

Original Research Article

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Functional outcome of internal fixation of tibial plateau fractures: an observational study

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ABSTRACT

Background: Tibial plateau fractures are intra-articular fractures usually caused by high energy trauma either a valgus or varus force in combination with axial loading which affect the stability and function of weight bearing knee joint. Understanding the outcomes of surgical treatment for these fractures is crucial for both orthopaedic research and patient care. This study set out to examine the functional results of surgically managing tibial plateau fractures.

Methods: This prospective observational study took place in the Department of Orthopedic Surgery at Bangabandhu Sheikh Mujib Medical University in Dhaka, Bangladesh, from January 2020 to December 2022. The study included 37 patients with tibial plateau fractures who underwent internal fixation. Data was analyzed using tools from Microsoft Office.

Results: Among the study participants, 56.8% had an immobilization period of 1 week or less, and 32.4% were immobilized for 2-3 weeks. Complications included knee stiffness in 10.8% and malunion in 8.1% of cases. According to the Rasmussen grading system, 51.4% achieved an excellent outcome, 35.1% were categorized as good, while 8.1% and 5.4% fell into the fair and poor categories. Functional outcome was assessed by Oxford knee score is excellent 20 (54.5%), good 11 (29.7%), fair 4 (10.8%) and poor 2 (5.4%) respectively.

Conclusions: Surgical treatment of tibial plateau fractures typically yields positive results in most cases. The use of internal fixation, particularly with locking compression methods, is considered an effective approach for treating these fractures. This technique is associated with a lower risk of complications and promotes efficient healing, contributing to favourable outcomes.

Keywords: Functional outcome, Internal fixation, Stability, Tibial plateau fracture

INTRODUCTION

Tibial plateau fractures often lead to significant functional impairment. Managing tibial plateau fractures can be challenging due to their intra-articular nature.¹ Addressing these fractures requires careful management due to the complex anatomy of the knee joint and the potential for complications which may be accompanied by injuries to the meniscus and ligaments of the knee.²

Tibial plateau fractures represent about 1% of all fractures and make up roughly 8% of fractures in the elderly population. These fractures can result in premature osteoarthritis and lifelong pain and disability if the plateau surface and leg axis are not adequately restored.^{3,4} The severity of the fracture increases with each ascending numeric category, signifying a higher level of energy imparted to the bone.⁵ Managing tibial plateau fractures requires precise fixation. Ali et al

observed that fixation of tibial plateau fractures in their elderly cohort had a failure rate of 31%.⁶ Stevens et al found that only 57% of patients under 40 achieved a favorable functional outcome following operative management.⁷ Open reduction and internal fixation (ORIF) are associated with a considerable complication rate.⁸ The use of locking compression plates in treating tibial plateau fractures is becoming increasingly common.⁹ The main advantage of using periaricular locking plates is their capability to sustain the reduction in bicondylar fractures with just one laterally based plate, thereby lowering the risk of late varus malalignment and minimizing surgical exposure overall.¹⁰ The goal of this study was to assess the functional outcomes of internal fixation of tibial plateau fractures.

METHODS

This was a prospective observational study that was conducted at the Department of Orthopedic Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. A purposive selection process was employed to choose a total of 37 adult patients diagnosed with Tibial plateau fractures all of whom underwent internal fixation. The inclusion criteria for the study specified patients with tibial plateau fractures displaced intra-articular fractures, Articular depression (>3 mm), Open Fracture (Gustilo Anderson Grade I & II), Excluded from the study were fractures with Gustilo Anderson severity greater than Grade II, those accompanied by ipsilateral meniscal or ligamentous injuries, pathological fractures, and fractures associated with conditions like floating knee, compartment syndrome, vascular injury or other polytrauma. Initial evaluation of fracture pattern, which was done using routine Antero-posterior, lateral X-ray and CT scan images with 3D reconstruction done in all the patients. Surgical interventions were carried out under appropriate antibiotic cover and fluoroscopic control, with operations performed as soon as local soft tissue conditions permitted. Fracture site reduction was conducted under fluoroscopic guidance using percutaneous clamps and distractors, with repeat fluoroscopic assessments to ensure anatomical reduction. Open reduction was performed when necessary, and buttress plates were applied, considering the tibia's proximal end with its substantial cancellous bone, prone to axial deviation or bending under compression or shearing forces. Weight-bearing was deferred until evidence of union was observed on X-rays, and partial weight-bearing was initiated around 10 to 12 weeks, depending on the fracture configuration. Follow up was done at 6th week, 3 months, 6 months and 1year both clinically and radiologically. The study's results were assessed using the functional grading system proposed by Rasmussen et al.¹⁰ and Oxford Knee Score at final follow up. Data processing and analysis were carried out utilizing MS Office tools.²⁴

RESULTS

This study included the highest percentage of participants 32.4% from the 31-40 years age group, followed by 24.3% from the 20-30 years age group, and 21.6% from the 41-50 years age group. More than two-thirds of our participants 68% were male and the rest 32% were female. Involvement of right side 21(57%) and left 16 (43%), fair 4 (10.8%) and poor 2 (5.4%).

