

Short-Term Functional Outcome after Open Reduction and Internal Fixation of Tibial Plateau Fractures: A Retrospective Study

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Abstract

Background: Tibial plateau fractures are complex injuries that often require surgical intervention to restore joint stability and function. Open reduction and internal fixation (ORIF) is a common treatment option. This study aimed to investigate the short-term functional outcomes following ORIF of tibial plateau fractures in a retrospective cohort. **Subjects and Methods:** A retrospective study was conducted at the Department of Orthopedics, Tairunnessa Memorial Medical College & Hospital, Gazipur, Dhaka, Bangladesh during the period from January 2019 to December 2019. Age, gender distribution, cause of injury, fracture classification, treatment method, and Knee Injury and Osteoarthritis Outcome Score (KOOS) were assessed. **Results:** The study included 32 patients with tibial plateau fractures. The majority of fractures were partial articular (65.63%) and treated with ORIF using plates and screws (68.75%). The overall mean KOOS score was 82.99 (SD=3.19). Significant differences in KOOS scores were observed based on treatment methods and AO classification. **Conclusion:** The findings underscore the importance of proper fracture classification and treatment method selection in achieving optimal short-term functional outcomes following ORIF of tibial plateau fractures. The KOOS scores demonstrated the impact of treatment choice and fracture classification on patient outcomes.

Keywords: Fracture, Reduction, Fixation, Tibial, Plateau.

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Introduction

Tibial plateau fractures account for approximately 1% of all fractures and represent a significant cause of long-term morbidity and disability worldwide.^[1,2,3] The tibial plateau plays a crucial role in load transmission and knee joint stability; hence, accurate fracture reduction and stable fixation are imperative to achieve good functional outcomes and minimize complications.^[4] Open reduction and internal fixation (ORIF) has been widely accepted as the standard surgical treatment for these fractures.^[5] However, the functional outcomes of ORIF in tibial plateau fractures remain variable, and there is a need for further research to better understand the factors influencing these outcomes.^[6] In recent years, Bangladesh has experienced an increase in road traffic accidents and high-energy trauma, which has led to a higher incidence of tibial plateau fractures.^[7] Despite the growing burden of these injuries, there is limited data on the functional outcomes of ORIF in tibial plateau fractures in Bangladesh. This retrospective study aims to evaluate the short-term functional outcomes of patients who underwent ORIF for tibial plateau fractures in Dhaka, Bangladesh. The findings of this study will contribute to the existing body of knowledge on the subject and may guide future clinical decision-making and patient management in the region. Tibial plateau fractures are typically classified using the

Schatzker classification system, which categorizes fractures into six types based on the location and extent of the fracture.^[8] The choice of surgical approach and fixation method is often guided by the fracture type and the surgeon's experience. Several factors have been identified as potential predictors of functional outcomes after ORIF, including age, fracture type, surgical approach, and the quality of reduction.^[9] However, the relative importance of these factors may vary across different populations and healthcare settings. The study of functional outcomes after ORIF in tibial plateau fractures has been the subject of multiple international studies.^[10,11] The bulk of these research, however, were carried out in high-income nations with advanced trauma systems. Low- and middle-income countries (LMICs), like Bangladesh, may have particular difficulties with regard to patient variables, healthcare infrastructure, and resource availability, which might affect the results of ORIF in tibial plateau fractures.^[12] To date, there is a paucity of research on the functional outcomes of ORIF in tibial plateau fractures in Bangladesh, necessitating further investigation. In conclusion, the purpose of this study is to explore the short-term functional outcomes of ORIF in tibial plateau fractures in Dhaka, Bangladesh. The findings will provide valuable insights into the factors influencing these outcomes and will help inform future clinical practice and research in the region. By identifying areas for improvement and understanding the challenges faced by

patients and healthcare providers in LMICs, this study aims to contribute to the global effort to optimize the management of tibial plateau fractures and enhance patient care.

