Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 9 September 2023

Research Article

Open Reduction and Internal Fixation of Schatzker Type II Tibial Plateau Fracture by Proximal Tibial Metaphyseal Plate

Muhammad Amzad Hussain[1]*, Shorif Uz Zaman[2], Mohammad Shah Kamal Uddin[3], AKM Harun-Ar-Rashid[4], Mohammad Shaha Alam[4], Ushahla Marma[5] and Ayub Ali[6]

[1]Medical Officer of Orthopaedic Surgery, 250 Bed District Sadar Hospital, Cox's Bazar, Bangladesh

[2]Junior Consultant of Orthopaedic Surgery, 250 Beded General Hospital, Gopalganj, Bangladesh

[3]Junior Consultant of Orthopaedic Surgery, Cox's Bazar Sadar Hospital, Cox's Bazar, Bangladesh

[4]Assistant Professor of Orthopaedic Surgery, Cox's Bazar Medical College, Cox's Bazar, Bangladesh

[5]Assistant Registrar of Orthopaedic Surgery, 250 bed District Sadar Hospital, Cox's Bazar, Bangladesh

[6]Associate Professor of Orthopaedic Surgery, Cox's Bazar Medical College, Cox's Bazar. Bangladesh

***Corresponding Author:** Muhammad Amzad Hussain, Medical Officer of Orthopaedic Surgery, 250 Bed District Sadar Hospital, Cox'sbazar, Bangladesh.

DOI: 10.31080/ASOR.2023.06.0828

Received: August 03, 2023

Published: August 31, 2023

Abstract

Background: Most intra-articular fractures are "tibial plateau fractures". The large amount of bone fragment movement, depression, and complex fracture patterns make it hard to treat impaction of the cancellous "subchondral bone," which damages cartilage.

Objective: To find out the Open Reduction and Internal Fixation of Schatzker type II Tibial Plateau Fracture by Proximal Tibial Metaphyseal Plate.

Methodology: This was a prospective observational study, carried out at NITOR, Dhaka, Bangladesh from July 2019 to June 2021. Purposive sampling technique was used.

Results: Motor vehicle accident accounted for 90.3%, Fall from height was accounted for 9.7%, 64.5% had right and 35.5% had left sided injury. The association between bone graft and outcome was not statistically significant (p value = 0.083 > 0.05).

Conclusion: It may be stated that treatment of a Schatzker type II tibial plateau fracture with a proximal tibial metaphyseal plate results in an excellent to good functional outcome with minimum problems; hence, this procedure is successful and safe.

Keywords: Open Reduction; Internal Fixation; Schatzker type II; Tibial Plateau; Proximal Tibial; Metaphyseal Plate

Introduction

Most intra-articular fractures are tibial plateau fractures. The considerable displacement of bone pieces, associated depression, and intricate fracture patterns make management difficult impaction of the cancellous subchondral bone, causing cartilage damage. Compartment syndrome, cartilage degradation, soft-tissue envelope injury, post-surgery infection, knee instability/stiffness, and early/late post-traumatic arthritis are serious sequelae [1]. Schatzker type II is a split wedge fracture of the lateral column associated with depression and a tibial plateau fracture [2]. Tibial plateau fractures pose a treatment dilemma to the orthopedic surgeon, with little consensus on optimal management [3]. Tibial plateau fractures represent approximately 1% of fractures in adults [4], 56.9% of all proximal tibia fractures/dislocations, and 8% of all fractures in the elderly [5]. They have an annual incidence of 10.3 per 100,000 [6]. Schatzker classification classifies the most prevalent kind as type II, with an epi- to metaphyseal split and lateral tibial plateau articular depression [7].

When the knee is injured, tibial plateau fracture patterns vary. Age affects fracture mechanism and energy. Younger individuals get these fractures from high-energy trauma like a car crash or a fall from a height, while older patients get them from low-energy trauma like a fall [3]. Because of the complex anatomy of the knee joint and the need for anatomic reduction in all intra-articular fractures, open reduction, bone grafting for cancellous bone depression, and stiff internal fixation with plates and screws have been the gold standard for decades [1,8,9]. A spanning the knee external fixator is often needed for soft-tissue resuscitation, pain alleviation, fracture configuration assessment (typically with a CT-scan), and appropriate treatment timing [10].

