



## **Application of Percutaneous Screw Fixation and Closed Reduction for Tibial Plateau Fractures in Karachi, Pakistan**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author MAA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ML, RZM, ZK, ZN and NR managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Objective:** Objective of this study is to assess the application of percutaneous screw fixation and closed reduction for tibial plateau fractures in Karachi, Pakistan.

**Methods:** The study design of this study is case series with sample size of 58 patients calculated by WHO calculator with functional outcome of 80-100%. The duration of the study was about 6 months. Non-probability sequential technique was adopted for data collection.

**Results:** The average patient age was 35.35±6.84 years however male patient were high in numbers (83.8%). Types of fractures (type I, II and IV) and functional outcomes (un-satisfactory

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and satisfactory) showed 17(29.3%), 33(56.8%) and 12(20.6%) and 4(6.45%) and 58(93.5%). The mean Rasmussen Score was 24.6(4.9%) however significant relationship between age and functional group were observed ( $p < 0.05$ ). The Rasmussen Functional Scoring System and Schatzker classification were also evaluated w.r.t ache, capability of walking normally, extension lag, stability as well as range of motion. Scores ranging from 28 up till 36 stipulate excellent, from 20 to 27 good, considering score of 10 to 20 fair and 6 to 10 poor.

**Conclusion:** The application of Percutaneous screw fixation and closed reduction for tibial plateau fractures in Karachi, Pakistanis less invasive, decrease hospital stays and charges, escalation of early mobilization along with satisfactory outcomes.

*Keywords: Tibial plateau fracture; trauma; percutaneous fixation; Rasmussen score.*

## 1. INTRODUCTION

Tibial plateau fracture (TPF) areperiarticular injuries of proximal tibia making up 1% of all fractures. TPF associates with soft tissue injury to the nearby structures such as ligamentous and meniscal injury. Males over age of 50 years suffer this fracture from high energy trauma. Female over age 70 years incur this fracture due to low energy trauma [1]. The treatment of tibia plateau remain clinically challenge [2]. The applied and medical locking plates for tibia plateau have good clinical significance [3-6]. The treatment options depending upon the intensity of injury incurred and involvement of other surrounding tissues. Hybrid fixation, arthroscopically assisted techniques and internal/external fixations are available surgical options [7]. Percutaneous fixation and closed reduction are less invasive and require lesser operative exposure than internal fixation and open reduction. It poses a reduced risk of blood loss, infections and insult of soft tissues. The complications of the discussed treatment include nerve compression, wrongly placed screw or failure of hardware [8].

The purpose of the treatment is to restore range of motion (ROM), stability of joint and axial alignment with a lesser recovery time and at sustainable cost. Previously conducted researches on the use of percutaneous screw fixture and closed reduction on different fractures were found to be satisfactory depending upon the intensity of fracture [9,10].

Sament et al. performed a study in which they used the same technique for tibial plateau fracture repair and reported that the outcome was satisfactory in 80-100 % of fractures reliant on the type of fracture [11]. Studies on use of percutaneous screw fixation and closed reduction on tibial plateau fracture is scarce locally. The present study focuses on the local

data to determine degree of fixation on this fracture type using closed reduction and percutaneous screw. This study therefore intends to evaluate the functional outcome (by Rasmussen functional scoring system) of percutaneous fixation as well as closed reduction for tibial plateau fractures. It reinforces modality of fixation for fracture types.

## 2. METHODOLOGY

The study design classified as case series, conducted in department of orthopedics, AbassiShaheed hospital Karachi. The sample size was calculated by WHO standard calculator with the power of 80%, satisfactory functional outcome 80-100% (by Rasmussen score) [11] and the calculated sample size was 58 patients. Non-probability sequential technique was adopted for data collection.

The age of the patients were 20 – 50 years with closed tibial plateau fractures, both sex, fractures (within first week of injury), fractures (type 1-4 of Schatzger classification of Tibial Plateau fractures) were selected as inclusion criteria. However, Patients suffering from diabetes mellitus, hypertension, previously on surgical treatment, identified with sustaining bony fractures other than tibial plateau fracture, Pathological and open fractures, types 5 and 6 of Schatzger classification of tibial plateau fractures and patients demanding open reduction and bone grafting during surgery considered to be excluded.

