How to Cite:
Jain, P., & Rathore, S. S. (2022). Compare the functional and surgical outcomes of operative treatment of unicondylar and bicondylar tibia fractures. *International Journal of Health Sciences*, *6*(S4), 11696–11705. https://doi.org/10.53730/ijhs.v6nS4.11279

Compare the functional and surgical outcomes of operative treatment of unicondylar and bicondylar tibia fractures

Dr. Pravesh Jain
Assistant Professor, Department of Orthopaedics, Ruxmaniben Deepchand Gardi Medical College, Ujjain, M.P.

Dr. Siddharth Singh Rathore*
Assistant Professor, Department of Orthopaedics, Ruxmaniben Deepchand Gardi Medical College, Ujjain, M.P.
*Corresponding Author

***Abstract*---**Background & Method: The aim of this study is to compare the functional and surgical outcomes of operative treatment of unicondylar and bicondylar fractures. During this period 50 patients were treated for tibial plateau fractures. All patients are selected on the basis of history, clinical examination and radiography. The Schatzker's classification was used to classify these fractures. The patients were followed up for an average period of 6 to 12 months. Result: In group 1 mean injury to surgery time (in days) was 1.24 ± 0.831 and in group 2 was 2.08 ± 1.115, p value was (0.0042)<0.05, therefore there is significant difference in group 1 and group 2 with respect to injury to surgery time (in days). In group 1 mean range of motion (ROM) was 131.2 ± 6.337 and in group 2 was 130.4 ± 7.059, p value was (0.675)>0.05, therefore there is no significant difference in group 1 and group 2 with respect to range of motion (ROM) (in degree). Conclusion: Comparing the functional results of this study with those reported in the recent literature is complicated by the use of differing classification schemes, outcome measures, and treatment techniques. In our study the surgical and functional outcomes of both unicondylar and bicondylar fractures of proximal tibia are satisfactory and comparable to each other. Time taken for fracture union was same for both unicondyar and bicondylar fractures. Injury to surgery interval was slightly more for bicondylar fracture as compared to unicondylar fractures. This can be attributed to more swelling and associated soft tissue injuries in case of bicondylar fractures.

***Keywords*---**surgical, tibia, outcomes, operative, unicondylar, bicondylar fractures.

Introduction

Tibia plateau fractures constitute 1%of all fractures [1]. Bicondylar fractures account for 10-30%, whereas isolated medial and lateral condyle fractures constitute the remaining injuries. Although only 3% of these fractures are open injuries, many of them have closed degloving, deep abrasions or severe soft tissue injuries which require careful consideration in deciding timing and the nature of surgery [2]. Fractures in men tend to occur at younger age and tend to be the result of high energy trauma; women have increasing incidence with advancing age due to osteoporosis. Moore et al. [1] reported average age of 44 years with 62% fractures occurring in men. Proximal tibia fractures may be difficult to treat even in experienced hands due to intracrticular extension,comminution, cartilage damage and soft tissue injuries of the cruciate ligaments and menisci [3, 5]. Physical examination is very important in view of risk of compartment syndrome that may be associated with certain fracture patterns. Imaging studies should be of good quality in order to demonstrate clearly the location of fracture, pattern of fracture and the degree of displacement.

Newer methods of treatment have changed the surgical management of both low energy lateral condyle fractures and high energy medial or bicondylar fractures. Fractures occurring in high energy trauma, sports activities may have associated articular cartilage damage and hence poor outcomes and prognosis [3, 4]. Incidence is on the rise due increased road traffic accidents, sports activities and ageing population. [4]

Not every fracture requires surgery, presently conservative treatment is only for undisplaced or minimally displaced without any associated soft tissue and neurovascular injury. [6] Treatment concepts based on restoring or preserving limb alignment lead to satisfactory outcome for most patients; poor alignment will lead to poor results. The aim of surgery is anatomical reduction and stable fixation to allow early non weight bearing mobilization and knee bending exercises to prevent development of any arthritic changes [3, 5, and 7]. The optimal technique for a given fracture pattern is uncertain because of complexities of these fractures and difficulty of the techniques, their clearly is room for treatment to be based on personal preferences and experience of the surgeon.

Material & Method

This is a prospective study of Surgical and functional outcome of proximal tibial fractures in the department of orthopedics at our hospital from September 2020 to February 2022. Clearance was obtained from hospital ethical committee. During this period 50 patients were treated for tibial plateau fractures. All patients are selected on the basis of history, clinical examination and radiography. The Schatzker's classification was used to classify these fractures. The patients were followed up for an average period of 6 to 12 months. We divided these fractures into two groups-group-1 and group2.Group 1 includes unicondylar and depressed fractures i.e. Schatzker type 1,2,3,4. There are total 25 patients in group 1.Group 2 includes bicondylar fractures i.e. Schatzker type 5, 6. There are 25 patients in group 2. All cases were treated with open reduction and internal fixation.

