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The Outcome of Open Reduction and Internal Fixation of Tibial Plateau Fracture Schatzker type II by Proximal Tibial Locking Buttress Plate with Bone Graft

Md. Mofizur Rahman[1], Md. Iqbal Qavi[2], Moniruzzaman Monir[3], Md. Samiul Islam[4], Muhammad Rafiqul Islam[5], Moazzem Hossain[6]

[1]*Assistant Professor, Department of Orthopaedics, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh*
[2] *Ex. Director & Professor, Department of Orthopaedics, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh*
[3]*Assistant Professor, Department of Orthopaedics, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh*
[4]*Assistant Professor, Department of Orthopaedics, Manikganj Medical College, Manikganj, Dhaka, Bangladesh*
[5]*Assistant Professor, Sarkari Karmachari Hospital, Dhaka, Bangladesh*
[6]*Medical Officer, Trauma Centre, Dhaka, Bangladesh*
Corresponding Author: *Dr. Md. Mofizur Rahman, Assistant Professor, Department of Orthopaedics, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh*

Abstract

Introduction: *Fractures of the lower extremities, particularly around the knee joint, pose significant challenges in orthopedic trauma due to their impact on mobility and long-term function. Timely and effective management is crucial to ensure optimal bone healing, restore joint function, and prevent complications such as malunion, nonunion, or limited range of motion. This study aims to evaluate the clinical, radiological, and functional outcomes of patients treated for such injuries.*

Methods: *This prospective observational study was conducted at the National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, from January 2014 to July 2016. All patients attending emergency and out-patient and indoor departments in NITOR, Dhaka were considered as the study population. A total of 20 patients with tibial plateau fracture Schatzker type II were selected as study subjects by purposive sampling technique. Data were processed and analyzed by SPSS.*

Result: *In this study of 20 male patients (mean age 34.75 ± 8.03 years), the majority sustained injuries from road traffic accidents (90%) and most had left-sided involvement (60%). The mean fracture union time was 90.5 ± 11.27 days, and radiographic evaluation showed good healing with no malunion or nonunion. The mean knee ROM was 113.5° ± 14.4°, with most patients achieving functional mobility. According to Rasmussen grading, 60% had excellent, 30% good, and 10% fair outcomes, resulting in a 90% overall satisfactory clinical outcome.*

Conclusion: *Tibial Plateau Fracture Schatzker's type II can be treated by open reduction and internal fixation by proximal tibial locking buttress plate with bone graft. Open reduction, the elevation of the depressed fragments, and application of allograft finally fixation by locking buttress plate is an effective method of treatment.*

Keywords: *Open Reduction and Internal Fixation, Tibial Plateau Fracture Schatzker type II, Buttress Plate, Bone Graft*

I. INTRODUCTION

A tibial plateau fracture is a break in the continuity of the bone with soft tissue occurring in the proximal part of the tibia. The tibial plateau fractures are one of the most common intra-articular fractures affecting the knee joint stability and motion. They result from indirect coronal or direct axial compressive forces. This makes up about 1% of all fractures and 8% of the fractures in the elderly. Most injuries affect the lateral tibial condyle (55-70%) and isolated medial condyle occur in 10 -23 %, whereas the involvement of bicondylar lesions is found in 10-30 % (1). Fractures of the tibial plateau are caused by a varus or valgus force combined with axial loading (a pure valgus force is more likely to rupture the ligaments). This is sometimes the result of a car striking a pedestrian (hence the term 'bumper fracture'); more often it is due to a fall from a height in which the knee is forced into valgus or varus. The tibial condyle is crushed or split by the opposing femoral condyle, which remains intact. Many different classification systems have been proposed, none with universal acceptance. The system

