

TIBIAL PLATEAU FRACTURES: A COMPARISON STUDY OF RESULT OF CLOSED REDUCTION AND PERCUTANEOUS CANNULATED SCREW FIXATION VERSUS OPEN REDUCTION AND INTERNAL FIXATION

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ABSTRACT

Objective: The aim of this study is to evaluate the functional results of surgical treatments of tibial plateau fractures by either closed reduction with percutaneous cannulated screw fixation or open reduction and internal fixation. In addition to, detection complications resulting from the surgery. **Patients and Methods:** Retrospective comparative study conducted for the period one year (July 2019 – July 2020) at Tishreen University Hospital in Lattakia-Syria. The study included two groups of patients were compared: group1 consisted of 15 patients (45.5%) who underwent to closed reduction and fixation with percutaneous cannulated screw, whereas group 2 consisted of 18 patients (54.5%) who underwent to open reduction and internal fixation. **Results:** The median age was 46 years; the most frequent age group was 18-35 year (39%), followed by the group 36-55 year (33%). Males represented 57.5 % of the patients, and right side was affected in 22 patients (67%). High-energy injury was present in 24 patients (73%), and motor vehicle accidents was the most frequent cause of injury (60%). According to Knee Society Scoring system (KSS) during follow up periods, a significant improvement in functional outcome with the same grade was observed in the two groups (p: 0.0002), and 76% of the patients had satisfactory results, more frequently in group 1. Age was significantly associated with excellent and good functional outcomes(p:0.04). The observed complications in group1 were impaired mineralization (6.5%) and stiffness of knee joint (6.5%), whereas stiffness of knee joint (9%) was the most frequent complication in group2. **Conclusion:** Functional outcome in young patients was better after management of fractures in the form of closed reduction and fixation with percutaneous cannulated screw, whereas in elderly patients better outcome was obtained in open reduction with internal fixation.

KEYWORDS: Tibial plateau, fractures, outcome.

INTRODUCTION

The tibial plateau is one of the most critical loadbearing areas in the human body.^[1]

Tibial plateau fractures are intra-articular fractures that affect knee alignment, stability, and motion.^[2] They account for approximately one percent of all fractures, and lateral plateau is the most commonly involvement. More than 50% of patients are aged 50 years or older.^[3] The most common mechanism of the fractures is a valgus force with axial loading, 80% of them are motor vehicle -related injuries, and the remainder are sport related.^[4]

Schatzker classification system is commonly used by

orthopedists to describe location and type of fracture. It classifies fractures as types I to VI, which helps surgical planning with higher grades requiring aggressive interventions.^[5] Non -operative management can be trialed in uncomplicated tibial plateau fractures including no evidence of ligamentous damage, tibial subluxation, or articular step<2mm. Operative management is typically warranted in complicated tibial fractures, or any evidence of open fracture or compartment syndrome.^[6,7] Early detection and appropriate treatment of these fractures are critical for minimizing patient disability and reducing the risk of complications, particularly posttraumatic arthritis.^[7]

Therefore, the aims of our study were: 1- to determine

differences between the two techniques of reduction (closed vs open) regarding the results of surgical correction of fractures 2- to determine functional outcomes of the two methods.

PATIENTS AND METHODS

This is a retrospective comparative study of a group of patients with tibial plateau fractures attending department of orthopedic at Tishreen University Hospital in Lattakia-Syria during one-year period (July 2019- July 2020). The inclusion criteria were: patients of both sexes, aged older than 18 years, with closed fractures, type I or II according to Schatzker classification, and depressed fracture <5 mm. The exclusion criteria were: open fractures, concomitant lower extremity fractures, pathologic fractures, history of previous knee surgery, congenital lower limb deformities, open reduction of fracture with bony grafting, presence of associated vascular and neurological primary injuries.

The following workup included: history and physical examination were performed. Patients assigned to group1 who undergone surgical treatment by closed reduction and percutaneous cannulated screw fixation, and group2 who undergone surgical treatment by open reduction and internal fixation.

Patients were classified according to Schatzker classification, to type I (20 patients), and type II (13 patients).

