Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Orthopedic Surgery

The Role of Early Mobilization in Outcome of Proximal Tibia Fractures Treated with Dual Plating

Abdullahel Wafee[1*], Ashoke Kumar Modak[2], Mohammad Asif[3], Nabil Zunayed Sidny[4]

[1]Assistant Registrar, Department of Orthopedic Surgery, Kurmitola General Hospital, Dhaka, Bangladesh
[2]Medical Officer (Orthopedic), Kurmitola General Hospital, Dhaka, Bangladesh
[3]Medical Officer (Orthopedic), Kurmitola General Hospital, Dhaka, Bangladesh
[4]Assistant Professor, Dept. of Orthopaedic and Trauma Surgery, Shaheed Monsur Ali Medical College, Dhaka, Bangladesh

DOI: https://doi.org/10.36347/sjams.2024.v12i08.006 | **Received:** 05.06.2024 | **Accepted:** 12.07.2024 | **Published:** 13.08.2024

***Corresponding author: Abdullahel Wafee**
Assistant Registrar, Department of Orthopedic Surgery, Kurmitola General Hospital, Dhaka, Bangladesh

Abstract **Original Research Article**

The management of bicondylar fracture of the proximal tibia is a challenging task and the aim of management is to achieve stable, painless and mobile joint and also to prevent the secondary degeneration ofthe joint. Open reduction and internal fixation with dual plating in such fractures is beneficial to address fracture fragments in different planes and also to achieve anatomical reduction under direct vision. It also allows stabilizing the fracture which helps in early mobilization of the patient. Early post-op rehabilitation is one the most important factor that play a vital role in outcome of the operated knees by preventing the post- operative stiffness and achieving good range of motion. This is a retrospective study conducted in Department of Orthopedic Surgery, Kurmitola General Hospital, Dhaka, Bangladesh from July to December 2022. Total 100 patients were included in the study. The functional outcome was evaluated according to Rasmussen scoring system. Mal-reduction of the articular surface was defined as an intra-articular step-off of at least 2 mm measured on scaled radiographs. Oldest patient was 71 years and youngest patient was 20 years old. Male were 79% and female were 21%. All the patients with bicondylar fracture treated with dual plating. Data was obtained from the Medical record department, indoor ward records, OPD registers and Operation theatre records. This study analyses the outcome of bicondylar proximal tibia fracture treated with dual plating in 100 patients. In our series we found 63 % excellent results and 28 % good results, while 7 % and 2% fair and poor outcome respectively. Fractures of proximal tibia are increasing with the increase in mechanization and increased road traffic in current world today. These fractures are more in men and those who use automobiles frequently for their outdoor ventures. Better preoperative planning in selection of approach can minimize the soft tissue injury and unnecessary periosteal stripping. Stable fixation with dual plating with or without use of bone graft to provide support for subchondral area is important in prevention of loss of reduction; unionas well allows early mobilization.

Keywords: Outcome, Proximal Tibia Fractures, Dual Plating.

1.INTRODUCTION

The history of treating these fractures dates back to the 2nd century, when Arabs used plaster to immobilize limbs. Until the end of the 18th century, the main treatment was the use of splints. In 1805, Samuel David introduced skin traction in the form of adhesive tape to reduce and stabilize these fractures. A detailed description of proximal tibia fractures was first given by Sir Astley Cooper in 1825. Cotton and Berg [1] first called these fractures "bumper fractures", which often occur in patients hit by automobiles. Bahr et al., [2] were the first to describe the mechanism behind proximal tibial fractures. Tibial plateau fractures are challenging due to their increasing incidence, complexity, associated complications, and availability of various treatment options. Conservative management was previously the mainstay of treatment, leading to joint incongruity, early osteoarthritis, and knee stiffness. Over time, there has been a better understanding of how the knee joint works, the mechanisms involved in the fracture, the importance of a congruent reduction and stable fixation to promote early mobility, improved implants, and improved antibiotic defense against infection. Internal fixation of fractures is now a more acceptable treatment method than conservative treatment. Although various options are available, the method of definitive fixation remains controversial. Open reduction and internal fixation is the best method to achieve the goal of anatomic reduction, but has historically been associated with a

higher incidence of complications, including: A. Soft tissue damage and increased serious wound-related complications. Alternative methods are discussed with their respective advantages and disadvantages.