most widely used today is the Schatzker classification; type I: Vertical split fracture of the lateral plateau, type II: Vertical split-depression of the lateral plateau, type III: depression of the articular surface with an intercondylar rim, type IV: medial tibial plateau fracture, type V: bicondylar fracture, and type VI: a fracture with metaphyseal diaphyseal dissociation (2). Over the past 2 decades, new implants have been advised to minimize the bone-implant contact area. A locking plate was developed in which the unicortical locking head screws can be locked into the screw hole on the plate. The advantages of Locked plating are internal fixation, angular stability, better conservation of blood supply to the bone, no displacement of locking screw, combination of both dynamic compression plating and locked plating, which allows early functional mobilization (3). Over the last decade plate fixation has become popular for the treatment of fractures of proximal tibial fractures. This coupled with the biological advantage of percutaneous insertion has resulted in a high union rate (4). Locking compression plate devices offers a potential biomechanical advantage over other methods by: better distribution of forces along the axis of the bone, they can be inserted with minimal soft tissue stripping using minimally invasive per-cutaneous plate osteo-synthesis (MIPPO), substantially reducing failure of fixation in osteoporotic bones, reducing the risk of a secondary loss of intra-operative reduction by locking with screws to the plate, uni-cortical fixation option, better preservation of blood supply to the bone as a locked plating does not rely on plate bone compression, provide stable fixation by creating a fixed angle construct and angular stability, early mobilization. Locking compression plate has added advantage of the ability to manipulate and reduce the small and often osteoporotic fracture fragments directly (5–7). Treatment goals include preservation of soft tissues, restoration of articular congruity, and correction of anatomic alignment in the lower extremities. Adequate fixation and early achievement of postoperative range of motion are important for a good prognosis and adequate postoperative functioning. Buttressing of lateral compartments with bone graft is the gold standard for managing Schatzker type II fractures because this may provide sufficient rigid fixation to prevent collapse and subsequent varus deformity and secondary osteoarthritis. However, this may require excessive dissection through injured soft tissue, leading to wound complications or compromised osteosynthesis (4). So this study was undertaken for evaluation of results of tibial plateau fracture Schatzker type II treated by locking compression buttress plating with bone graft on the lateral side.

II. METHODS

This prospective observational study was conducted at the National Institute of Traumatology & Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, from January 2014 to July 2016. All patients attending emergency and out-patient and indoor departments in NITOR, Dhaka were considered as the study population. A total of 20 patients with tibial plateau fracture Schatzker type II were selected as study subjects by purposive sampling technique. A complete history was recorded followed by a physical examination was performed. A general survey was done to exclude other associated injuries and relevant clinical examinations were done to exclude other injuries such as head injury, chest injury, abdominal and pelvic injury. In this study, classification was based on Schatzker and Mcbroom, (1979), and a CT scan with 3D reconstruction of the involved part was done (8). A data sheet was formulated to evaluate the outcome according to the Rasmussen Functional Grading Criteria for this study. Data were processed and analyzed by SPSS. Qualitative data had been expressed as frequency and corresponding percentage while the quantitative data as mean and range. The post-operative outcome was evaluated. Prior permission was taken from the Ethical Review Committee, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh to conduct this study. Informed written consent from the patient or legal guardian after duly informed about the procedure of treatment.

Inclusion criteria

1. Tibial plateau fracture Schatzker type II
2. Patients above 18-60 years of age.
3. The patients who are mentally alert and physically fit.
4. Presented within two weeks of injury.

Exclusion criteria

1. Tibial plateau fracture Schatzker type I, III, IV, V, and VI
2. Pathological fracture.
3. Fracture with neurovascular injuries.
4. Patients below 18 years.
5. Open fracture.