Age, concurrent health issues, smoking history, occupation, functional capacity, and personal aspirations also influence immediate and long-term benefits. Conservative therapy is reserved for very simple displaced fractures, a tiny fraction of tibial plateau fractures, or very low demand patients with significant comorbidities [1].

Thus, surgery is almost usually used today. Schatzker type II tibial plateau fractures can be treated with percutaneous screw fixation, percutaneous periarticular plate fixation, external fixation, open reduction, internal fixation with screws, k-wires, and buttress plates, or arthroscopically assisted reduction and internal fixation with plating. The best treatment method is still debated [3]. Even with comminuted fractures, a reduction closer to the articulation's morphology with preservation of periarticular soft tissues and tibial epiphysis vascularization is ideal [11]. Some writers advocate arthroscopic aided reduction and internal fixation for some patients (pure depression fractures). This module is limited by the risk of compartment syndrome from irrigation fluid leakage into the tibial compartments, surgical time, and operating room logistics [9,12]. Circular ring fixators are an effective treatment for high-energy fractures with gross intra-articular comminution (AO/OTA category C3) and severe soft-tissue damage [13].

Objective

To find out the Open Reduction and Internal Fixation of Schatzker type II Tibial Plateau Fracture by Proximal Tibial Metaphyseal Plate

Methodology

This was a prospective observational study. The study was carried out at NITOR, Dhaka, Bangladesh. The study was conducted from July 2019 to June 2021. Purposive sampling (non-randomized) was done according to availability of the patients and strictly considering the inclusion and exclusion criteria. Data were collected with a pretested structured questionnaire containing history, clinical examination, laboratory investigations, pre-operative, peri-operative, post-operative complications and post-operative follow up findings. Data sheet was formulated to evaluate the outcomes according to Rasmussen criteria and Hospital for Special Surgery (HSS) criteria. Data were processed and analyzed using computer software program SPSS version 23.0. The data present on categorical scale was expressed as frequency and corresponding percentage, while the quantitative data was presented as mean and standard deviation (SD).

Results

In this study, a total of 31 patients with type II Schatzker tibial plateau fractures who met the inclusion criteria for this thesis were chosen. Patients were examined and treated between September 2019 and May 2021. All patients were observed for a minimum of 24 weeks. The following results were obtained in this series. In this study, the maximum proportion of patients (35.5%) were between the ages of 18 - 31 and 32 - 45. 9 (29%) patients were between the ages of 46 - 59. The range of ages was 18 to 59 years, with a mean age of 37.4 ± 10.9 years. A total of 27 (87.1%) of the study participants were men, while 4 (12.9%) were women (a male-to-female ratio of 6.75:1). 7 (22.6%) cases were businessman, followed by 7 (22.6%) service holder, 5 (16.1%) were student, 5 (16.1%) were farmer, 2 (6.5%) were housewives, 2 (6.5%) were vehicle drivers and 3 (9.7%) were other occupants.

Variables	Frequency	Percentage
Age Range		
18-31	11	35.5%
32-45	11	35.5%
46-59	9	29.0%
Total	31	100.00%
Mean ± SD		37.4 ± 10.9
Gender		
Male	27	87.1%
Female	4	12.9%
Total	31	100%

Table 1: Distribution of socio demographic profile of the patients (N = 31).

Mechanism of injury

In this study, among 31 cases, motor vehicle accident accounted for 28 (90.3%) cases which was the most common cause of injury. Fall from height was accounted for 3 (9.7%) cases. 20 (64.5%) had right and 11 (35.5%) had left sided injury. 11 (35.5%) cases, operation was done between 15 to 19 days after injury and in 20 (64.5%) cases it was 10-14 days. The mean duration of injury to operation was 14.4±2.3 days, ranging from 10 days to 19 days. Distribution of patients according to duration of hospital stay showed

the mean duration was 17.5 ± 2.2 days ranging from 13 days to 22 days. Most of cases stayed at hospital in between 13 to 17 days (61.3%, n = 19). No complication occurred in 29 (93.5%) cases. Superficial wound infection was found in 2 (6.5%) cases. At last, follow up, normal coronal alignments were shown in 27 (87.1%) cases. 50 valgus malalignment was shown in 2 (6.5%) patients and 100 valgus malalignment was shown in 2 (6.5%) patients (Table 2).

