# Outcome of the posterior approach in management of posterior tibial plateau fractures: Case series study

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The Egyptian Orthopedic Journal; 2020 supplement (2), December, 55: 20-24

## Abstract

#### **Background:**

Complex tibial plateau fracture management remains clinically challenging. A threecolumn classification system, first proposed by Luo et al. in 2010, divided the tibial plateau into medial, lateral, and posterior columns, Lou's classification system was then revised by Hoekstra et al in defining the line between the lateral column and posterior column. Chang et al classification includes four articular quadrants, two intercondylar spines, and one anterior tibial tuberosity.

The posterior approaches to posterior fractures of the tibial plateau has been used to overcome limitations related to conventional anteriorly directed approaches in dual or triple plate fixation

#### Aim of Work:

Evaluate the functional outcome of the knees when posterior approaches is utilized for tibial plateau fractures whether alone or combined with other approaches sequentially or staged for complex tibial plateau fractures with posterior involvement. **Patients and methods:** 

This study included twenty seven consecutive patients with tibial plateau fractures involving the posterior column. Cases underwent Lobenhoffer approach for the posteromedial fragment with or without anterolateral approach. Patients were evaluated radiologically immediately postoperative, at 3, 6, 12, 18 months by serial anteroposterior and lateral X- rays of knee.

#### **Results:**

The cases were 4 females and 23 males, with age range between 18-46 years.

Using the knee society score (KSS) and functional knee score parameters results showed that 7.4% of the patients had Knee society score (KSS) of 70, 18.5% of the patients had a score of 75, while 29.6% of the patients had a score of 80, only 3.7% of the patients had a score of 85; in addition to 11.1% of the patients had a score of 90, 3.7% of the patients had a score of 95, and 25.9% of the patients had a score of 100.

#### **Conclusion:**

Posterior approaches to tibial plateau fractures whether alone or combined with other approaches was associated with good outcomes along the duration of postoperative follow up and should be advised for management of tibial plateau fractures.

#### **Keywords:**

Tibial plateau, posterior approach, and Knee society score.

# Introduction:

plateau Complex tibial fracture management is clinically challenging. These fractures are usually described as Schatzker Type V and VI or as a 41- C type injury when using the AO/ Orthopedics Trauma Association classification <sup>(1,2)</sup>. Dual plating is usually recommended as the definite fixation for this kind of fracture <sup>(3, 4)</sup>. However, this technique sometimes is not applicable <sup>(5, 6)</sup>. Previously, the treatment for tibial plateau

fractures is based on two-dimensional classification systems. Several authors have noted computed tomography (CT) based threedimensional consideration of the fracture pattern was important in the treatment of tibial plateau fractures.

The three-column classification is described by Lou et al<sup>(7-8)</sup>. According to this classification, one independent articular depression with a break of the column wall is defined as a fracture of the relevant column, pure depression in any three columns was classed as zero column, and pure split and split with depression were classified according to the column involved as per the CT scans <sup>(7-8)</sup>.

Hoekstra et al <sup>(9)</sup> revised Lou's classification system in defining the line between the lateral column and posterior column <sup>(9)</sup>. Stressing the ability of using variable angle locked plate in holding the lateral plateau fragment lined by anterior and posterior fibular head margins. Chang et al classification includes four articular quadrants, two intercondylar spines, and one





**Figure (1):** The four-quadrant tibial plateau classification involves four articular surfaces, two intercondylar spines (ACL and PCL insertion), and one anterior tibial tuberosity (patella tendon attachment). AM anteromedial quadrant, PM posteromedial quadrant, AL anterolateral quadrant, PL posterolateral quadrant, a-ICS ACL attachment, p-ICS PCL attachment, ATT anterior tibial tuberosity<sup>(10)</sup>

Complex bicondylar tibial plateau fractures follow a regular pattern, which is not represented in 2dimensional fracture classifications. A twoincision techniques starting with the reduction of the posteromedial edge results in accurate fracture reduction with low complication rates and excellent knee function <sup>(11)</sup>. Fractures of the tibial plateau that have an associated displaced posteromedial fracture pattern are difficult to reduce and fix adequately through conventional anterolateral surgical approaches.

Stahel et al <sup>(12)</sup> utilized vertical incision starting below the transverse popliteal crease located posteromedially for reduction and fixation of posteromedial fragment of the tibial plateau; hence utilizing part of the posterior of the approach described by Galla and Lobenhoffer <sup>(13)</sup>; with the patient in a prone position this approach allows for fracture reduction by hyperextension of the knee through axial traction over a surgical bump. The technique allows the direct visualization of posteromedial fractures of the tibial plateau without the need for dissection of the neurovascular bundle, and for placement of an antiglide buttress plate at the apex of the posteromedial fracture fragment (12-13).

This prospective interventional study was conducted to evaluate the clinical and radiologic

efficacy of use of posterior approaches to tibial plateau whether alone or combined with other approaches sequentially or staged for complex tibial plateau fractures with posterior involvement.

