SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Orthopedics & Traumatology

Functional Outcome of Surgical Management of Tibial Plateau Fractures: A Prospective Observational Study

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DOI: 10.36347/sasjs.2022.v08i11.005 | **Received:** 01.10.2022 | **Accepted:** 08.11.2022 | **Published:** 20.11.2022

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Abstract **Original Research Article**

Background: Because of intra-articular nature, tibial plateau fractures are significant and difficult to manage. Low and high-energy tibial plateau fractures usually result from axial loading in combination with valgus stress forces, present a variety of soft tissue and bony injuries that can produce permanent disabilities. Although there are various modalities for fixation of these fractures with satisfactory results, but there is no general consensus as to which modality is the best in terms of functional outcome and proving the superiority of one over the other. ***Aim of the Study:*** The study aimed to evaluate the functional outcome of surgical management of tibial plateau fractures. ***Methods:*** It was a prospective observational study conducted in the Trauma Center, Bangabandhu Sheikh Mujib Medical College (BSMMC) & Hospital, Faridpur, Bangladesh during the period from January 2021 to December 2021. In total 85 more than 20 years old patients of both sexes with tibial plateau fractures attended to the mentioned hospital during the first six months of the study were selected as the study population. Obeying the inclusion criteria of this study, only simple fractures of tibial plateau presenting in patients requiring open or closed reduction as well as internal fixation to restore the articular anatomy were finalized for this study. ***Result:*** In this study, according to the Schatzker classification and outcomes as per the recommendation of Rasmussen *et al.*, 89% (n=76) patients got acceptable outcomes whereas the rest 11% (n=9) did not get satisfactory results. For majority (55%) of the patients, the union time was found <12 weeks whereas in 2% cases (n=2) incidence of non-union was observed. Besides these, in general grading of patient's outcome as per patient's satisfaction, 56% patients got excellent results. ***Conclusion:*** In this study we found satisfactory outcomes in majority of the patients but in case of more than 10% cases outcomes were not acceptable. These findings may be helpful for the future researchers for any further research in the same issue.

Keywords: Tibial plateau fractures, Schatzker classification, Gustilo Anderson Grade, Bone.

1. INTRODUCTION

Low and high-energy tibial plateau fractures usually result from axial loading in combination with valgus stress forces, present a variety of soft tissue and bony injuries that can produce permanent disabilities. Such fractures gravely affect the stability, biomechanics and range of motion of the knee joint [1]. The management of these types of injuries has for long been subject of controversies. The spectrum of treatment of tibial plateau fractures ranges from simple casting and bracing to skeletal traction as well as early motion to open reduction and internal fixation [2]. But Ali, *et al.*, reported a 31% fixation failure for tibial plateau fractures in their elderly population [3]. The most widely used classification for tibial plateau fractures was introduced by Schatzker *et al.*, in 1979 [4] and was later modified by Luo *et al.*, [5]. As tibial plateau fractures are intraarticular, the gold standard for treatment of such cases is surgery by open reduction along with internal fixation (ORIF) with locked plates to restore the joint congruence and to get a stable knee, an adequate mechanical axis and early mobilization [6,

7]. On the other hand, Gaston *et al.*, reported that, after the fracture of the tibial plateau, 20% of the cases have stiffness at 12 months after surgery [8]. The incidence of knee stiffness after tibial plateau fracture is 3% to 18% depending on the series [9, 10], although the necessity of surgical re- intervention for this reason is not so high (0–5%) [11]. On the other hand, arthroscopic release may be considered as an option while the stiffness lasts longer than 12 weeks or even earlier if there is a clear halt in the progression of joint range gain [12]. Besides all of these, some authors have proposed techniques to treat extensor contractures without the need for open surgery, such as the quadriceps pie-crusting technique associated with an arthroscopic technique [13, 14].

2. OBJECTIVES

General Objective

- To evaluate the functional outcome of surgical management of tibial plateau fractures.

Specific Objective

- To assess the mechanism of injuries of tibial plateau fractures.
- To assess the time to union and the final outcomes.