We have used various treatment modalities depending on the different fracture patterns. Close reduction with percutaneous screws were used in 7 cases ,open reduction internal fixation with cc screws in 2 cases ,open reduction and internal fixation with one plate in 13 cases, open reduction and internal fixation with one plate and cc screws in 9 cases and open reduction and internal fixation with two plates in 18 cases.

Inclusion criteria

1. Adults aged over 18 years (skeletally mature), all males and females having proximal tibia metaphysis fracture (closed and up to grade IIIb compound)
2. Patients willing for treatment and given informed written consent.

Exclusion criteria

1. Patients aged below 18 years.
2. Patients medically unfit for surgery.
3. Patients with neuro vascular injuries (grade IIIc compound injuries)
4. Patients not willing for surgery.
5. Patients having chronic neuromuscular problems affecting the limb
6. Patients concurrent lower limb fractures
7. Patients having previous unrelated surgeries in the area of study.

52 year old female, a case of RTA, sustained Schatzker type 2 fracture of the left tibia. She was treated with orif lateral LCP plus elevation and bonegrafting.

Fig 1. Preoperative x-ray

Fig 1A- X-ray at6 weeks follow up

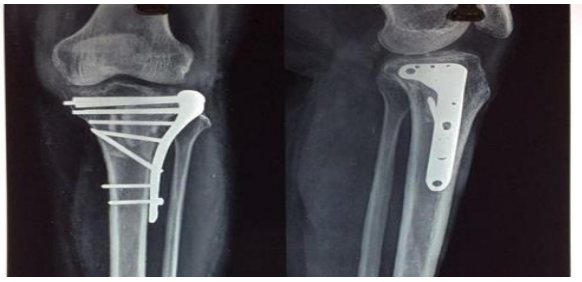

Fig 1B- X-ray at 3 months follow up

49 year old male, a case of RTA, sustained type 6 Schatzker fracture. He was treated with orif with lateral LCP plus posteromedial LCP.