# **Patients and methods**

This is a prospective interventional study conducted in the authors' institution in the period between August 2016 and August 2018. Twenty seven consecutive patients with tibial plateau fracture involving the posterior column were included with the following criteria: 4 females (14.8%) and 23 males (85.2%) with age range between 18-46 years with mean 33.93±7.89 of age. Inclusion criteria was: both sexes, skeletally mature patients, closed tibial plateau fractures involving the posterior column as demonstrated on CT scans, recent fracture (within three weeks of injury).

Exclusion criteria was: patients blow 18 years of age (skeletally immature), tibial plateau fractures not involving the posterior column, open fractures, associated vascular or neurological injuries requiring different management protocol, patients with fracture configurations not amenable for internal fixation, other serious leg injuries sufficient to affect outcome at final follow up as peripheral angiopathy, neuropathy in the injured limb, impaired cognition, morbid obesity.

# Methodology

# **Preoperative evaluation:**

All patients had given informed consent, and the study protocol was approved by the Institutional Review Board in our hospital.All cases were subjected to careful history taking and assessment of the patients, its duration with special emphasis on the mode of trauma and mechanism of injury.A detailed physical examination of affected limb with special emphasis on skin condition soft tissue status, edema and current vascular status and any preinjury disabilities, surgery or neurovascular compromise. The following radiological techniques were conducted for all the cases including plain x ray: knee (AP & LAT), , C.T scans axial with reformatted sagittal, coronal and 3D images.

# **Operative technique:**

Operative planning after CT scans for posterior column involvement, and location of theses fragments, in case of posteromedial fragment fixation; prone patient position was utilized, with use of Lobenhoffer approach for the posteromedial fragment which can be extended to extensile Lobenhoffer <sup>(13)</sup>. Anterolateral approach for lateral column (wether sequential or staged

after soft tissue condition over the skin incision site turn favourable).



Figure (2) A: AP, B: LAT, C: Postoperative, D: after healing, E: limb alignment clinical photo

#### Postoperative

All patients were encouraged to do full range of motion of the knee active and passive as tolerated immediately postoperative and continued to increase gradually, no splints or braces were used, all patients strict non weight bearing till evidence of fracture healing, mobility was encouraged using 2 crutches non weight bearing of the affected limb, no extended use of the antibiotics.

### Follow up:

Patients were evaluated radiologically immediately postoperative, at 3, 6, 12, 18 months by serial anteroposterior and lateral x- rays of knee. Weight bearing was allowed based upon progression of healing by radiographs. AP standing radiographs of the knees to assess alignment.

## **Postoperative evaluation:**

Postoperative radiographs was scrutinized for: articular depression, condylar widening, alignment. The Knee Society Scoring System <sup>(14)</sup> was measured at one year postoperative when most patients would be expected to have reached maximal recovery.

#### Statistical analysis

Data entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS 21.0, IBM/SPSS Inc., Chicago, Illinois, USA) software for analysis. For comparison of data, Chi-Square test (or Fisher's exact test) was used to compare two independent groups of qualitative data. Correlation of numeric data was done by Pearson's or Spearman correlation (r). For all tests, P values <0.05 are considered significant.

## Results

Three case of complication were reported in the form of wound infection which responded to oral antibiotics and wound care without extra surgery. All patients attained healing without any case nonunion with mean time of healing was 120 days (range 90–160 days). at the final clinical follow up that no patient showed clinical knee instability, and the mean range of motion was  $110.5^{\circ}$  ( $85^{\circ}$ - $135^{\circ}$ ) no cases of malalignment , 12 cases of flexion contracture 10 degrees and 2 cases of flexion contracture 15 degrees.

Function score KSS results showed that 7.4% of the patients had a score of 70, 18.5% of the

patients had a score of 75, while 29.6% of the patients had a score of 80, only 3.7% of the patients had a score of 85; in addition to 11.1% of the patients had a score of 90, 3.7% of the patients had a score of 95, and 25.9% of the patients had a score of 100. As shown in table 1

The overall KSS score results were excellent in 70.4%, good in 25.9%, fair in 3.7% of the patients. None of the patients showed poor result. These data are illustrated in table 2.

Function score KSS	No.	%	
70	2	7.4%	
75	5	18.5%	
80	8	29.6%	
85	1	3.7%	
90	3	11.1%	
95	1	3.7%	
100	7	25.9%	
Range [Mean±SD]	70-80 [85.37±10.55]		

Table (1): Function score KSS distribution of the study group

Table (2):	Knee	society	score	distribution	of the	study
group						

Knee society score	No.	%	
Poor below 60	0	0.0%	
Fair 60-69	1	3.7%	
Good 70-79	7	25.9%	
Excellent 80-100	19	70.4%	
Range [Mean±SD]	68-92 [82.56±6.08]		

## **Discussion:**

Generally, complex and high energy intraarticular fractures of the weight bearing lower extremity represent a management challenge and a decision-making dilemma to the orthopedic surgeon <sup>(15,16,17,18)</sup>. Several studies have overemphasized the importance of accurate restoration of articular cartilage congruity and suggested an association between it and functional improvement <sup>(16,17)</sup>. However, other authors have linked functional outcome and subsequent osteoarthritis to the initial cartilage injury <sup>(15)</sup>.

