



PROSPECTIVE ANALYTICAL STUDY OF BICONDYLAR PROXIMAL TIBIA FRACTURES MANAGED WITH DUAL PLATING.

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ABSTRACT

Introduction - Bicondylar proximal tibia fractures are usually 10-30% of proximal tibia fractures. Though there are recent advancements in the management of these type of fractures, results are relatively poor. In this study, our aim was to analyse functional outcome, radiological outcomes and complications in dual plate fixation technique for bicondylar proximal tibia fractures without posteromedial fragment. **Methods**- We evaluated 35 patients who underwent surgical treatment due to bicondylar proximal tibia fractures between 2020 and 2022. 35 were included in the study from which 2 patients were lost to follow up. Functional outcome, radiological outcomes and complications after fixation were analysed. **Results**- At the final follow up, Oxford Knee Score in dual plating group, 6 patients has excellent functional outcome, 27 patients has satisfactory functional outcomes, 2 patients were lost to follow up. At 6 weeks and 3 months, all the patients were seen to have uniting fracture with implant in situ whereas at 6 months, there were 32 patients who had uniting fracture with implant in situ and there was 1 patient with malunited fracture with implant in situ. The complications reported were significant and encountered in 3 patients. There were no cases of non union or implant failure. **Conclusions**- In our study of bicondylar proximal tibia fractures treated surgically with dual plate fixation. Satisfactory functional outcomes and radiological union were achieved. However the number of complications were significant. Hence we conclude that if bicondylar plating is chosen as a modality, it should be performed with a lot of caution. Adequate soft tissue care is of paramount importance to avoid serious complications like infections and wound dehiscence.

KEYWORDS : bicondylar proximal tibia fractures, Schatzkers type 5 and 6, Oxford knee score, VAS, radiological outcome, complications

INTRODUCTION-

One of the most frequent intraarticular fractures that develop from car accidents, falls from great heights, sports injuries, etc. is a tibial plateau fracture. Bicondylar tibial plateau fractures (Schatzker type V and VI) are common in young age group as they are a result of high energy trauma and are often associated with other bony or soft tissue injuries. Bicondylar tibial plateau fractures remain a challenge for orthopaedic surgeons in spite of the advances in the management of intra articular fractures. Decision making in the management of Schatzker type V and VI fractures depends on the degree of articular depression, extent of condylar widening, degree of meta-diaphyseal separation and integrity of soft tissue envelope. Fractures with displacement >4mm in any axis are usually managed surgically.[1] Operative intervention helps in achieving anatomical/good reduction and stable fixation. The most important factor in determining the outcome is adequacy of reduction.

Inclusion criteria:

1. All patients with proximal tibia fractures treated surgically with dual plate.
2. All patients with Schatzkers type 5 & 6.
3. Age > 18 years.

Exclusion criteria:

1. Pathological fractures
2. Associated neurovascular injury
3. Patients who are not fit for surgery due to medical co-morbidities
4. Polytrauma
5. Compound injuries
6. Patients with schatzkers type 1,2,3 & 4.

METHODOLOGY-

We prospectively evaluated 35 patients who underwent surgical treatment with dual plate due to bicondylar proximal tibia fractures between 2020 and 2022 in Department Of Orthopaedics Of Bharati Hospital, Pune, India.

1) Operative Procedure- The affected limb was placed on a wooden radiolucent frame while the patient was operating in the supine position. All procedures were carried out fluoroscopically under spinal anesthesia or spinal anesthesia with an epidural under strict aseptic conditions on a radiolucent operating table. The affected leg was scrubbed, painted, and draped thoroughly. Over the fracture site, an incision was made either medially or laterally. Manual traction and reduction forceps were used to reduce the fracture. A minimally

invasive surgical (MIS) approach was used to perform the operation. Functional and radiological outcomes were analysed at immediate post op, 6 weeks, 3 months and 6 months. Complications were analysed at 6 months.

2) Statistical analysis was performed using software SPSS- statistical package for social sciences version 26, India). The qualitative parameters were presented as frequency (n) and percentages (%), and compared between the groups using Chi-square test. The quantitative parameters were presented as mean, median and were compared between the group using students 't' test/Mann Whitney U test. A p < 0.05 was considered statistically significant.

