker type IV fractures.Average score of 14 was found with patients with Schatzker type V fractures. Better outcomes were seen with Schatzker Type IV fractures. (Table 2).

Table 2: Radiological Score Correlation Among The Three Fracture Types

Fracture Pattern (Schatzker Type)	IV	V	VI
Radiological Score	18	14	12
Total patients	12	6	4

11 (91.47%) out of the 12 patients fount to have excellent score and 1(8.3%) had good score. 3(50.0%) among the 6 patients with fracture type V had excellent scores while the other 3(50.0%) had good scores. 1(25%) among the 4 patients with type VI fracture had excellent score and 3(75%) had a good score (Table 3).

Table 3: Correlation Between The Functional Outcome And Fracture Type

Schatzker Type	IV	V	VI	p-value
Clinical Score	23.0 ±3.4	18.7 ±3.3	16.7 ±3.0	0.004
Good	1	3	3	0.025
Excellent	11	3	1	

No significant difference was seen in the functional and radiological outcomes when comparing male and female patients. (p-value = 0.655) (Table 4).

Table 4: A Comparison Of Functional And Radiological Scores In Males And Females

	Male	Female	P value
Clinical Score	20.2 ± 3.3	22.0±6.6	0.417
Radiological Score	16.5±2.2	15.6±2.2	0.443
Good	5 (29.4%)	2 (40.0%)	0.655
Excellent	12 (70.6%)	3 (60.0%)	

DISCUSSION:
Posterior column tibial fractures were first described by Postel and his colleagues in 1974 (Söylemez et al., 2022). Studies have shown that adding a posteromedial buttress plate to a posterior plate provides the most robust fixation for tibial condyle fractures. As a result, posterior plating is becoming a standard treatment for these fractures(Gicquel et al., 2013; Snowden et al., 2012; Zeng et al., 2011). We evaluated the functional and radiological outcomes of patients with Schatzker types IV, V, and VI fracture injuries with a posteromedial approach in prone position. The surgery was uncomplicated, and all patients recovered without needing additional procedures.

A single medial approach may not be enough to fix a posteromedial column (Galla et al., 2009; Galla & Lobenhoffer, 2003; Hake & Goulet, 2016a; Young & Barrack, 1994). The tibial posterior column fracture was initially reinforced with a postero-medial plate. Subsequently, the lateral column was raised and/or realigned and secured using shorter screws near the top of the tibia. The medial column fracture was repositioned and secured with a medial plate. Additionally, the screws initially placed in the medial column from the lateral side were replaced with longer screws.

Buttressing the posterior column using a plate is a widely used method for treating proximal tibial posteromedial condyle fractures. In our study, we attached the posterior column to the plate, and the clinical and radiological outcomes of these patients were assessed. Posterolateral column fractures requires posterior approaches as these fractures are difficult to reduce with medial midline or posteromedial incision. Even if direct posterior approach allows reducing a collapsed articular fragment, it also has disadvantages viz. skin necrosis and limited movements across the joint. The most dreaded complications

are associated with soft tissue coverage while operating these plateau fractures . Therefore minimal damage to the soft tissue is crucial while achieving anatomical reduction of the articular surface. Long term functional compromises are seen when there is articular incongruity of the tibial plateau fracture reductions (Marsh et al., 2002). Some supporters of this technique have employed it solely to place a buttress plate, instead of raising a depressed lateral plateau or reducing a fracture. They have then elevated and finally reduced the lateral and posterolateral plateau using an anterolateral incision. Posterolateral column fractures requires posterior approaches while posterior or posteriomedial column fractures requires medial midline incision. Few had mild skin infection, and the infection was successfully treated with oral antibiotics. Zhang utilized a combined lateral peri-patellar and postero-medial approaches to reduce Schatzker IV tibia condyles and showed good results(Zhang et al., 2020).

We treated 12 patients with Schatzker type IV fractures. All patients achieved anatomically correct and satisfactory fracture reduction, leading to favorable functional outcomes. There is still no guideline for treatment of posterior column fractures among researchers on the best type of implant and approach to be used.

CONCLUSION:

The posteromedial approach is a safe and efficient technique. Visualization of the fracture fragment followed by anatomic reduction via a buttress plate is achieved in this approach without compromising the neurovascular bundle.

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