As mechanization and acceleration increase, the frequency and severity of locomotion fractures increases. Bumper fractures are pedestrian injuries that occur when a non-moving body part is injured by a moving object. These forces can result in impingement, deflection, rotation, or shear stress. In our study, we examined the functional outcomes of high-energy fractures such as Schatzker type V and type VI tibial plateau fractures treated with double-plate and double-approach treatment. None of the patients had wound infections, and all had excellent xenograft integration and subsequent union. Luo *et al.*, [3] proposed a new classification of proximal tibial fractures based on CT scan findings. All fractures were classified as "three-column fractures," which means that at least one separate fragment was found in the lateral, medial, and posterior columns of the proximal tibia (Schatzker classification types V and VI). Three-column fixation is a new fixation concept for the treatment of complex tibial plateau fractures, and is especially useful for multiplanar posterior column fractures. The combination of a posterior approach and an anterior-lateral approach is a safe and effective method for direct reduction and satisfactory fixation of such challenging tibial plateau fractures.

2.MATERIALS AND METHODS

This is a retrospective study conducted in Department of Orthopedic Surgery, Kurmitola General Hospital, Dhaka, Bangladesh from July to December 2022. Total 100 patients were included in the study. The functional outcome was evaluated according to Rasmussen scoring system Rasmussen et al., [4] Mal-reduction of the articular surface was defined as an intra- articular step-off of at least 2 mm measured on scaled radiographs. Oldest patient was 71 years and youngest patient was 20 years old. All the patients with bicondylar fracture treated with dual plating. Data was obtained from the Medical record department, indoor ward records, OPD registers and Operation theatre records.

Inclusion criteria of the study were:

- Bicondylar tibia fractures treated with dual plating.
- No previous involvement of ipsilateral leg in surgery.
- No previous arthritis or any other joint abnormality.

The hospital data sheet included brief history of the incident, mechanism of injury, delay in surgery and operative notes. Preoperative conditions, preoperative x-rays and post-operative x-rays with details of wound condition, period of immobilization, period of non-weight bearing, status of range of motion with each follow up was obtained though their follow-up outdoor patient medical notes. The data records were specifically searched for intraoperative and postoperative complications. The patients were contacted on phone and/or conventional mail. All the patients were informed of the study and consent to participate was taken. Alignment of the proximal tibia was determined by measuring the tibial plateau angle (the medial angle between the tangential line and anatomic axial of the tibia) on anteroposterior radiographs and the posterior slope angle (the angle between the tangential line of medial plateau and the perpendicular line of the anterior tibial cortex) on lateral radiographs. Tibial plateau angle more than 90° or less than 80° or posterior slope angle equal or more than 15° or equal or less than−5° was considered indicative of mal alignment. All patients were given preoperative antibiotics (1.5 gm cefuroxime intravenous) as per the institution protocol after testing for any allergic reaction. The operative procedures were performed in a standard operating room under regional or general anaesthesia and tourniquet control. The fractures were approached through anterolateral, posteromedial, medial and lateral side depending upon the fracture configuration.

Table-1: Materials

Material that were used in fixation of Shatzker‟s type V and type VI fractures are-	Proximal tibia locking plate Medial buttress locking plate. T-buttress plate. 6.5 mm cancellous screws (plain and locking) 4.5 mm locking screw 3.5 mm cortical and locking screw. Bone graft (+/-)

Table-2: Evaluation and grading of the obtained results (clinical score) are according to following criteria

Range of flexion	Extension leg	Thigh atrophy	Stability
• >130 degree • 110 – 129 degree	1. None 2. 1 – 5 degree 3. 6 – 10 degree	• None • >0 to 1 cms • >1 to 3 cms	Normal Mediolateral -stable in extension, 5-10 degree instability in 30 degree flexion

Range of flexion	Extension leg	Thigh atrophy	Stability
• 90 -109 degree • <90 degree	4. >10 degree	• > 3 cms	Anteroposterior – grade I instability (lachman test) Medio-lateral – up to 10 degree instability in extension Antero-posterior – grade II instability (lachman) Instability- >10 degree in medio-lateral plane Grade III instability in antero-posterior plane.