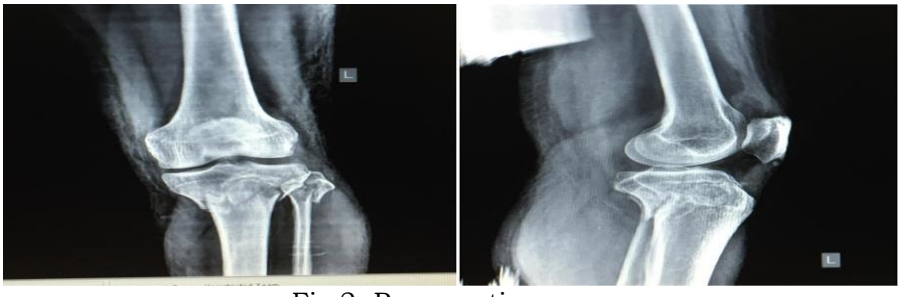

Fig.2. Preoperative x-ray

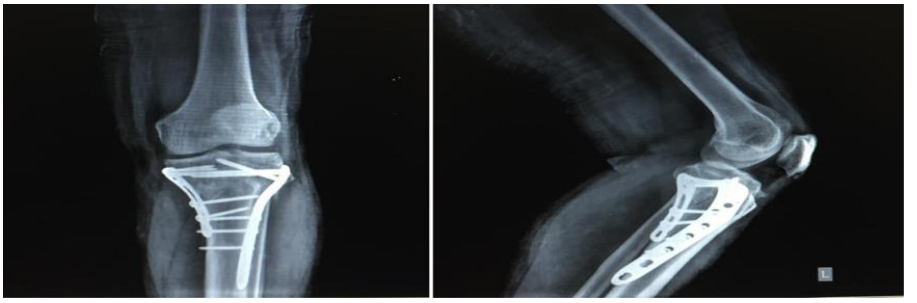

Fig 2A- 6 weeks follow up

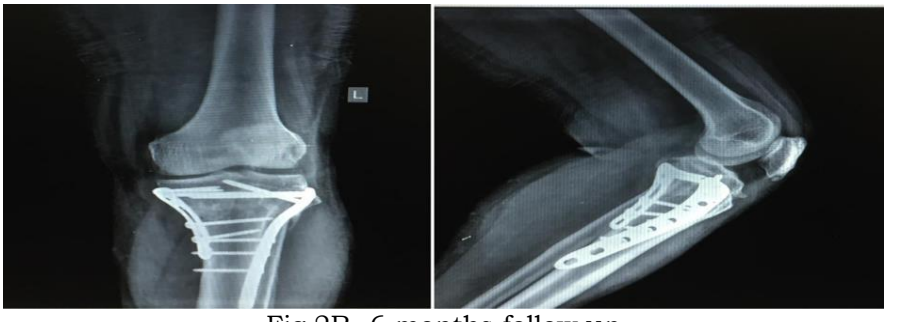

Fig 2B- 6 months follow up

Results

Table 1: comparison of union time between both the study groups

Variables	Group	N	Mean	SD	p-value
UNION TIME (IN MONTHS)	I	25	3.04	0.3512	0.593
	II	25	3.1	0.433	

In group 1 mean union time was 3.04 ± 0.351 and in group 2 was 3.1± 0.433, p value was (0.593)>0.05, therefore there is no significant difference in group 1 and group 2 with respect to union time (months).

Table 2: comparison of injury to surgery interval between both the study groups

Variables	Group	N	Mean	SD	p-value
INJURY TO SURGERY TIME (IN DAYS)	I	25	1.24	0.831	0.0042
	II	25	2.08	1.115	

In group 1 mean injury to surgery time (in days) was 1.24 ± 0.831 and in group 2 was 2.08 ± 1.115, p value was (0.0042)<0.05, therefore there is significant difference in group 1 and group 2 with respect to injury to surgery time (in days).

Table 3: comparison of range of motion between both the study groups

Variables	Group	N	Mean	SD	p-value
RANGE OF MOTION (IN DEGREE)	I	25	131.2	6.337	0.675
	II	25	130.4	7.059	

In group 1 mean range of motion (ROM) was 131.2 ± 6.337 and in group 2 was 130.4 ± 7.059, p value was (0.675)>0.05, therefore there is no significant difference in group 1 and group 2 with respect to range of motion (ROM) (in degree).

Table 4: groupwise analysis of patients

VARIABLE	GROPUP 1 SCHATZKER 1 TO 4 [MEAN] N=25	GROUP 2 SCHATZKER 5,6 [MEAN] N=25	P VALUE
AGE	45.72 ±10.85	46.4 ±8.602	0.807
GENDER(M:F)	18:7	21:4	
BMI	23.05 ±2.575	24.12 ±1.40	0.076
UNION TIME	3.04 ± 0.3512	3.1 ± 0.433	0.593
INJURY TO SRGERY INTERVAL	1.24 ± 0.831	2.08 ± 1.115	0.0042
FOLLOW-UP TIME	12.81 ± 2.09	13.04 ± 2.28	0.608
RANGE OF MOTION	131.2 ± 6.337	130.4 ± 7.059	0.675
FUNCTIONAL SCORE	91.2 ± 12.27	87 ± 18.2	0.5961
WOMAC SCORE	12.2 ± 21.179	16.72 ± 16.923	0.0801

Table 5: overall analysis of patients

VARIABLE	N=50
AGE	46.06 ± 9.696
GENDER (M:F)	39:11
BMI	23.58 ± 2.12
UNION TIME	3.07 ± 0.39
FOLLW UP TIME	12.88 ± 2.172
RANGE OF MOTION	130.8 ± 6.652

INJURY TO SURGERY INTERVAL	1.66	± 1.0616
FUNCTIONAL SCORE	89.1	± 15.508
WOMAC SCORE	14.46	± 19.11

Statistical anaylsis

All the Data was statistically described in terms of mean (±SD), frequencies (number of cases) and percentages when appropriate. Student's T test and Mann-Whitney U test were used in our study. A probability value (p value) less than 0.05 was considered statistically significant.

Discussion

Tibia plateau fractures affect patients during the most productive years of their lives, with potentially devastating consequences the treatment of tibial plateau fractures is a topic of debate. Controversies regarding both the indications for surgical treatment and the type of intervention to be employed exist since several years. Several studies supporting different methods of treatment can be found in the literature. During the last decade, studies analyzing surgically treated tibial plateau fractures have shown good results.[8, 9, 10] Open reduction and rigid internal fixation, according to the principles of Association for Osteosynthesis/Association for the Study of Internal Fixation (AO/ASIF), has been the treatment of choice for the past several decades.