Alignment which is the most predictor of long term outcome of tibial plateau fracture<sup>(19)</sup> Normal or slight valgus alignment of the tibial plateau protected best against secondary degeneration. On the other hand, medial or lateral tilt of the tibial plateau was followed by osteoarthritis in most cases <sup>(19)</sup>. Instability is an important predictor of outcome <sup>(20)</sup>

In agreement with other studies ,Yu et al (2009), Post-operative objective knee society score was 70.3 (39-91), all pateints in the study had dual plate fixation <sup>(16)</sup>. In the study of Citak et al (2019), Post-operative objective knee society score was 79.1 (49-100) all ten patients had dual plate fixation <sup>(17)</sup>.In the study of Sinha et al (2019), Post-operative objective knee society score was 85.4 (69-100) functional knee society score was 81 (75-90) <sup>(18)</sup>. Summary of the different studies is shown in Table three.

There was no statistically significant difference in the knee society score between males and females. On the other hand, the relation between knee society score and age of the study group was statistically significant

The results showed statistically significant negative correlation between age with final knee society score and function score KSS of the study group.

Table (	3):	Summary	of the	different	studies
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Study	Citak et al. 2019	Yu et al. 2009	Sinha et al. 2019	Current study 2019
No. of patients	10	54	30	27
Males	7	33	28	23
Female	3	21	2	4
Age	51.2 (25-83)	45.2 (19-68	41.5 (20-60)	33.93 (18-46)
Technique	Dual plating	Dual plating	Dual plating	Posteromedial only 11 patients
	Posteromedial and	Posteromedial and	Posteromedial and	Posteromedial and anterolateral
	anterolateral all	anterolateral all	anterolateral all patients	16
	patients	patients		
Mean duration of	24	23.7 (12-48)	10.9 (7-15)	18
follow up (months)				
KSS	79.1 (49-100)	70.3 (39-91)	Objective assessment	Objective assessment 82.56 (68-
			85.4 (68-100)	92)
			Functional assessment	Functional assessment
			81 (75-90)	85.37 (70-80)
	1			

Yu et al. reported at the final clinical follow up that no patient showed knee instability, and the mean range of motion was  $107.6^{\circ}$  ( $85^{\circ}$ - $130^{\circ}$ )

<sup>(16)</sup>.There were 9 cases suffering from stiffness of knee joint, 3 cases of varus abnormity, 2 cases of valgus abnormity, 2 cases of incisional wound

infection (debridement and External fixation were performed with internal implants removed), 10 cases of traumatic arthritis of knee joint (2 cases received the total knee arthroplasty 1 year and 2 years postoperatively, and the other 8 cases did not receive any further operation during the follow-up periods), and 1 case of delayed union. <sup>(16)</sup>. Yu et al. concluded that Double-buttress plate fixation is a feasible treatment option for bicondylar and complex tibial plateau fractures <sup>(16)</sup>.

Citak et al. had one case of superficial surgical site infection which resolved with antibiotic therapy and wound care 6 cases of late postoperative complication in the form of arthrosis with no single case of non-union <sup>(17)</sup>. Citak et al. concluded that Dual locking plate fixation technique and lateral locking plate fixation technique are effective methods in the treatment of bicondylar tibial plateau fractures when used properly. The lateral locking plate fixation technique may provide comparable clinical and radiological outcomes with dual locking plate fixation technique for the treatment of bicondylar plateau fractures without posteromedial fragment <sup>(17)</sup>.

Sinha et al. reported three patients developed wound infection. two patients recovered with antibiotics, but the third required regular debridement and finally removal of implant <sup>(18)</sup>. A prominent lateral plate was seen in two patients, which was not causing any clinical problem. Articular malreduction was observed in one patient, but his functional scoring was acceptable with good range of movement <sup>(18)</sup>. Sinha et al. concluded that Addition of posterior approach for stabilization of the posterior fragment in posterior tibial plateau fractures achieves early and improved knee Functions, good range of movements, minimal deformities, and pain scores by the time fracture unites. However, perioperative morbidity, extra-implant costs and increased operative time are its disadvantages.

Our post-operative KSS was comparable to other studies although our mean age of patients was younger (33.93).

# **Conclusion:**

Posterior approaches to tibial plateau fractures whether alone or combined with other approaches was associated with good clinical and radiologic outcomes along the short term follow up and should be advised when posteromedial and or posterolateral fragments need fixation.

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