Variables	Frequency	Percentage
Mechanism of injury		
Motor vehicle accident	28	90.3%
Fall from height	3	9.7%
Side of injury		
Left	11	35.5%
Right	20	64.5%
Duration of Injury to surgery in days [Mean ± SD 14.4 ± 2.3]		
10-14	20	64.5%
15-19	11	35.5%
hospital stay in days [Mean ± SD 17.5 ± 2.2]		
13-17	19	61.3%
18-22	12	38.7%
Complication		
No Complication	29	93.5%
Superficial wound infection	2	6.5%

Table 2: Distribution of injury among the patients [N = 31].

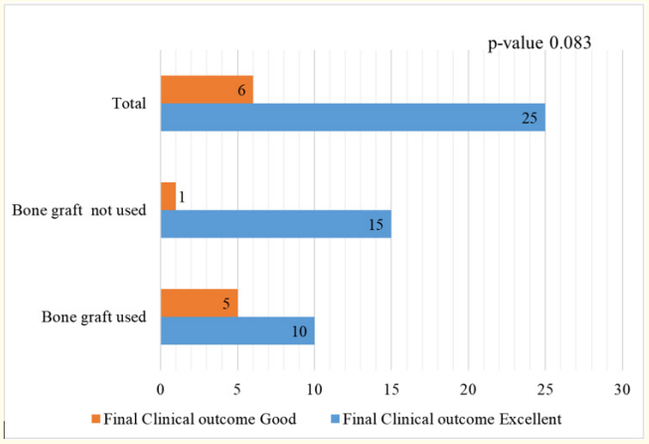

Figure 1: Bar chart distribution of clinical outcome.

Variables	Mean	± SD
Rasmussen radiological criteria		
Articular depression (in mm)	0.68	1.11
Condylar widening (in mm)	0.26	0.68
Angulation (in degree)	0.48	1.50
Range of motion of knee		
Arc of flexion extension of knee (in degree)	126.1	8.2
Extension lag (in degree)	6.6	2.4

Table 3: Distribution of rasmussen radiological criteria and motion knee range among the patients.

Complication

Pain was evaluated with visual analogue scale (VAS) at different follow up. At second follow up, the mean VAS was 4.81 ± 0.87 which has decreased significantly to 3.16 ± 1.04 at 3rd follow up (p value < .0001). Again, at last follow up VAS was 0.29 ± 0.78 after decreasing significantly (p value < .0001). Hospital for Special Surgery (HSS) knee score at different follow up the mean HSS was 22.33 ± 4.59 at 2nd follow up, 65.12 ± 6.47 at 3rd follow up and 87.96 ± 5.01 at last follow up. In every follow up, the score has increased significantly (p value < 0.05). Among 15 cases where bone graft was used, 10 were excellent and 5 were good. Among 16 cases where bone graft was not used, 15 were excellent and 1 was good. The association between bone graft and outcome was not statistically significant (p value = 0.083 > 0.05).]

Rasmussen radiological criteria and motion knee range

The mean arc of flexion extension of knee at last follow up was 126.10 ± 8.20. Again, the mean extension lag was 6.6^0 ± 2.4^0 at last follow up. At last, follow up, the mean angular depression was 0.68 ± 1.1 mm, mean condylar widening was 0.26 ± 0.68 mm and mean angulation was 0.48^0 ± 1.5^0.