An informed consent was obtained from all patients with tibial plateau fracture meeting the inclusion criteria and was enrolled at the time of admission from the emergency (ER) and Out Patient Department (OPD). Patients were diagnosed for tibial plateau fractures as Types 1-4, determined on x-ray tibia (AP and Lateral views). Medically fit and approved patients were operated. All patients were received pre-

operative dose of 3rd generation cephalosporin and continued until 72 hours post operatively. By using manual ligamentotaxis considering closed reduction in extension under image intensifier control (C-arm) were achieved. By using percutaneously cancellous screws (6.5 mm) with washers, fixations were performed. Number of screws ( $\geq 2$ ) and direction were determining on the basis of fractures.

C-arm in antero posterior and lateral views was observed and assessed under Articular congruency. The groin-to-ankle slab (cylinder slab) was used to restrain limb movement. The procedure was performed with high surgical experience. After 3 weeks the slab was removed, with gradual knee bending is taken in account along with non-weight-bearing crutch walking extension exercises for the subsequent 3 weeks. In post-surgical condition partial weight bearing is permissible for initial 3 weeks and for subsequent 6 weeks full weight bearing is commended. At 1 and 3 month's intervals, follow up of patients are regularly taken. At 3 months, final functional outcome was evaluated. Functional outcome as defined in operational definition was evaluated by the researcher using the predesigned proforma. Data was entered and analyzed using the SPSS-20 version. Age and weight were reported as mean with standard deviations (S.D). Gender, side of fractured leg, fracture's type and functional outcome (satisfactory/unsatisfactory) were computed as proportions and percentages. Stratification was done to control effect modifiers like age, weight, gender, type of fracture and side of fractured leg, to observe an outcome. Chi-square test was applied to compare proportion

difference of outcome. The significant p-value was  $< 0.05$ .

### 3. RESULTS

The selected sample size of the study was 58 in numbers (N=58), according to Schatzger classification closed Tibial plateau fractures are carefully chosen. The average age of the patients was  $35 \pm 7$  years however male patient were high in numbers (83.8%). Types of fractures and functional outcomes showed in Table 1.

The functional outcome along with Rasmussen score i.e. satisfactory and un-satisfactory w.r.t age, gender, weight, type of fractures and site of fractures N(%) are showed in Table 2.

The Shatzker classification of Tibial Plateau Fractures were classified as:

- Type I: Lateral Tibial plateau fracture with no sign of depression,
- Type II: Lateral tibial plateau fracture having clear sign of depression,
- Type III: Focal depression of articular surface and no split is seen,
- Type IV = Medial tibial plateau fracture, may have or have no depression; may implicatetibial spines; concomitant injuries in soft tissues.
- Type V and type IV were excluded in the study. However, Rasmussen functional score were mentioned along with the shatzker classification showed in Table 3.

**Table 1. Patient demographics, types and functional outcomes**

	<b>All patients N(%) = 58</b>	<b>Male N(%) = 50(83.8)</b>	<b>Female N(%)= 08 (16.1)</b>
<b>Age (years)</b>			
Mean $\pm$ SD	35 $\pm$ 7	36 $\pm$ 7	32 $\pm$ 5
Median (range)	35 (29)	38 (28)	32 (17)
<b>Weight (Kg)</b>			
Mean $\pm$ SD	74 $\pm$ 11	76 $\pm$ 9	63 $\pm$ 6
Median (range)	75 (46)	75 (43)	60 (28)
<b>Rasmussen Score</b>			
Mean $\pm$ SD	25 $\pm$ 5	25 $\pm$ 5	13 $\pm$ 7
Median (range)	26 (24)	26 (24)	26(20)
<b>Site of injury</b> (Right, Left)	58(100)	27 (43)	35 (56)
<b>Type of fractures</b> (Type 1, type 2, Type 4)	17(29)	33(57)	12(21)
<i>Type 3: No patient falls category 3 in this study</i>			
<b>Functional Outcomes</b> (Un-Satisfactory, satisfactory) <i>Un-satisfactory score: 4-19 , Satisfactory (20-40)</i>	4 (6)	58 (93)	-