3. RESULTS

Total 100 patients were included in the study. Oldest patient was 71 years and youngest patient was 20 years old. Male were 79% and female were 21%. All the patients with bicondylar fracture treated with dual plating. Incidence of the fracture pattern in the age group are needed for the evaluation of the outcome in fractures treated with dual plating, as they pose a difference in the response to postoperative rehabilitation which then directly affects the post- operative outcome. Tibial plateau fractures are more common in the age group of young active and productive population who are more involved in outdoor activities. Response of this young age group to the fixation is better due to greater ability of osteogenesis in comparison to the older age group. Outcome of the tibial plateau fracture is fairly affected by the gender of the patient which attributes to the fact that many of the young male patient have more muscle mass, strong ligaments and greater ability to comply with the post-operative rehabilitation protocol. The relation of fractures treated with dual plating with the gender of the patients. Majority of the fractures were involved in males compared to females. The occupation which involves more traveling from one place to another were more likely to be related in high energy injuries. In our study we found greater percentage of the patients were students, drivers and office workers who had to travel every day. In our study there was a higher incidence of fractures on right leg compared to left (table-3).

Table 3: Clinical characteristics of the study population (n=100)

Variables	Number	Percentage
Age in yrs		
<20 yrs	05	5%
20-29 yrs	44	44%
30-39 yrs	25	25%
40-49 yrs	12	12%
50-59 yrs	10	10%
>60 yrs	04	4%
Sex		
Male	79	79%
Female	21	21%
Occupation		
Student	32	32%
Office workers	22	22%
Drivers	35	35%
Housewives	06	6%
Farmers	05	5%
Laterality Of Fracture		
Right	71	71%
Left	29	29%

Table 4: Type of fracture and use of bone graft (N=100)

Type	N	%	Bone Graft	N	%
Type V	59	59%	Yes	75	75%
Type VI	41	41%	No	25	25%
TOTAL	100	100%	Total	100	100%

Table-4 shows that the incidences of type V fractures treated with dual plating were more than the type VI fractures. Shatzker‟s type V and type VI fracture were normally associated with more comminution and depression due to collapse of the cancellous part of condyles. To fill the gap created due to collapse use of bone graft is common in such type of fractures. In our study three fourth of the fractures treated with dual plating were done with the use of bone graft.

Period of Immobilisation: One of the most important factors that was found to influence the outcome of these fractures was the period of immobilization. In our study majority of the treated patients were mobilized within first week of the surgery as soon as the patient started tolerating the pain. Mobilization in some patients was delayed because of their intolerance to pain or delayed follow up (fig-1).

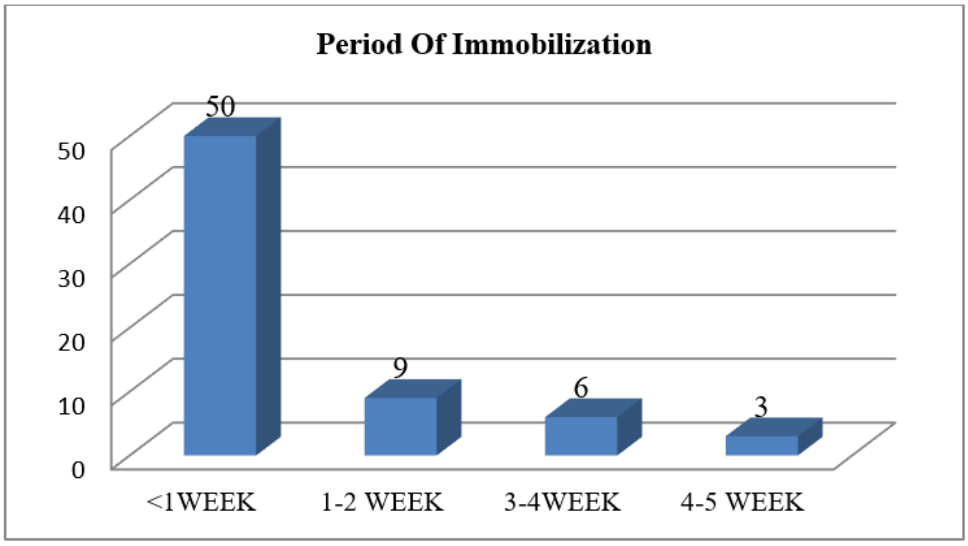

Fig 1: Period of Immobilisation

Associated Injuries: Associated injuries along with the tibial plateau fractures affect the outcome due to delay in immobilization, infection, and relatively poor compliance to the post-op rehabilitation (fig-2).