Table 1: Type of fracture distribution according to Schatzker staging system.

Type of fractures	N	%
I	14	37.83
II	10	27.02
III	2	5.4
IV	6	16.2
V	3	8.1
VI	2	5.4

Type I: 14(37.83%), Type-II: 10 (27.02%), Type-III: 2(5.4%), Type- IV: 6(16.2%), Type-V: 03(8.1%) and Type-VI: 02 (5.4%).

Table 2: Nature of internal fixation.

Period	N	%
Cancellous screws	11	29.7
Single buttress plating	21	56.7
Dual plating	05	13.5

Nature of internal fixation done by cancellous screws 11 (29.7%), Single buttress plating 21(56.7%) and dual plating 05 (13.5%).

Table 3: Period of immobilization.

Period	N	%
≤1 week	21	56.8
2-3 weeks	12	32.4
4-6 weeks	3	8.1

Autogenous cancellous bone graft was applied in 24 (64.86%) patients. The distribution of the period of immobilization among the study participants revealed that 56.8% of patients had an immobilization period of 1 week or less, 32.4% were immobilized for 2-3 weeks and 8.1% had an immobilization period lasting 4-6 weeks.

Table 4: Distribution of complications.

Complications	N	%
Knee stiffness	4	10.8
Malunion	3	8.1
Varus deformity	2	5.4
Extensor lag	1	2.7

The distribution of fracture types in the study population is as follows according to Schatzker staging system.^{8,17} The most common mode of injury in the highest number of participants 41% was road traffic accidents, while in 32% of cases, it was low-energy incidents. As per the distribution of complications among the study participants, knee stiffness was observed in 10.8%, malunion occurred in 8.1%, varus deformity was present in 5.4%, and extensor lag was noted in 2.7% of the cases. In the Rasmussen grading system, 51.4% of the study population achieved an excellent outcome, 35.1% were categorized as good, while 8.1% and 5.4% fell into the fair and poor categories. Functional outcome was assessed by Oxford Knee Score is Excellent 20(54.5%), Good 11(29.7) respectively.

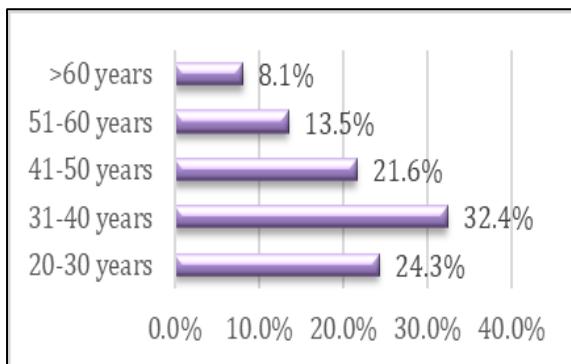


Figure 1: Age distribution of participants.

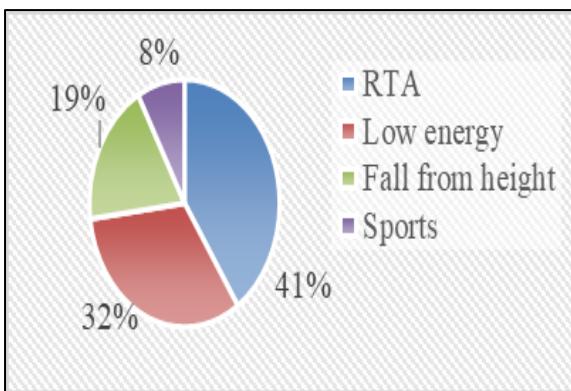


Figure 2: Mode of injuries distribution.

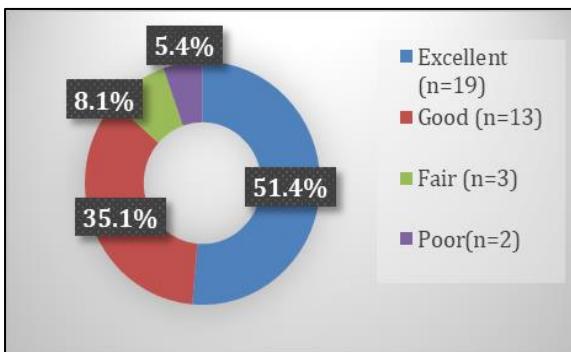


Figure 3: Outcome as per Rasmussen grading.