3. METHODOLOGY & MATERIALS

It was a prospective observational study conducted in the Trauma Center, Bangabandhu Sheikh Mujib Medical College (BSMMC) & Hospital, Faridpur, Bangladesh during the period from January 2021 to December 2021. In total 85 more than 20 years old patients of both sexes with tibial plateau fractures attended to the mentioned hospital during the first six months of the study were selected as the study population. Obeying the inclusion criteria of this study, only simple fractures of tibial plateau presenting in patients requiring open or closed reduction as well as internal fixation to restore the articular anatomy were finalized for this study. Any fracture having Gustilo Anderson severity of more than Grade I, ipsilateral meniscal or ligamentous injury, all pathological fractures or fractures having associated condition like floating knee, compartment syndrome or any other polytrauma were rejected. Surgical interventions were performed under suitable antibiotic cover and fluoroscopic control and as soon as local soft tissue conditions were favorable, operations were done. Fracture site reduction was performed under the fluoroscopic guidance with the use of percutaneous clamps and distracters judiciously as well as repeats fluoroscopic assessment was done to assess anatomical reduction. Open reduction was also performed as per need. Buttress plates were applied since the proximal end of the tibia contains a large amount of cancellous bone and has a tendency of axial deviation or bending under the effect of compression or shearing forces. Whenever the fixation was deemed stable then intermittent knee mobilization was started once pain subsided. Weight bearing was deferred until evidence of union was seen on X ray. Partial weight bearing was started at around 10 to 14 weeks depending upon the fracture configuration. The results of this study were evaluated using the functional grading of Rasmussen *et al.*, [15].

4. RESULTS

In this study among total 85 participants, 56 were male which was 66% and the rest 29 were female which was 34%. So, male participants were dominating in number and the male-female ratio was 2:1. Among total population the highest, 36% were from 31-40 years' age group. Besides this, 19% were from 20-30 years' age group, 26% were from 41-50 years' age group, 13% were from 51-60 years' age group and only 6% were from >60 years' age group. In analyzing the mode of injuries of the participants we found that, one-third (33%) injuries occurred by road traffic accidents. In 21% cases the mechanism was low energy, in 18% cases it was high energy, in 13% cases it was fall from height, in 11% cases it was simple falls and in only 5% sports injuries were found. The average duration of hospitalization of the participants was 7.5 days. In total 12 cases were managed with cancellous screws; 23 patients underwent open reduction and fixation with plating while plating supplemented with bone grafting was performed in 18 patients. Plating with MIPO technique was performed in 15 patients and external fixator was applied in 5 patients. In total 11 patients had fixation done with dual plating. Average time gap between operation and partial weight bearing was around 11 weeks. Most of the patients had 120º or more knee flexion. Average range of motion was 112.5º. Two patients had varus deformity of 10º due to collapse of medial condyle. In this study, according to the Schatzker classification and outcomes as per the recommendation of Rasmussen *et al.*, 89% (n=76) patients got acceptable outcomes whereas the rest 11% (n=9) did not get satisfactory results. For majority (55%) of the patients, the union time was found <12 weeks whereas in 2% cases (n=2) incidence of non-union was observed. Besides these, in general grading of patient's outcome as per patient's satisfaction, 56% patients got excellent results.

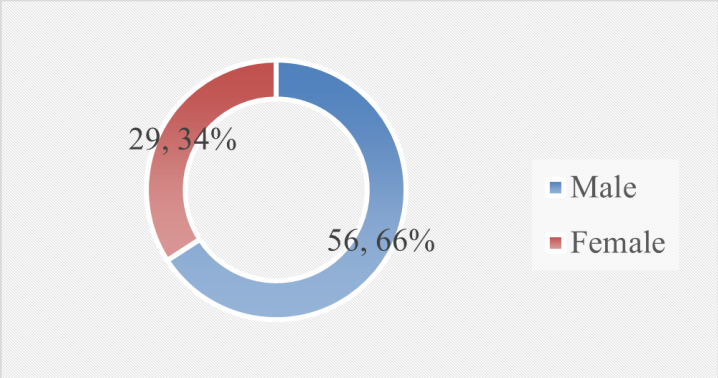

Figure 1: Gender distribution of participants (N=85)