Discussion

Tibial plateau fractures are serious injuries, associated with significant secondary early and late complications. Prompt diagnosis, thorough pre-operative assessment of the bony and soft-tissue trauma adequate soft-tissue monitoring and resuscitation, anatomic reduction and sound fixation allowing early joint movement, and intensive rehabilitation often for over 1 year post injury are mandatory for good clinical results [1]. In this study, the highest number of patients 11 (35.5%) were 18-to-31-year age group and in 32-to-45-year age group. Nine (29%) patients were in 46-to-59-year age group. The mean age was 37.4 ± 10.9 years with range from 18 to 59 years. In the series of Biggi., *et al*., (2010) and Kripalani, et al., (2018) the mean age was 43 and 38 years respectively which is similar to my study [18]. Male was 27 (87.1%) and female 4 (12.9%) with a male-female ratio of 6.75:1. In the study of Kayali., *et al.*, (2017) 83.33% cases were male. In other studies, also male were seen predominantly affected from this type of fracture which is similar to this study. Still now in our country, males are taken part in most of the outdoor activities thus expose themselves to motor vehicle accident [19]. This may be the cause of high percentage of male patients suffering this low energy fracture. Regarding

occupations of the study patients, 7 (22.6%) cases were businessman, followed by 7 (22.6%) service holder, 5 (16.1%) were student, 5 (16.1%) were farmer, 2 (6.5%) were housewives, 2 (6.5%) were vehicle drivers and 3 (9.7%) were other occupants. This occupation pattern also signifies the above-mentioned statement that homebound occupants were the least sufferers. In this study, motor vehicle accident accounted for 28 (90.3%) cases which was the most common cause of injury. Fall from height was accounted for 3 (9.7%) cases. Trauma is the prime cause of Schatzker type II fracture. This is evident in the present series. Also seen in other studies like Russell., *et al*., (2009) and Abghari., *et al*., (2016) where the main cause of fracture was motor vehicle accident. Regarding duration of injury to operation, the mean duration was 14.4 ± 2.3 days, ranging from 10 days to 19 days [14,15]. Out of 31 cases, in 11 (35.5%) cases, operation was done between 15 to 19 days after injury and in 20 (64.5%) cases it was 10-14 days. As NITOR is a busy orthopedic hospital with huge load of patients, there was delay in surgery of the cases including COVID-19 pandemic situation. Furthermore, as patients were discharged at 3rd POD, mean duration of hospital stay was 17.5 ± 2.2 days ranging from 13 days to 22 days. Most of cases stayed at hospital in between 13 to 17 days (61.3%, n = 19). The mean duration of follow up was 28.6 ± 2.4 weeks, ranging from 24 weeks to 32 weeks. Among the 31 cases, most of cases were followed up for 30 to 32 weeks (41.9%, n = 13). Ten (32.3%) cases were followed up for 27 to 29 weeks and the rest 8 (25.8%) cases were followed up for 24 to 26 weeks. In the study of Tahririan., *et al*., (2014), the mean duration of follow up was 13.4 months. The duration of this study was limited (only 2 years), long term duration could not be given [16]. In this study, no complication occurred in 29 (93.5%) cases. Superficial wound infection was found in 2 (6.5%) cases. The cases with superficial infection were managed by regular dressing and changing of antibiotic according to culture and sensitivity. Superficial injury was not uncommon following tibial plateau fractures. Likewise in the studies of Biggi., *et al*., (2010) and Tahririan., *et al*., (2014) rate of superficial infections was 5.17% and 5% which is similar to the present study. Pain was evaluated with visual analogue scale (VAS) at different follow up [17]. At second follow up, the mean VAS was 4.81 ± 0.87 which has decreased significantly to 3.16 ± 1.04 at 3rd follow up (p value <.0001). Again, at last follow up VAS was 0.29 ± 0.78 after decreasing significantly (p value < .0001). During operation, soft tissue was handeled very gently. These factors may be contributed to improved pain status of the patients of this study. In the study of Tahririan., *et al.,* (2014) the mean VAS pain severity score at the end of 6 months was 4.45 which is similar to the present study.

Conclusion

The proximal tibial metaphyseal plate is a surgical technique that has been shown to yield excellent to good functional outcomes for Schatzker type II tibial plateau fractures. The study found that patients who underwent the procedure experienced significant improvements in their functional abilities, such as increased range of motion, reduced pain, enhanced weight-bearing capacity, and a faster return to daily activities compared to non-surgical or alternative treatment methods. The low rate of complications, such as infection, hardware failure, and malalignment, contributes to the overall safety of the procedure. The success of the proximal tibial metaphyseal plating approach may be attributed to its ability to provide stable fixation and anatomical reduction of fractured fragments. This technique allows for optimal healing and functional recovery, leading to the excellent clinical outcomes observed in the study. Orthopedic surgeons and healthcare providers should consider the proximal tibial metaphyseal plating method as a viable treatment option for patients seeking improved functional outcomes and reduced postoperative complications. However, individual patient factors and fracture characteristics should be considered, and a personalized treatment plan should be formulated to ensure the best possible outcomes for each patient.