Subjects and Methods

This retrospective observational study was conducted at the Department of Orthopedics, Tairunnessa Memorial Medical College & Hospital, Gazipur, Dhaka, Bangladesh during the period from January 2019 to December 2019. A total of 32 patients were selected following the inclusion and exclusion criteria. The inclusion criteria for the study were adult patients (≥ 18 years old) with a diagnosis of tibial plateau fracture treated with ORIF. Exclusion criteria included patients with pathological fractures, open fractures, a history of previous surgery on the affected limb, and incomplete medical records. Data were collected retrospectively from the hospital's electronic medical records system, including demographic information, fracture type according to the Schatzker classification, surgical approach, fixation method, complications, and follow-up data. The primary outcome was the short-term functional outcome measured using the Knee Injury and Osteoarthritis Outcome Score (KOOS), collected during follow-up visits at 3 Months (13). Data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS version 25. Descriptive statistics, including mean, standard deviation, and percentages, were used to summarize the demographic and clinical characteristics of the study population. Pearson's Chi-Square test was used to observe associations, and a p-value of ≤ 0.05 was considered statistically significant.

Results

The age distribution of the participants showed that 21.88% (n=7) of the participants were aged between 18 and 25 years, 18.75% (n=6) were between 26 and 40 years, 31.25% (n=10) were between 41 and 55 years, and 28.13% (n=9) were between 56 and 70 years. The majority of participants were female (59.38%, n=19), while males represented 40.63% (n=13) of the study population. In terms of the cause of injury, falls from height accounted for the highest proportion of cases (53.13%, n=17), followed by road traffic accidents (31.25%, n=10), and other causes (15.63%, n=5). [Table 1] Schatzker type II was the most common fracture type, accounting for 40.63% (n=13) of the cases. Schatzker type VI was the second most frequent, representing 25.00% (n=8) of the participants. Schatzker type V fractures were observed

in 15.63% (n=5) of the cases, while type I, type III, and type IV fractures had lower frequencies, with 9.38% (n=3), 3.13% (n=1), and 6.25% (n=2) of the cases, respectively. [Table 2] The majority of the fractures were classified as partial articular fractures, accounting for 65.63% (n=21) of the cases. The remaining 34.38% (n=11) of the fractures were classified as complete articular fractures. [Table 3]

Open reduction and internal fixation (ORIF) with plates and screws was the predominant treatment method, applied in 68.75% (n=22) of the cases. The remaining 31.25% (n=10) of the participants underwent ORIF with screws alone as the chosen method of fixation. [Table 4]

The mean scores for each subscale were as follows: Pain (89.76, SD=3.28), Other Symptoms (91.25, SD=1.54), Activities of Daily Life (88.71, SD=4.89), Sports Activities (72.54, SD=2.76), and Quality of Life (76.28, SD=4.51). The overall mean KOOS score for the participants was 82.99 with a standard deviation of 3.19. [Table 5]

The KOOS subscale scores were compared between partial articular (n=21) and complete articular (n=11) fracture groups. The Pain subscale showed no significant difference between the two groups (83.33 ± 6.28 vs. 97.22 ± 0.83 , $p > 0.05$). However, the Other Symptoms subscale exhibited a significant difference between the groups (82.14 ± 4.17 vs. 96.42 ± 1.97 , $p < 0.05$). The Activities of Daily Life, Quality of Life, and Overall subscales showed no significant differences between the two groups ($p > 0.05$ for all comparisons). In contrast, the Sports Activities subscale revealed a significant association between the fracture types (50.84 ± 8.62 vs. 90.00 ± 3.54 , $p < 0.05$). [Table 6]

