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

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KEYWORDS:
Open Reduction and Internal Fixation, Complications, Proximal Tibia, Buttress Plate

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ABSTRACT

Introduction: Tibial plateau fractures, particularly Schatzker type II, represent a significant orthopedic challenge due to their intra-articular involvement and potential for long-term functional impairment if not properly managed. The present study aims to evaluate the complications associated with ORIF using a proximal tibial locking buttress plate with bone graft in the management of Schatzker type II tibial plateau fractures.

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: Most patients (60%) achieved fracture union within 76–90 days, with a mean union time of 90.5 ± 11.27 days. Radiographically, 60% showed a RUST score of 3, indicating good healing, and all patients achieved a functional knee range of motion averaging 113.5° ± 14.4°. The average hospital stay was 11 days, and complications were minimal, with only 2 patients (10%) experiencing superficial wound infections, one of whom also had knee stiffness.

Conclusion: The present study highlights that open reduction and internal fixation of Schatzker type II tibial plateau fractures using a proximal tibial locking buttress plate with bone graft is a reliable and effective technique with a low complication profile.

INTRODUCTION

Tibial plateau fractures, particularly those involving the lateral plateau, represent challenging injuries that can compromise the stability, alignment, and congruency of the knee joint if not properly addressed. Schatzker type II fractures, characterized by a split depression of the lateral tibial plateau, are among the most frequently encountered patterns in clinical practice (1). These injuries typically result from axial loading in combination with valgus stress and are more prevalent in younger individuals after high-energy trauma or in elderly patients with osteoporotic bone following low-energy trauma (2). Surgical management of Schatzker type II fractures aims to achieve anatomical reduction of the articular surface, restoration of limb alignment, stable internal fixation, and early joint mobilization to reduce the risk of post-traumatic arthritis and functional impairment (3). Open reduction and internal fixation (ORIF) with proximal tibial locking buttress plates has become a standard approach, offering enhanced biomechanical stability, especially in osteoporotic and comminuted fractures (4,5). These plates, when applied properly, allow for precise reduction while minimizing further soft tissue trauma, particularly with minimally invasive techniques (6). Bone grafting is often necessary in Schatzker type II fractures due to the metaphyseal void created after elevating the depressed articular fragment. Autologous iliac crest grafts, allografts, or synthetic substitutes are commonly used to fill these defects and support bone healing (7). While this combination of locking plates and bone grafts generally improves outcomes, it is not without complications. Despite advances in

surgical techniques and fixation devices, postoperative complications continue to be a significant concern for orthopedic surgeons. Common complications associated with ORIF of tibial plateau fractures include surgical site infection, wound complications, implant failure, malunion or nonunion, neurovascular injury, deep vein thrombosis, and post-traumatic osteoarthritis (8). Deep infections are particularly devastating, often requiring debridement or hardware removal, and have been reported in up to 8% of cases depending on surgical technique and soft tissue handling (9). Soft tissue compromise is a critical factor, especially in open procedures, as excessive dissection around the proximal tibia can predispose to wound necrosis or delayed healing (10). Implant-related complications such as screw loosening, breakage, or plate prominence may necessitate revision surgery, particularly in the osteoporotic bone where fixation strength is diminished. Furthermore, suboptimal reduction or inadequate fixation can lead to joint incongruity and residual depression, predisposing the joint to early-onset osteoarthritis and reduced functional outcomes (11). Bone grafts, though essential for metaphyseal support, also carry risks—autografts may cause donor site morbidity, while allografts have limited osteogenic potential and pose a theoretical risk of disease transmission (12). Locking plate systems have been shown to reduce some of these complications by providing angular stability and minimizing micro-motion at the fracture site. Studies comparing locking plates to conventional buttress plates suggest improved radiologic alignment and reduced rates of hardware failure (13,14). Nevertheless, complication rates remain non-negligible, often ranging from 10% to 30%, depending on fracture complexity, patient comorbidities, and surgical technique (15). The present study aims to evaluate the complications associated with ORIF using a proximal tibial locking buttress plate with bone graft in the management of Schatzker type II tibial plateau fractures.