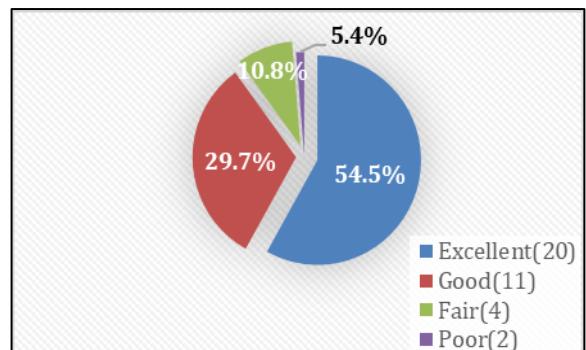


Figure 4: Functional outcome as per Oxford Knee Score.

DISCUSSION

The tibial plateau bears the superior articular surface, which is a crucial weight-bearing region in the body.¹¹ Tibial plateau fractures were often called bumper or fender fractures. This study had the largest proportion of participants (32.4%) in the 31-40 age group, followed by 24.3% in the 20-30 age group, and 21.6% in the 41-50 age group. These results align with those of a prior study conducted in Bangladesh.¹¹ More than two-thirds of our participants (68%) were male which was like the findings of another study.¹² The predominant mode of injury for most of our participants (41%) was road traffic accidents, while 32% of cases were attributed to low-energy incidents. In a series by Chia et al 71% of the injuries were by road traffic accidents (RTA).¹³

Hohl et al and Segal et al recommended fixation for tibial plateau fractures when there is a depression of 5 mm. On the other hand, Mahbub et al and Honkonen et al considered a 3 mm depression significant in their study and used this criterion for deciding on fixation. In our study, surgery was indicated when there was 3 mm depression, consistent with previous literature. The distribution of tibial plateau fractures in our study population, according to the Schatzker staging system [8,17] is as follows: Type-I: 14 (37.83%), Type-II: 10 (27.02%), Type-III: 2 (5.4%), Type-IV: 6 (16.2%), Type-V: 3 (8.1%), and Type-VI: 2 (5.4%). Nature of Internal fixation done by Cancellous screws 11 (29.7%), Single buttress plating 21(56.7%) and dual plating 05 (13.5%). Autogenous cancellous bone graft was applied in 24 (64.86%) patients. Among our study participants, most of the cases (56.8%) had an immobilization period of 1 week or less. In a previous study mobilization and weight bear started depend on the stability of the fixation.¹¹ The distribution of complications among our study participants revealed knee stiffness in 10.8%, malunion in 8.1%, varus deformity in 5.4%, and extensor lag in 2.7% of the cases. Gaston et al. noted that 20% of patients develop stiffness, defined as a residual knee flexion contracture of more than 5 degrees, 12 months after surgery for tibial plateau fractures.¹⁴ In various studies, the incidence of knee stiffness following these fractures ranges from 3% to 18%, indicating significant variability

in outcomes.^{15,16} In the Rasmussen grading system, 51.4% of our participants demonstrated excellent outcomes, 35.1% were classified as good, and 8.1% and 5.4% were categorized as fair and poor, respectively. These findings were comparable to the findings of some previous studies.^{1,11} Functional outcome was assessed by Oxford Knee Score is Excellent 20(54.5%), Good 11(29.7%), Fair 4(10.8%) and poor 2 (5.4%). Narayana et al. 2022 reported 55.5% excellent and 36.12% good outcome. Similar finding also seen in Jagdev et al and Ravikumar et al.²¹⁻²³ The results obtained in this study may provide valuable insights for future research in similar domains.

Limitation

Limitations of this study include its single-centred design with a small sample size and a brief duration of data collection. Consequently, caution is needed when generalizing the findings, as they may not accurately represent the broader scenario and diversity of the entire country.

CONCLUSION

In the realm of internal fixation for tibial plateau fractures, optimistic outcomes prevail in most cases. The locking compression method stands out as an effective approach, demonstrating a lower complication rate and promoting efficient healing. This underscores its viability as a preferred strategy for managing tibial plateau fractures. The method's success in achieving favorable results contributes to the growing body of evidence supporting its efficacy, positioning it as a valuable option in the surgical arsenal for addressing this specific orthopedic challenge.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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