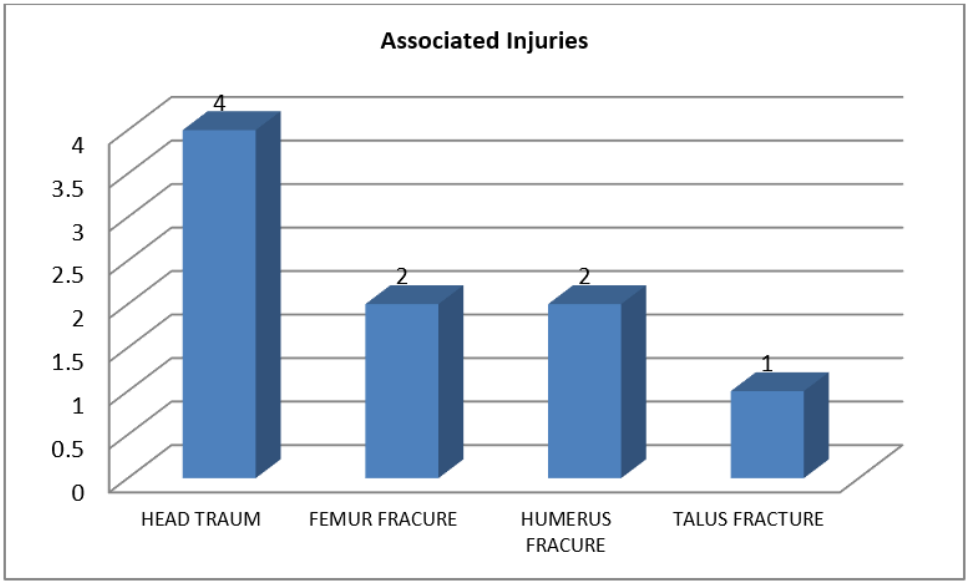

Fig 2: Associated Injuries

Table 5: Clinical results of outcome

Results	Number	Percentage
Excellent	63	63%
Good	28	28%
Fair	7	7%
Poor	2	2%

Out of 68 cases treated with dual plating 63% of the patients showed excellent outcome, 28%. showed good outcome and 7 % revealed fair outcome while 2 % showed outcome to be poor both clinically and functionally. Fair outcome was found mainly in patients with comminuted fracture, delayed mobilization or

associated injuries. Poor outcome was found to be higher in those who had associated ipsilateral comminuted supracondylar fracture (table-5).

Table-6: Association of the outcome in type of the fracture

Type of fracture	RESULTS	Total Cases
TYPE V	Excellent-37 \Good –17 Fair- 5 Poor- 0	59
TYPE VI	Excellent- 19 Good – 12 Fair- 7 Poor- 3	41
Total		100

Above results of the outcome with type V and type VI fractures treated with dual plating clearly depict that type V fractures have better prognosis in comparison to type VI (table-6).