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 (16). 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. 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.

Open fracture

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: Hospital stay of the patients (n=20)

Length of stay (week)	Number of Patients	Percentage (%)	Mean± SD
≤1 week	6	30	11±4.86
≤2 weeks	8	40	
≤ 3 weeks	6	30	

The mean hospital stay was 11 days with SD±4.86; the lowest and the highest stays were 4 and 18 days respectively. [Table 7]

Table 8: Post-operative complications (n=20)

Post-operative complications	Number of patients	Percentage (%)
superficial wound infection	01	5 %
superficial wound infection with knee stiffness	01	5%

In terms of complication, 2 (10%) of the patients - had superficial wound infection (1) another patient developed superficial wound infection with knee stiffness, and 18 (90%) cases had no complication. [Table 8]

DISCUSSION

Regarding the age distribution of this study, the mean age is 34.75 years (range is 21 -51). Unnikrishnan et al. (17) 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. (18) 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. (19) showed that their study patients' female ratio was 3:1, and most of the patients were male. Raza et al. (18) 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 fall from height 2 (10 %). Unnikrishnan et al. (17) showed the cause of injury 17(64 %) were 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. (9) 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. (19) also showed a side of involvement, 63% on the right side and 36 % on the left side which is also similar to my study. The mean fracture union time in this study was 90.5 ± 11.27 days, with most patients (60%) achieving union between 76–90 days, and the full range spanning 80 to 120 days. These findings align with those of Manidakis et al., who observed a mean union time of around 93 days in surgically treated tibial plateau fractures (9). Similarly, Papagelopoulos et al. reported average healing times ranging from 10 to 14 weeks in patients managed with open reduction and internal fixation (3). Radiographic outcomes based on the RUST scoring system indicated that 60% of patients had a score of 3, representing significant callus formation and an obscured fracture line, while the remaining 40% scored 2, indicating ongoing healing. These results suggest effective stabilization and satisfactory biological healing. Stevens et al. and Higgins et al. similarly documented effective healing using locking plate systems, reporting radiographic union in most patients by 12 weeks postoperatively (5,11). Postoperative range of motion (ROM) of the affected knee is a critical functional outcome in tibial plateau fractures. Our study demonstrated a mean ROM of 113.5° ± 14.4°, with 90% of patients achieving at least 100° of flexion. Notably, none had ROM below 90°, indicating good functional recovery. These findings are in line with Barei et al., who observed ROM >100° in nearly 85% of patients following dual plating of complex tibial plateau fractures (13). The mean hospital stay in our study was 11 ± 4.86 days, with stays ranging from 4 to 18 days. About 70% of patients were discharged within two weeks. These durations are comparable to the findings of Canadian Orthopaedic Trauma Society, which reported an average stay of 10–14 days for operatively managed bicondylar tibial plateau fractures (10). However, Chin et al. observed shorter hospitalizations with external fixator use, although those cases had a higher rate of complications like pin site infection (15). Regarding the postoperative complication of this study, only superficial infection with good range of movement was found in 1(5%) and superficial infection with knee stiffness in 1 (5%) patient who was given physiotherapy. Unnikrishnan et al. (17) showed that 1(8%) patient with superficial infection which is similar to this study and it is acceptable result. In this study there was no other complication like mal reduction, malalignment and implant failure.

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

The present study highlights that open reduction and internal fixation of Schatzker type II tibial plateau fractures using a proximal tibial locking buttress plate with bone graft is a reliable and effective technique with a low complication profile. The majority of patients achieved timely fracture union, demonstrated good radiographic healing scores, regained satisfactory knee range of motion, and experienced no cases of nonunion, malunion, or significant postoperative complications.

RECOMMENDATION

It is recommended that open reduction and internal fixation using a proximal tibial locking buttress plate with bone graft be considered a preferred surgical option for managing Schatzker type II tibial plateau fractures, as it offers stable fixation, promotes early union, and minimizes postoperative complications.

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