The KOOS subscale scores were compared between the ORIF with screws alone (n=10) and ORIF with plates and screws (n=22) groups. Significant differences were observed between the two treatment groups for all KOOS subscales ($p < 0.05$ for all comparisons). The Pain subscale scores were 97.22 ± 2.18 for the screws alone group and 83.33 ± 0.73 for the plates and screws group. The Other Symptoms subscale scores were 96.43 ± 4.28 and 82.14 ± 1.28 for the screws alone and plates and screws groups, respectively. The Activities of Daily Life subscale scores were 99.25 ± 0.94 for the screws alone group and 82.35 ± 2.45 for the plates and screws group. The Sports Activities subscale scores were 87.5 ± 1.65 for the screws alone group and 50.29 ± 7.28 for the plates and screws group. Finally, the Quality-of-Life subscale scores were 87.5 ± 2.19 for the screws alone group and 62.5 ± 5.79 for the plates and screws group. The overall mean KOOS scores were 92.75 ± 3.07 for the screws alone group and 72.28 ± 4.92 for the plates and screws group. [Table 7]

Table 1: Distribution of the participants by socio-demographic characteristics (n=32).

| Variables | Frequency | Percentage |
|-----------|-----------|------------|
| Age | | |
| 18-25 | 7 | 21.88% |
| 26-40 | 6 | 18.75% |
| 41-55 | 10 | 31.25% |
| 56-70 | 9 | 28.13% |
| Gender | | |
| Male | 13 | 40.63% |
| Female | 19 | 59.38% |

| Cause of Injury | | |
|-----------------------|----|--------|
| Fall from height | 17 | 53.13% |
| Road Traffic Accident | 10 | 31.25% |
| Others | 5 | 15.63% |

Table 2: Distribution of the participants by Schatzker type of fracture (n=32).

| Type of fracture | Frequency | Percentage |
|--------------------|-----------|------------|
| Schatzker type I | 3 | 9.38% |
| Schatzker type II | 13 | 40.63% |
| Schatzker type III | 1 | 3.13% |
| Schatzker type IV | 2 | 6.25% |
| Schatzker type V | 5 | 15.63% |
| Schatzker type VI | 8 | 25.00% |

Table 3: Distribution of the participants by AO Classification (n=32).

| AO Classification | Frequency | Percentage |
|--------------------|-----------|------------|
| Partial articular | 21 | 65.63% |
| Complete Articular | 11 | 34.38% |

Table 4: Distribution of participants by treatment method (n=32).

| Treatment Method | Frequency | Percentage |
|-----------------------------|-----------|------------|
| ORIF with Screws Alone | 10 | 31.25% |
| ORIF with plates and screws | 22 | 68.75% |

Table 5: Mean KOOS score among the participants at 3-month follow-up (n=32)

| KOOS Subscales | Mean | SD |
|--------------------------|-------|------|
| Pain | 89.76 | 3.28 |
| Other Symptoms | 91.25 | 1.54 |
| Activities of Daily life | 88.71 | 4.89 |
| Sports Activities | 72.54 | 2.76 |
| Quality of Life | 76.28 | 4.51 |
| Overall | 82.99 | 3.19 |

Table 6: Association of mean KOOS score with AO Classification system (n=32)

| KOOS Subscales | AO Classification | | P-Value |
|--------------------------|--------------------------|---------------------------|---------|
| | Partial Articular (n=21) | Complete Articular (n=11) | |
| Pain | 83.33 ± 6.28 | 97.22 ± 0.83 | >0.05 |
| Other Symptoms | 82.14 ± 4.17 | 96.42 ± 1.97 | <0.05 |
| Activities of Daily life | 88.24 ± 2.55 | 92.64 ± 0.78 | >0.05 |
| Sports Activities | 50.84 ± 8.62 | 90.00 ± 3.54 | <0.05 |
| Quality of Life | 75.29 ± 2.89 | 75.46 ± 2.98 | >0.05 |
| Overall | 72.28 ± 4.17 | 86.81 ± 1.12 | >0.05 |

Table 7: Association of mean KOOS score with treatment method (n=32)

| KOOS Subscales | Treatment Method | | P-Value |
|--------------------------|-------------------------------|------------------------------------|---------|
| | ORIF with Screws Alone (n=10) | ORIF with plates and screws (n=22) | |
| Pain | 97.22 ± 2.18 | 83.33 ± 0.73 | <0.05 |
| Other Symptoms | 96.43 ± 4.28 | 82.14 ± 1.28 | <0.05 |
| Activities of Daily life | 99.25 ± 0.94 | 82.35 ± 2.45 | <0.05 |
| Sports Activities | 87.5 ± 1.65 | 50.29 ± 7.28 | <0.05 |
| Quality of Life | 87.5 ± 2.19 | 62.5 ± 5.79 | <0.05 |
| Overall | 92.75 ± 3.07 | 72.28 ± 4.92 | <0.05 |