Table 1: Age distribution of participants (N=85)

Age (Years)	n	%
20-30	16	19%
31-40	31	36%
41-50	22	26%
51-60	11	13%
>60	5	6%

Table 2: Mode of injury among participants (N=85)

Mechanism	n	%
Road traffic accident	28	33%
Low energy	18	21%
High energy	15	18%
Fall from height	11	13%
Simple fall	9	11%
Sports	4	5%

Table 3: Distribution of patients as per Schatzker classification and their outcomes as per Rasmussen *et al.*, (N=85)

Schatzker type	Total patients (n=56)	Patients got acceptable outcome		Patients without acceptable outcome
		n	%	
I	9	9	100%	9 (11%)
II	20	20	100%	
III	7	6	86%	
IV	12	9	75%	
V	21	18	86%	
VI	16	14	88%	
Total	**85**	**76**	**89%**	

Table 4: Distribution of patients on basis of time to union (N=85)

Union time (Week)	n	%
<12	47	55%
12 to 14	13	15%
>14	23	27%
Non-union	2	2%
Total	**85**	**100%**

Table 5: General grading of patient's outcome as per patient's satisfaction (N=85)

Grade	n	%
Excellent	48	56%
Good	17	20%
Fair	11	13%
Poor	9	11%

5. DISCUSSION

The study aimed to evaluate the functional outcome of surgical management of tibial plateau fractures. Among total population of our settings the highest, 36% were from 31-40 years' age group. Besides this, 19% were from 20-30 years' age group, 26% were from 41-50 years' age group, 13% were from 51-60 years' age group and only 6% were from >60 years' age group. In a similar study the average age of patients was 55 years [15]. In this study, the majority of patients were male (66%) which can be attributed to an Indian set up where the female population largely remains indoors and is less prone to automobile accidents. In this study the commonest mode of injury was road traffic accident (33%). which did not correlate well with a previous study by Chiax *et al.,* who in their series, reported that, 71% of the injuries occurred because of road traffic accident [16]. In our series, we studied cases of simple tibial plateau fractures treated only by surgical method. Different authors use different criteria for surgical management of these fractures. Seppo E Honkoenen in his series of 130 tibial plateau fractures, conducted surgery taking into consideration condylar widening of >5 mm and lateral condyle step off >3 mm [17]. Hohl *et al.,* and Segal *et al.,* advised fixation at 5 mm of depression and Honkonen *et al.,* took 3 mm of depression in consideration in his study [18, 19]. In our study, the indication for surgery were the same standard indications as for those tibial plateau fractures, 3 mm depression was considered as an indication for surgery. In this study, according to the Schatzker classification and outcomes as per the recommendation of Rasmussen *et al.,* 89% (n=76) patients got acceptable outcomes whereas the rest 11% (n=9) did not get satisfactory results. For majority (55%) of the patients, the union time was found <12 weeks whereas in 2% cases (n=2) incidence of non-union was observed. Ebraheim *et al.,* in his series of 117 tibial plateau fractures had excellent results in 68% of cases, good in 13%, fair in 11% and poor in 8% of the patients [20]. In another recent study [21] they claimed that, in spite of complexity of those fractures they were able to achieve 83.3% acceptable results (33.3% Excellent and 50% good) with their methods of fixation, in addition they had 13.3% fair and 3.3% poor results. Noted that, in this study, in general grading of patient's outcome as per patient's satisfaction, 56% patients got excellent results.

Limitations of the Study

This was a single centered study with a small sized sample. So, the findings of this study may not reflect the exact scenario of the whole country.

6. CONCLUSION AND RECOMMENDATIONS

In this study we found satisfactory outcomes in majority of the patients but in case of more than 10% cases outcomes were not acceptable. These findings may be helpful for the future researchers for any further research in the same issue. Besides all the technical issues surgeons should provide more attention in reducing the number of non-union. For getting more specific findings we would like to recommend for conducting more studies regarding the same issue with larger sized sample.

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