Patients were followed up at regular intervals in the post-operative period by performing X-ray images of all patients' which taken in weight-bearing anteroposterior, and lateral projections to assess for union status and to evaluate any complication if occurred. The Knee Society Scoring system (KSS) was calculated at 3, 6, and 12 months postoperatively.

Knee Society Scoring system (KSS): It has a 100-point scale includes three main parameters (pain, stability, and range of motion) and other parameters (contraction of flexion, loss of extension and alignment) considered as deductions.^[8]

Ethical consideration: All patients were provided a complete and clear informed consent after discussion about the study. This study was performed following the Declaration of Helsinki.

Statistical Analysis

Statistical analysis was performed by using IBM SPSS version20. Basic Descriptive statistics included means, standard deviations (SD), median, Frequency and percentages. To examine the relationships and comparisons between the two group, chi-square test was used. All the tests were considered significant at α 5% type I error rate ($p < 0.05$), β :20%, and power of the study:80%.

RESULTS

The baseline characteristics of the participants were as shown in (Table 1). Patients were divided into three groups: 18-35(39%), 36-55 (33%), and >55 (28%). 57.5% of the patients were males, and 42.5% were females. Right side was affected in 22 patients (67%), and left side in 11 patients (33%). According to Schatzker classification system, fractures were classified to type I (60.5%) and type II (39.5%). Motor vehicle accident was the most frequent cause of fractures (60%), followed by fall from standing (24%), sport injury (13%), and fall from height (3%). The fractures had occurred as a result of low-energy injury in 9 patients (27%) and high-energy injury in 24 patients (73%). 57% of the patients underwent surgery during 48 hours, and 43% after 48 hours.

Table 1: Demographic characteristics of the study population.

Variable	Result
Sex	
Male	19(57.5%)
Female	14(42.5%)
Age group	
18-35	13(39%)
36-55	11(33%)
>55	9(28%)
Affected side	
Right	22(67%)
Left	11(33%)
Classification of fracture	
Type I	20(60.5%)
Type II	13(39.5%)
Etiology of fracture	
Motor vehicle accidents	20(60%)
Fall from standing	8(24%)
Sport injury	4(13%)

Fall from height	1(3%)
Mechanism of injury	
High energy	24(73%)
Low energy	9(27%)
Time of intervention (hour)	
>48 h	14(43%)
<48 h	19(57%)

In the group1, the mean time of splinting was 4.8 ± 0.9 weeks, whereas in the group 2, the time was shorter with mean time 4.3 ± 1.1 weeks, $p:0.08$. In the group1, average time to union was 3.5 ± 0.4 , whereas in the group 2, the union time was longer with mean time 3.9 ± 0.6 , $p:0.2$. In group 1, time to returning to work ranged between 3.5 months and 5.5 months with mean time 4.5 ± 0.7 , whereas in the group 2, the time was longer and ranged between 4 months and 6.5 months with mean time 5.1 ± 0.8 , $p:0.1$.

In group 1, complications were occurred in two cases which represented by impaired mineralization (6.5%) and stiffness of knee joint (6.5%).

In group 2, stiffness of knee joint occurred in two cases (9%), followed by deep vein thrombosis, superficial skin necrosis, non-union, and impaired mineralization on average one case of each of them (5.5%), $p:0.02$.

Table 2: Operation characteristics and complications of the study population by comparison of the two group.

Variable	Group 1 15(45.5%)	Group2 18(54.5%)	P value
Duration of union(month)	3.5 ± 0.4	3.9 ± 0.6	0.2
Splinting duration(week)	4.8 ± 0.9	4.3 ± 1.1	0.08
Return to work(month)	4.5 ± 0.7	5.1 ± 0.8	0.1
Complication			
Deep vein thrombosis	0(0%)	1(5.5%)	
Superficial skin necrosis	0(0%)	1(5.5%)	
Impaired union	0(0%)	0(0%)	
Non-union	0(0%)	1(5.5%)	0.02
Impaired mineralization	1(6.5%)	1(5.5%)	
Stiffness of knee Joint	1(6.5%)	2(9%)	

During follow up periods, KSS increased significantly during follow-up period to 85.4 ± 11.3 and 80.1 ± 12.7 in group1 and 2 respectively after 12 month of surgery.