III. RESULTS

Table 1: Baseline Characteristics of the Patients (n=20)

Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)	10–19	0	0
	20–29	6	30
	30–39	10	50
	40–49	3	15
	50–59	1	5
Sex	Male	20	100
	Female	0	0
Occupation	Service holder	6	30
	Day laborer	4	20
	Student	2	10
	Teacher	2	10
	Farmer	2	10
	Businessman	2	10
	Policeman	2	10

The mean age of the patients was 34.75 ± 8.03 years, with the youngest being 21 and the oldest 51 years. Half of the participants (50%) belonged to the 30–39 years age group, followed by 30% in the 20–29 years range. All 20 patients (100%) were male. Regarding occupation, the majority were service holders (30%), followed by day laborers (20%). Other occupations included students, teachers, farmers, businessmen, and policemen, each accounting for 10% of the study population. [Table 1]

Table 2: Distribution of Patients by Cause of Injury (n=20)

Cause of Injury	**Number of Patients**	**Percentage (%)**
Road traffic accident (RTA)	18	90
Fall from height	2	10

Out of 20 patients, the majority (90%) sustained injuries due to road traffic accidents, while only 10% were injured from falls from height. [Table 2]

Table 3: Distribution of Patients by Side of Injury (n=20)

Side of Injury	**Number of Patients**	**Percentage (%)**
Right	8	40
Left	12	60

Of the 20 patients, 60% had injuries on the left side and 40% on the right side. [Table 3]

Table 4: Distribution of Patients by Union Time (n=20)

Union Time (Days)	**Frequency**	**Percentage (%)**
76–90	12	60
91–105	6	30
106–120	2	10
Mean ± SD	90.5 ± 11.27	

The mean union time of fracture healing was 90.5 ± 11.27 days. The shortest and longest healing durations were 80 and 120 days, respectively. Most patients (60%) achieved union within 76–90 days. [Table 4]

Table 5: Radiographic Criteria (n=20)

Score per Cortex	**Frequency**	**Percentage (%)**
1	0	0
2	8	40
3	12	60

Radiographic assessment using the RUST score showed that 60% of patients had a score of 3 (indicating callus formation and invisible fracture line), while 40% had a score of 2 (callus with visible fracture line). No case of malunion or nonunion was observed. [Table 5]

Table 6: Distribution of Patients by Range of Motion (ROM) of Affected Knee (n=20)

ROM (Degrees)	**Frequency**	**Percentage (%)**
80–89	0	0
90–99	2	10
100–109	5	25
110–120	8	40
121–140	5	25
Mean ± SD	113.5 ± 14.4	

The mean knee range of motion was 113.5° ± 14.4°, with values ranging from 90° to 140°. The majority of patients (40%) had ROM between 110–120°, and none had ROM below 90°. [Table 6]

Table 7: Functional outcome according to Rasmussen Functional Grading Criteria (n=20)

Patient Serial no.	Pain	Walking capacity	Extension	Total ROM	Stability	Final Score	Result
1	6	4	6	4	6	26	Good
2	6	6	6	6	6	30	Excellent
3	6	6	6	6	6	30	Excellent
4	5	6	6	4	6	27	Good
5	6	6	6	4	6	28	Excellent
6	6	4	6	4	6	26	Good
7	6	6	6	4	6	28	Excellent
8	6	6	6	6	5	29	Excellent
9	6	4	6	6	6	28	Excellent
10	5	5	2	4	4	20	Fair
11	5	4	6	4	5	24	Good
12	6	6	6	4	6	28	Excellent
13	6	6	6	6	6	30	Excellent
14	6	6	6	4	6	28	Excellent
15	6	6	6	6	6	30	Excellent
16	5	4	6	4	5	24	Good
17	6	6	6	4	6	28	Excellent
18	6	6	6	6	5	29	Excellent
19	4	4	4	2	4	20	Fair
20	5	6	6	4	6	27	Good

The highest score was 30, the lowest score was 20, and the mean score was 27 ± 2.97. In this series 12 excellent, 6 good, and 2 fair results were achieved in patients. [Table 7]

Table 8: Final Clinical Outcome

Rasmussen Score	**Category**	**Frequency**	**Percentage (%)**
28–30	Excellent	12	60
24–27	Good	6	30
10–20	Fair	2	10