4. DISCUSSION

Tibial plateau fractures especially type V and type VI pose a challenge to orthopaedic surgeons for being very complex, as they are associated with significant amount of comminution, severe soft tissue and ligament injuries, and associated other long bony injuries. Fernandez DL et al., [5] recommended the anterior approach with osteotomy of tibial tubercle in treatment of patients who have a severely displaced bicondylar fracture of proximal end of the tibia. Mallik AR et al., [6] used a technique of indirect reduction followed by application of a hybrid circular external fixator, noting stability similar to that of an open reduction and internal fixation but with fewer complications. Stamer DT et al., [7] studied bicondylar tibial fracture in 22 patient treated with hybrid external fixator and concluded that this method provides good stabilization and allows early range of motion for complex tibial plateau fractures where extensive dissection and internal fixation is contraindicated due to traumatized soft tissue, osteopenia, and fracture comminution. During such situations if the wage earner gets injured then there is tremendous pressure on the family. Hence it not only affects the man himself but the entire family. So the aim towards treatment of these fracture are. In our study, individuals in between 20-49 years are the ones who have maximum incidence of these high energy fractures. Boume in 1981 has also presented with similar results with 74 % of the patients in the age group between 15-55 years, whereas 79 % of the patients present in the age group of 20-49 years. Our study also correlates well with the results of the study conducted by Seppo in 1993 on 130 patients where maximum patients belong to middle age group 30-49 years. While study done by Vasanand et al., [8] found 75 % patient were in age group 30-50 years. In our study 79% of the patients were males. In a Bangladeshi setup this data can be attributed to the fact that the males are more involved in outdoor works, driving and sports while most females are involved in house hold work. This correlates well with the study done by Vasanand et al., [8] who found 90 % of the patients were male and Wu et al., [9] found 75 % male prevalence in their studies. Relation with occupation also follows the same as greater portion (93 %) of the fractures were involved among those associated with more outdoor activities as travelling to work, students, and drivers. While incidence was less common amongst those who would engage less in such activities e.g. farmers and house wives (7 %). Besides motor vehicular accidents these injuries were also found to result from a fall from height and less common with trivial fall. Prevalence in type V fractures 59 % and type VI 41%. Prasad et al.,[10] reported 50-50% involvement of both types of the fractures. Wu et al., [9] found 55 % prevalence of type V fractures. In our study we found that 74 % patients were mobilized within first week of surgery as the principle of anatomical reduction, stable fixation and early mobilization was followed. 13 % patients were mobilized in 2nd week while rest 13 % were mobilized in 3rd to 5th week because of associated injuries. Vasanand et al., [8] in their study of 32 patients mobilized 24 patients within 10 days. Benefits of early mobilization gives better results in terms of good range of motion, less stiffness, and quick articular healing. However, these benefits have to be balanced against complications which can be associated with early loss of reduction in severely comminuted fractures, extensive internal soft tissue insult, associated ligament injuries and other associated fractures involving ipsilateral limb. In these cases, giving significant amount of time for soft tissue healing may benefit to reduce the surgical wound related problems as well as help in better compliance to the post-operative rehabilitation programme. Shatzker, Robert Mc Broom et al., [11], Magonhobi and Steven, Gausewitz et al., [12] stated that prognosis or outcome results of these fractures can be given with consideration of the amount of displacement, comminution, depression, type of fracture, and quality of post-operative care along with rehabilitation programme. Most of bicondylar fractures are known to be associated with significant internal soft

tissue insult which appear in the form of swelling and fracture blisters. Therefore, all such fractures were operated 2 or 3 days after injuries. Duration of time between injury and the surgery varied from days to weeks in presence of fracture blisters as surgery with persistent swelling may complicate the closure of the fascia. In our study there was only 1 patient who suffered from compartment syndrome in early post op period owing to preoperative swelling which resulted in tight closure. Emergency release was done and with delayed secondary closure along with flap surgery, patient recovered with good results. The severity of articular irregularities correlated poorly with the degenerative process. Associated ligamentous injuries as well as postoperative infection increase the incidence of secondary degeneration [13]. In our study, majority of the patients were in relatively young age group 20-39, which could be the reason for no new osteoarthritic changes found in the series. In our series we found 63 % excellent results, 28 % good results, 7 % fair and 2% poor results. These results are comparable to various other studies done. Chang-Wug Oh et al., [14] reported excellent results in 21 patients out of 23 patients. All cases with bicondylar tibial fracture operated with dual plating are included in this study, while some of the bicondylar fractures which were managed with single plate for one plateau and screws for other plateau are not included. There were 75 % patients treated with use of bone graft (auto grafts) while 25% without use of the primary bone graft. Use of bone graft is necessary in such fractures as they involve significant amount of comminution and depression which need to be elevated to achieve articular congruous reduction. Use of bone grafting in form of autograft or allograft improve the outcome in treated fractures [15-17].