According to this score, 12 (80%) cases had satisfactory results in group1, whereas 13 (72%) cases had satisfactory results in group2.

Table 3: Functional outcome of the study population by comparison of the two group.

Variable	Group 1 15(45.5%)	Group2 18(54.5%)	P value
KSS			
3 month	55.4 ± 7.5	53.3 ± 9.5	0.8
6 month	70.5 ± 9.1	68.6 ± 8.7	0.7
1 year	85.4 ± 11.3	80.1 ± 12.7	0.3
KSS			
Excellent	6(40%)	6(33.5%)	
Good	6(40%)	7(38.5%)	
Fair	2(13.5%)	3(16.5%)	0.06
Poor	1(6.5%)	2(11.5%)	
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Satisfactory	12(80%)	13(72%)	
Unsatisfactory	3(20%)	5(28%)	

According to the KSS, satisfactory results were more frequently in the age group (18- 35 years) who

underwent closed reduction compared to other groups. Patients older than 55 years who underwent open

reduction were associated with satisfactory outcomes as compared to other groups ($p:0.04$). There was no significant correlation between the functional outcomes

and the following variable: sex, time of intervention, and the type of fractures ($p>0.05$).

Table 4: Comparison of functional outcome according to demographic characteristics of patients.

Variable	KSS			
	Satisfactory		Unsatisfactory	
	Group 1	Group 2	Group 1	Group 2
Sex				
Female	10(72%)		4(28%)	
Male	15(78%)		4(22%)	
Age group(years)				
18-35	6(24%)	5(20%)	0(0%)	2(25%)
36-55	4(16%)	4(16%)	1(12.5%)	2(25%)
>55	2(8%)	4(16%)	2(25%)	1(12.5%)
Time of intervention (hours)				
>48 h	5(20%)	5(20%)	1(12.5%)	3(37.5%)
<48 h	7(28%)	8(32%)	2(25%)	2(25%)
Classification of fracture				
Type I	8(32%)	8(32%)	1(12.5%)	3(37.5%)
Type II	4(16%)	5(20%)	2(25%)	2(25%)

DISCUSSION

Tibial plateau fractures are a risk to the functional integrity of the knee, and remain a surgical challenge due to the complexity of fractures patterns.

This study showed the main findings. First, the most frequent type of fractures was type I, and motor vehicle accidents were the main etiologies of fractures. Second, high-energy injury was the main mechanism of fractures. Surgical procedures were done in early time in approximately two-third of patients, and the mean time for union was longer in open reduction but without significant difference. Third, during follow up periods the functional outcome was favorable in group1 compared to group 2 especially in the age group 18-35 year which associated with satisfactory results, whereas outcome in patients older than 55 years was favorable in open reduction. The rate of complications was higher in patients who underwent open reduction compared to other group. These findings may be explained by the difference of surgical trauma between the two surgical technique, which is lower in the open reduction.

These findings are comparable with study conducted by Naveen et al (2016) in 19 patients with tibial plateau fractures who underwent closed reduction technique with percutaneous cannulated screw. Males represented the majority of patients, and motor vehicle accidents were the most frequent etiologies. KSS increased significantly during follow-up period to 91 after 12 month of surgery. Superficial skin necrosis (10%), non-union (5%), and stiffness of knee Joint (5%) represented the observed complications.^[9]

Polat et al (2019) demonstrated in a study conducted in 27 patients with tibial plateau fractures who underwent

open reduction technique that majority of patients were males, and motor vehicle accidents represented the most frequent etiology of injury. After 12 month of surgery, KSS increased significantly to 84.3. Superficial skin necrosis (7%), and deep vein thrombosis (3.5%) represented the observed complications.^[10]

In summary, the current study demonstrated favorable functional results in management fractures with two techniques, with less complications in closed reduction compared with open reduction method.

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