Among the 20 patients, 90% had satisfactory outcomes (excellent or good), while 10% had unsatisfactory outcomes (fair). No poor results were observed in this study. [Table 8]

Dissection of the right leg

Dissection of the right leg

Figure 1: Dissection of right leg

Figure 2: Intraoperative procedure

Figure 3: X-ray of affected region during follow-up

IV. DISCUSSION

We successfully decreased the rate of postoperative malalignment, as observed on postoperative radiographs. Postoperative functional outcome was assessed by the standard Rasmussen Knee Scoring system of 20 study patients. A study assumed that high malreduction rates may result from difficulties in gross evaluation of alignment and the articular surface under intraoperative fluoroscopy or from inexperience in using the reduction technique (9). Regarding the age distribution of this study, the mean age is 34.75 years (range is 21 -51). Unnikrishnan et al. (10) showed that they studied 25 patients and the mean age was 37.20 years (range 20-49 years) which is similar to my study. Raza et al. (11) also showed mean age of their study patients was 40 which is near my study. Regarding the sex distribution of the study patients – in 20 study patients all are male. Patil et al. (12) showed that their study patients female ratio was 3:1, and most of the patients were male. Raza et al. (11) also showed study populations were predominant,35 were male, and only 6 were female in 41 study patients. Regarding the cause of injury of the study patients, a road traffic accident was found in 18 (90 %) and falls from height 2 (10 %). Unnikrishnan et al. (10) showed the cause of injury 17(64 %) were due to road traffic accidents 8 (36 %) were due to falls from height and the total number of patients was 25, which is similar to my study. Manidakis et al. (13) also showed causes of injury were mainly due to road traffic accidents (86 %), falls from height (37%), and gunshot injury (2 %). Regarding the side involvement of tibial plateau fractures in schatzkars type II of this study patients, 12 (60%) were on the left side and 8 (40%) were on the right side. Patil et al. (12) also showed a side of involvement, 63% on the right side and 36 % on the left side which is also similar to my study. Regarding the Rasmussen criteria for the functional outcome of this study patients, Excellent was found 12 (60%), good was 6 (30%), and fair was 2 (10%). The poor result was not found. In my study, a satisfactory result is 90% (Excellent 60% + good 30 %). Raza et al. (11) showed an excellent 55%, a good 33%, and a fair 11 % which is similar to my study. Unnicrishnan et al. (10) showed their result excellent 68 %, good 16%, fair 12 %, and poor 4%, which is also near about my study. Regarding postoperative functional outcome in my study according to Rasmussen scoring criteria mean score is 27. Lundusi et al. (14) showed mean Rasmussen score was 26.5 and total patients were 24. Patil et al. (12) showed in their study mean Rasmussen score was 27.5 and the total patients was 30. In their study postoperative outcome is similar to my study.

Limitations of The Study

This study has several limitations, including a small sample size, which restricts the generalizability of the findings, and a short follow-up period, limiting the assessment of long-term outcomes. Additionally, the high cost of implants posed a financial constraint, and the lack of specialized operation theatre facilities, such as C-ARM imaging, may have affected the precision and standardization of surgical procedures.

V. CONCLUSION

Tibial Plateau Fracture Schatzker's type II can be treated by open reduction and internal fixation by proximal tibial locking buttress plate with bone graft. Open reduction, the elevation of depressed fragments, and application of allograft finally fixation by locking buttress plate is an effective method of treatment. This method enhances anatomical, clinical, and functional recovery, reduces pain, and improves the functional status of knee joints with early rehabilitation.

VI. RECOMMENDATION

The study, while valuable, was limited by its small sample size and short follow-up duration, which may not fully represent the broader population or long-term outcomes. To obtain more generalizable and comprehensive results, future research should be conducted with a larger sample size and extended follow-up period. Large-scale studies with longer follow-ups are essential for an optimal comparison of outcomes, and the findings from this preliminary study can serve as a foundation for designing and guiding such future research.

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