In our study the mean age was 46.06 years and the mean follow up time was 12.88 months. . We observed these fractures to be more common in middle age group[11].There was no significant difference in surgical and functional outcome between the two study groups with regards to mean age and mean follow up time and results are comparable with other studies . There is male preponderance in both the study groups with male/female ratio of 18:7 in group 1 and 21:4 in group 2. We found RTA as main cause of injury in both study groups (94%in group 1 and 76 % in group2). The other modes of trauma were fall from height and fall at home.

Rademakers et al.[12] did a long term follow up study of 109 patients of proximal tibia fractures treated surgically by internal fixation. The mean age at time of injury was 46 years and they found no correlation between the age and functional or radiologic results; excellent results were obtained in the majority of the patients through the entire age spectrum. They also concluded that there was no correlation between duration of follow-up and either Neer or HSS knee score. They found RTA as a cause of injury in 39% cases, other major causes being domestic, pedestrian and sports injuries. Nikolaos et al. [13] in their study to access the functional outcome of 125 cases of tibia plateau fractures found mean age to be 52 years and average follow up of 20 months. Their study had male preponderance with 73 male and 52 female patients. 86 patient sustained

fractures as a result of RTA, 36 patients had a fall and 2 patients had fracture due to gunshot injuries.

All patients in our study achieved union with a mean union time of 3.04 months for group 1 and 3.1 months in group 2 which is comparable with the studies of Vassilios[6] and Nikolaos[13]. We found no statistical significance for time taken for fracture union in unicondylar and bicondylarfractures. The union time coincided with the patient'sability bear full weight on the operated leg. Vassilios et al.[6] reported a mean union time of 3.2 months with a union rate of 94.5 %. Similarly study done by Nikolaos et al. [13] had a non union rate of 1.6% with mean union time of three months.

Majority of the fractures of the patients in our study have been fixed by locking plates. The union rate as well as the time taken for union in our study is supported by literature. Phinit Phisitkul et al.[14] in their study of complications of fractures treated by locking plates achieved mean union time of 12 weeks. Similarly Chang-Wug Oh et al.[15] in their study of double plating of proximal tibia fractures reported that all fractures healed at an average duration of 19 weeks. With regards to functional score in our study we found that 19 patients in group 1 and 16 patients in group 2 have excellent results. In group 1 the mean functional score was 91.2 and in group 2 it was 87 and there is no statistical significance between the two groups in terms of functional score. We also found no statistical significance between group 1 and group in terms of womac score. The mean womac score of group 1 and 2 were 12.2 and 16.72 respectively.

Comparing the functional results of this study with those reported in the recent literature is complicated by the use of differing classification schemes, outcome measures, and treatment techniques. Nikolaos et al.[6] used Knee Society Scoreto access functional outcome, which is graded between 0 and 100. A score of <60 was graded as poor, 60–70 as fair, 70–85 as good and 85– 100 as excellent. The outcome was good in 86 cases (69%), fair in 30 (24%) and poor in nine (7%). According to the mean Knee Society Score at the time of final follow-up was 91 points, and the mean functional score was 89 points. They concluded that polyaxial locking-plate system provided stable fixation of extra-articular and intra-articular proximal tibial fractures and good functional outcomes with a low complication rate. In our study also majority of the fractures have been treated by locking plates with excellent functional outcome in both the study groups. KA Egol et al.[16] in their study of staged management of high energy proximal tibia fractures had a mean WOMAC score of 91. We had very less WOMAC scores as compared to their study, signifying better functional outcomes. This may be due to less severe nature of trauma sustained by the cases in our study and also because of better and precise surgical techniques. Tul B Pun et al.[17] in their study of Schatzker 5 and 6 fractures had an average WOMAC score was 7.23.

Conclusion

Comparing the functional results of this study with those reported in the recent literature is complicated by the use of differing classification schemes, outcome measures, and treatment techniques. In our study the surgical and functional outcomes of both unicondylar and bicondylar fractures of proximal tibia are

satisfactory and comparable to each other. Time taken for fracture union was same for both unicondyar and bicondylar fractures. Injury to surgery interval was slightly more for bicondylar fracture as compared to unicondylar fractures. This can be attributed to more swelling and associated soft tissue injuries in case of bicondylar fractures.