5. CONCLUSION

With the increase in mechanization and road traffic in today's world, there has been an increase in proximal tibia fractures. These fractures are more common in men and those who frequently use cars for outdoor activities. The skin must be healthy to withstand the stress of a double incision and free of bruising or abrasions that may affect wound healing. Swelling at the fracture site may make closure after fixation difficult. Better preoperative planning in choosing the approach can minimize soft tissue damage and unnecessary periosteal removal. This also avoids the risk of flap necrosis. Early action is key to a good outcome. Stable fixation with double plating, with or without the use of bone graft to support the subchondral area, is important to prevent loss of reduction. Association also allows early mobilization.

BIBLIOGRAPHY

1. Cotton, F. J., & Berg, R. (1929). Fender fracture of the tibia at the knee. New England Journal of Medicine, 201(20), 989-995.
2. Barr J.S., 1940 " The treatment of the fractures of tibial condyle", J.A.M.A. 115 : 1683
3. Luo, C. F., Sun, H., Zhang, B., & Zeng, B. F. (2010). Three-column fixation for complex tibial plateau fractures. Journal of orthopaedic trauma, 24(11), 683-692.
4. Rasmussen, P. S. (1973). Tibial condylar fractures: impairment of knee joint stability as an indication for surgical treatment. JBJS, 55(7), 1331-1350.
5. Fernandez, D. L. (1988). Anterior approach to the knee with osteotomy of the tibial tubercle for bicondylar tibial fractures. JBJS, 70(2), 208-219.
6. Mallik, A. R., Covall, D. J., & Whitelaw, G. P. (1992). Internal versus external fixation of bicondylar tibial plateau fractures. Orthopaedic review, 21(12), 1433-1436.
7. Stamer, D. T., Schenk, R., Staggers, B., Aurori, K., Aurori, B., & Behrens, F. F. (1994). Bicondylar tibial plateau fractures treated with a hybrid ring external fixator: a preliminary study. Journal of orthopaedic trauma, 8(6), 455-461.
8. Vasanad, G. H., Antin, S. M., Akkimaradi, R. C., Policepatil, P., & Naikawadi, G. (2013). Surgical management of tibial plateau fractures–a clinical study. Journal of clinical and diagnostic research: JCDR, 7(12), 3128.
9. Wu, D., Reng, G., Shrivastava, A., Yu, Y., Zhang, Y., & Peng, C. (2015). A useful surgical strategy for proximal tibial fractures (AO/OTA type 41-C) with diaphyseal involvement. International Journal of Clinical and Experimental Medicine, 8(8), 13455.
10. Prasad, G. T., Kumar, T. S., Kumar, R. K., Murthy, G. K., & Sundaram, N. (2013). Functional outcome of Schatzker type V and VI tibial plateau fractures treated with dual plates. Indian journal of orthopaedics, 47(2), 188-194.
11. Schatzker, J., Mcbroom, R., & Bruce, D. (1979). The Tibial Plateau Fracture: The Toronto Experience 1968-1975. Clinical Orthopaedics and Related Research (1976-2007), 138, 94-104.
12. GAUSEWITZ, S., & HOHL, M. (1986). The significance of early motion in the treatment of tibial plateau fractures. Clinical Orthopaedics and Related Research (1976-2007), 202, 135-138.
13. Honkonen, S. E. (1995). Degenerative arthritis after tibial plateau fractures. Journal of orthopaedic trauma, 9(4), 273-277.
14. Oh, C. W., Oh, J. K., Kyung, H. S., Jeon, I. H., Park, B. C., Min, W. K., & Kim, P. T. (2006). Double plating of unstable proximal tibial fractures using minimally invasive percutaneous osteosynthesis technique. Acta orthopaedica, 77(3), 524-530.
15. Bucholz, R. W., Carlton, A., & Holmes, R. (1989). Interporous hydroxyapatite as a bone graft substitute in tibial plateau fractures. Clinical Orthopaedics and Related Research (1976-2007), 240, 53-62.
16. Lachiewicz, P. F., & Funcik, T. (1990). Factors influencing the results of open reduction and internal

fixation of tibial plateau fractures. Clinical Orthopaedics and Related Research®, 259, 210-215.

17. Lobenhoffer, P., Gerich, T., Witte, F., & Tscherne, H. (2002). Use of an injectable calcium phosphate bone cement in the treatment of tibial plateau fractures: a prospective study of twenty-six cases with twenty-month mean follow-up. Journal of orthopaedic trauma, 16(3), 143-149.