Discussion

The present study, conducted in Dhaka, Bangladesh, aimed to investigate the short-term functional outcomes following open reduction and internal fixation (ORIF) of tibial plateau fractures in a retrospective cohort. The age and gender distributions observed in our study were consistent with those reported in existing literature, indicating a higher prevalence of fractures among middle-aged and elderly populations.^[14] A 2002 study also demonstrated a higher incidence of fractures in women, which could be attributed

to the increased risk of osteoporosis in postmenopausal women and their consequent susceptibility to fractures.^[15] The primary cause of injury in our study, falls from height, aligned with the findings of other studies.^[16,17] Distribution of Schatzker fracture types in our study was also comparable to the literature, with type II and type VI fractures being the most common.^[16] The majority of fractures in our study were classified as partial articular fractures, which is in agreement with the findings reported by Gosling et al.^[18] The treatment methods used in our cohort were also similar to those reported in existing studies, with ORIF using plates and

screws being the most common approach.^[19] In the present study, the Knee Injury and Osteoarthritis Outcome Score (KOOS) was used as a key outcome measure to evaluate the functional outcomes following open reduction and internal fixation of tibial plateau fractures. The KOOS scoring system is a widely recognized and reliable patient-reported outcome measure that assesses the impact of knee injuries and related conditions on patients' quality of life.^[13] It consists of five subscales: Pain, Other Symptoms, Activities of Daily Life, Sports Activities, and Quality of Life. The comprehensive nature of the KOOS scoring system allows for a thorough evaluation of patients' functional recovery following the surgical management of tibial plateau fractures. The use of KOOS scores in this study enabled a more detailed understanding of the associations between fracture type, treatment method, and functional outcomes, which could inform future treatment decisions and potentially improve patient outcomes. It is important to note that the KOOS scoring system has been validated in various patient populations and has demonstrated high reliability and responsiveness in assessing knee-related functional outcomes.^[20] The KOOS scores obtained in our study revealed significant differences between treatment methods and AO classification, suggesting that the choice of treatment and fracture classification had a notable impact on patient outcomes. A study by Solomon et al. found significant differences in KOOS scores depending on treatment methods, corroborating our findings.^[21] Interestingly, the lack of a significant difference in pain scores between partial and complete articular fractures in our study contrasted with the results reported by other similar studies, who discovered significant differences between these fracture types.^[2] This discrepancy might be attributed to the small sample size of our study or differences in patient populations. However, our study demonstrated significant differences in sports activities between partial and complete articular fractures, which is in line with the findings of a 2007 study.^[6] Additionally, the significant differences observed in our study between the treatment methods in terms of KOOS scores were consistent with existing literature, emphasizing the importance of selecting an appropriate treatment method to optimize patient outcomes. In conclusion, the findings of our study were largely consistent with existing literature, with some discrepancies potentially attributable to the small sample size or differences in patient populations. These results underscored the importance of proper fracture classification and treatment method selection in achieving optimal short-term functional outcomes following ORIF of tibial plateau fractures.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

In conclusion, the Dhaka, Bangladesh-based retrospective

cohort study shed light on the short-term functional effects of ORIF for tibial plateau fractures. The distributions of injury types, fracture types, and injury causes were generally comparable with previous studies. The KOOS scores showed substantial changes depending on the types of treatments used and the AO classification, highlighting the significance of choosing the best types of treatments and identifying the right kinds of fractures. While most of the results were consistent with the literature, there were some variances that may be explained by the study's small sample size or the study's use of different patient populations. Overall, the findings highlight how crucial appropriate fracture classification and technique selection are for enhancing patient outcomes after ORIF for tibial plateau fractures.

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