References

1. Barei DP, Nork SE, Mills WJ, Coles CP, Henley MB, Benirschke SK. Functional outcomes of severe bicondylar tibial plateau fractures treated with dual incisions and medial and lateral plates. J Bone Joint Surg Am. 2006 Aug 1;88(8):1713-21.
2. Djuraev, A. M., Alpisbaev, K. S., & Tapilov, E. A. (2021). The choice of surgical tactics for the treatment of children with destructive pathological dislocation of the hip after hematogenous osteomyelitis. *International Journal of Health & Medical Sciences*, *5*(1), 15-20. https://doi.org/10.21744/ijhms.v5n1.1813
3. Egol KA, Su E, Tejwani NC, Sims SH, Kummer FJ, Koval KJ. Treatment of complex tibial plateau fractures using the less invasive stabilization system plate: clinical experience and a laboratory comparison with double plating. Journal of Trauma and Acute Care Surgery. 2004 Aug 1;57(2):340-6.
4. Gerich T, Blauth M, Witte F, Krettek C. [Osteosynthesis of fractures of the head of the tibia in advanced age. A matched-pair analysis]. Der Unfallchirurg. 2001 Jan;104(1):50-6.
5. Houben PF, van der Linden ES, van den Wildenberg FA, Stapert JW. Functional and radiological outcome after intra-articular tibial plateau fractures. Injury. 1997 Sep 30;28(7):459-62.
6. Hsu CJ, Chang WN, Wong CY. Surgical treatment of tibial plateau fracture in elderly patients. Archives of orthopaedic and trauma surgery. 2001 Jan 1;121(1-2):67-70.
7. Keating JF. Tibial plateau fractures in the older patient. Bulletin (Hospital for Joint Diseases (New York, NY)). 1998 Dec;58(1):19-23.
8. Manidakis N, Dosani A, Dimitriou R, Stengel D, Matthews S, Giannoudis P. Tibial plateau fractures: functional outcome and incidence of osteoarthritis in 125 cases. International orthopaedics. 2010 Apr 1;34(4):565-70.
9. Moore TM, Patzakis MJ, Harvey JP. Tibial plateau fractures: definition, demographics, treatment rationale, and long-term results of closed traction management or operative reduction. Journal of orthopedic trauma. 1987 Jan 1; 1(2):97-119.
10. Musahl V, Trkin I, Kobbe P, Tzioupis C, Siska PA, Pape HC. New trends and techniques in open reduction and internal fixation of fractures of the tibial plateau. Bone & Joint Journal. 2009 Apr 1;91(4):426-33.
11. Nikolaou VS, Tan HB, Haidukewych G, Kanakaris N, Giannoudis PV. Proximal tibial fractures: early experience using polyaxial locking-plate technology. International orthopaedics. 2011 Aug 1;35(8):1215-21.
12. Oh CW, Oh JK, Kyung HS, Jeon IH, Park BC, Min WK, Kim PT. Double plating of unstable proximal tibial fractures using minimally invasive percutaneous osteosynthesis technique. Acta orthopaedica. 2006 Jan 1;77(3):524-30.

13. Phisitkul P, Mckinley TO, Nepola JV, Marsh JL. Complications of locking plate fixation in complex proximal tibia injuries. Journal of orthopaedic trauma. 2007 Feb 1;21(2):83-91.
14. Pun TB, Krishnamoorthy VP, Poonnoose PM, Oommen AT, Korula RJ. Outcome of Schatzker type V and VI tibial plateau fractures. Indian journal of orthopaedics. 2014 Jan;48(1):35.
15. Rademakers MV, Kerkhoffs GM, Sierevelt IN, Raaymakers EL, Marti RK. Operative treatment of 109 tibial plateau fractures: five-to 27-year follow-up results. Journal of orthopaedic trauma. 2007 Jan 1;21(1):5-10.
16. Ratnawati, I. G. A. A., Suandayani, N. K. T., & Sutapa, G. N. (2019). The linearity of x-ray devices radiation output and its relationship with patient thickness. *International Journal of Physical Sciences and Engineering*, *3*(3), 1–6. https://doi.org/10.29332/ijpse.v3n3.351
17. Schatzker JO, MCBROOM R, BRUCE D. The Tibial Plateau Fracture: The Toronto Experience 1968-1975. Clinical orthopaedics and related research. 1979 Jan 1;138:94-104.
18. Weimann A, Heinkele T, Herbort M, Schliemann B, Petersen W, Raschke MJ. Minimally invasive reconstruction of lateral tibial plateau fractures using the jail technique: a biomechanical study. BMC musculoskeletal disorders. 2013 Apr 4;14(1):1.
19. Widana, I.K., Sumetri, N.W., Sutapa, I.K., Suryasa, W. (2021). Anthropometric measures for better cardiovascular and musculoskeletal health. *Computer Applications in Engineering Education*, *29*(3), 550–561. https://doi.org/10.1002/cae.22202
20. Zura RD, Browne JA, Black MD, Olson SA. Current management of high-energy tibial plateau fractures. Current Orthopaedics. 2007 Jun 30;21(3):229-35.