**Table 2. Functional outcome by Rasmussen score**

Functional group				
Age (years)	Satisfactory	Un-satisfactory	Total	P-value
21 to 30 Years	11(91.7%)	1(8.3%)	12	<0.05
31to 40 Years	37(100%)	0 (0%)	37	
41 to 50 Years	10(76.9%)	3(23.1%)	13	
Gender	49(94.2%)	3(5.8%)	52	>0.05
Male	9(90%)	1(10%)	10	
<b>Weight (Kg)</b>				
≤60 kg	11(100%)	0(0%)	11	>0.05
61 to 80 kg	36(94.7%)	2(5.3%)	38	
>80kg	11(84.6%)	2(15.4%)	13	
<b>Type of fractures</b>				
Type 1	16(94.1%)	1(5.9%)	17	>0.05
Type 2	32(97%)	1(3%)	33	
Type 4	10(83.3%)	2(16.7%)	12	
<b>Site of fractures</b>				
Right	24(88.9%)	3(11.1%)	27	>0.05
Left	34(97.1%)	1(2.9%)	35	

**Table 3. Rasmussen functional scoring system and Schatzker classification**

Rasmussen functional scoring system	Score	Schatzker classification			
		N=58			
		I (16)	II(32)	III (0)	IV (10)
<b>Pain</b>					
No pain	6	5	5	-	2
Occasional pain, bad weather pain	5	7	14	-	13
Throbbing pain in certain position	4	2	2	-	2
Constant pain after activity	2	2	3	-	1
Pain at rest	0	0	0	-	0
<b>Walking Capacity</b>					
Normal	6	8	16	-	6
Can walk outdoor for at least one hour	4	1	5	-	12
Can walk outdoor for 15 minutes	2	1	2	-	4
Can walk indoor only	1	0	1	-	2
Wheel chair bound / bedridden	0	0	0	-	0
<b>Extension lag</b>					
Normal	6	9	20	-	18
0 - 10°	4	2	4	-	3
> 10°	2	-	0	-	2
<b>Total Range of Motion</b>					
≥ 140°	6	8	9	-	5
≥ 120°	5	3	12	-	12
≥ 90°	4	1	3	-	1
≥ 60°	2	0	1	-	2
≥ 30°	1	0	0	-	1
0°	0	0	0	-	0
<b>Stability</b>					
Normal stability in extension & 20° flexion	6	9	18	-	16
Instability in 20° flexion	5	2	1	-	4
Instability in extension 10°	4	0	1	-	4
Instability in extension > 10°	2	0	1	-	2

Scores between 28 to 36 stipulate excellent, 20 to 27 good, 10 to 20 fair and 6 to 10 poor

#### 4. DISCUSSION

Tibial plateau considered to be the serious load bearing part of the body. The effects are clearly visible on alignment along with stability and movement of knee. Therefore, priority it is considered that primary detection along with suitable treatment opportune in minimizing patient's chance for any disability [12]. Cancellous bone involvement, intra articular nature and proximity are the major weight bearing joint. The continuum of injuries specifically for tibia is variable in number that no single technique has established uniformly successful. Multiple studies reported the satisfactory significance level for both surgical and non-operative methods of treatment [13]. Internal fixation and closed reduction (percutaneous cancellous washers, screw and ligamentotaxis) principally circumvents the disadvantages of conservative and operative treatments.

It has been proven that closed reduction and percutaneous screw fixation is relatively less invasive with reduced cost and hospital stay [14]. It is specified for large peripheral fragments like patients with Schatzker Type-I, type II and type IV fractures. Depressed Fractures >5mm along with intense comminution must be treated in the course of internal fixation and open reduction by bone grafting in addition with screw plate. Early mobilization (not before 4 weeks) and treatment modality is crucially important for the prevention of knee stiffness [11]. Multiple studies endorse the significance of tibiae fracture with percutaneous cancellous screw and washers with significant improvement w.r.t rasmussen score (20-30) and Schatzker classification. Our research report evidently points that ligamentotaxis productively reduced fractures with peripheral fragment, however a femoral distractor efficaciously minimized fractures using an indirect technique with comminution.

#### 5. CONCLUSION

We found that closed reduction and percutaneous screw fixation for Schatzker type I, II, and IV fractures is an exceptional treatment substitute to conservative management. Percutaneous cancellous screw fixation for closed tibial plateau fractures is nominally invasive, hence less morbid. It permits prompt recovery in the form of quick mobilization with the minimal use of instrumentation, while compared to the conservative conventional management,

our alternative treatment executes exceptionally satisfactory results without any anatomical or functional disfigurement.

#### CONSENT AND ETHICAL APPROVAL

The study was approved by Department of Orthopedics, AbbasiShaheed Hospital. As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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