Bibliography

1. F Biggi SDFDT. "Tibial plateau fractures: internal fixation with locking plates and the MIPO technique". *Injury* 41.11 (2010): 1178-1182.

2. Mauricio Kfuri JS. "Revisiting the Schatzker classification of tibial plateau fractures". *Injury* 49.12 (2018): 2252-2263.

3. Russell N., *et al*. "Tibial plateau fractures treated with plate fixation: To lock or not to lock". *European Journal of Orthopaedic Surgery and Traumatology* 19 (2008): 75-82.

4. Marsh JL and Saltzman CL. "Rockwood and Green's fractures in adults". *Ankle Fractures* 2 (2001): 2001-2090.

5. Christian M and Schmidt II JPSJTR. "Tibial Plateau Fracture". In: Nikolopoulos DD, Safos GK, Michos J, editors. Tibia Pathology and Fractures. Rijeka: IntechOpen (2020): 1.

6. Rasmus Elsoe PLNPHNJSSRSEO. "Population-Based Epidemiology of Tibial Plateau Fractures". *Orthopedics* 38.9 (2015): e780-786.

7. Prall WC RMFJHFMHBWKT. "Schatzker II tibial plateau fractures Anatomically precontoured locking compression plates seem to improve radiological and clinical outcomes". Injury 51.10 (2020): 2295-301.

8. Ebraheim NA., *et al.* "Open reduction and internal fixation of 117 tibial plateau fractures". *Orthopaedics* 27.2 (2004): 1281-1287.

9. Musahl V., *et al.* "New trends and techniques in open reduction and internal fixation of fractures of the tibial plateau". *The Journal of Bone and Joint Surgery (American Volume)* 91 (2009): 426-433.

10. Dirschl D and del Gaizo D. "Staged management of tibial plateau fractures". *American Journal of Orthopedics (Belle Mead NJ)* 36 (2007): 12-17.

11. Vendeuvre T., *et al.* "Contribution of minimally invasive bone augmentation to primary stabilization of the osteosynthesis of Schatzker type II tibial plateau fractures: Balloon vs bone tamp". *Clinical Biomechanics* (2018): 59.

12. Belanger M and Fadale P. "Compartment syndrome of the leg after arthroscopic examination of a tibial plateau fracture. Case report and review of the literature". *Arthroscopy* 13 (1997): 646-651.

13. Hall J., *et al.* "Open Reduction and Internal Fixation Compared with Circular Fixator Application for Bicondylar Tibial Plateau Fractures: Surgical Technique". *The Journal of Bone and Joint Surgery (American Volume)* 91.2-1 (2009): 74-88.

14. Russell N., *et al.* "Tibial plateau fractures treated with plate fixation: To lock or not to lock". *European Journal of Orthopaedic Surgery and Traumatology* 19 (2008): 75-82.

15. Abghari M., *et al.* "Are locked plates needed for split depression tibial plateau fractures? *Journal of Knee Surgery* 29.6 (2016): 482-486.

16. Tahririan MA., *et al.* "Comparison of functional outcomes of tibial plateau fractures treated with nonlocking and locking plate fixations: A nonrandomized clinical trial". *ISRN Orthopedics* (2014): 1-6.

17. Biggi F., *et al.* "Tibial plateau fractures: internal fixation with locking plates and the MIPO technique". *Injury* 41.11 (2010): 1178-1182.

18. Kripalani S. "Stability of Raft construct through Locking Compression Plate for depressed Tibial Plateau Fractures". *Journal of Trauma* 13.3 (2018): 14-18.

19. Kayali C., *et al.* "Subchondral raft construction with locking plates for the treatment of Schatzker type II fractures". *Acta Ortopédica Brasileira* 25.3 (2017): 99-102.