3) Ethical Approval- This study was conducted in accordance with the ethical guidelines of the Declaration of Helsinki and informed written consent was obtained from all the patients. The protocol was reviewed and approved by the Institutional ethics committee at Bharati Vidyapeeth Deemed university medical college, pune. (ref BVDUMC/IEC/127)

RESULTS-

1. Total 35 patients with who had bicondylar proximal tibia fractures were included. The mean age of the patients was 38.51 years, and of total 35 patients 27 were males and 8 were females.

2. The comorbidities among the proximal tibia fractures patients were recorded 22. The commonest co-morbidity was hypertension, followed by smoking, alcohol intake and diabetes mellitus.

3. Functional outcome - Oxford Knee Score (OKS) in dual plating : The means of oxford knee score was observed immediately after surgical procedure and at 6 weeks, 3 months and 6 months post-operatively. There was significant (p<0.0001) increase in OKS at each follow up.

4. VAS score was observed at each follow up and it was significantly improved.

5. At 6 weeks and 3 months, all the patients were seen to have uniting fracture with implant in situ whereas at 6 months, there were 32 patients who had uniting fracture with implant in situ and there was 1 patient with malunited fracture with implant in situ.

6. Complications were reported in 3 patients.

Table 1: Patient details

Variable	Demography
Total number of Patients	35
Mean Age range (in years)	38.51 ± 10.22
Male : Female	27:8
Mode of Injury RTA :Domestic Fall	33:2
Side Involvement Left: Right	20:15
Fracture Type (Schatzker) Type V : Type VI	19:16
Duration of follow-up (in months)	6
Associated fibular Fracture	15
Range of Motion at 6 months ≥ 100° : ≤ 100°	31:2
Mean Oxford Knee Score (OKS) at 6 months	37.33
VAS at 6 months mean	0.09
DM	5
HTN	9
Alcohol	6
Smoking	14
No comorbidities	13

Table 2: Oxford Knee Score (OKS) in dual plating

b	Immediate	Post OP 6 weeks	Post OP 3 months	Post OP 6 months	P value
Mean	25.77	30.18	33.58	37.33	<0.001
SD	1.90	1.73	1.37	1.53	

Table 3: OKS grading

GRADING	Distribution
Excellent	20.58 %
Satisfactory	79.41%
Average	0%
Poor	0%

At the final follow up in OKS in dual plating group, 6 patient has excellent functional outcome, 27 patient has satisfactory functional outcomes, 2 patients were lost to follow up.

VAS was statistically significant improvement at 6 months follow up. It was found to be excellent in 90.90% and persistent pain in 9.09%. Although 3 patients had various complications, their functional outcome score is satisfactory at the final follow up.

Radiological outcome- The radiological assessment at 6 weeks, 3 months and 6 months follow up was done. At 6 weeks and 3 months, all the patients were seen to have uniting fracture with implant in situ. At 6 months, there were 31 patients had united fracture with implant in situ in single plating. There were 3 patients having delayed union fracture with implant in situ. Complete union seen in 91.17%, delayed union seen in 8.82%.

Table 4: Radiological assessment

Dual plate	6 Weeks	3 months	6 Months
Uniting fracture with implant in situ	33	33	0
United fracture	0	0	32
Delayed union fracture with implant in situ	0	0	0
Malunited fracture with implant in situ	0	1	1
Non union	0	0	0

Table 5: Complications

Complications	Dual plating
Delayed union	0
Extensor lag	3
Knee stiffness	2
Surgical site infections	3

Malunion with varus deformity	1
Persistent pain	3
Secondary arthritis of knee joint	1
Total number of patients	3



Figure A - B showing pre-operative X-ray 2) Figure C-F showing Intra operative C-arm images 3) Figure G-H showing 3 months followup post operative X-ray 4) Figure I - J showing 6 months followup post operative X-ray. 5) Figure K showing Range of motion of knee joint at 6 months follow up.

DISCUSSION-

- Tibial plateau fractures are one of the commonest intra articular fractures that occur as a result of road traffic accidents, fall from height, sports injuries, etc. Bicondylar tibial plateau fractures (Schatzker type V and VI) are common in young age group as they are a result of high energy trauma and are often associated with other bony or soft tissue injuries. Bicondylar tibial plateau fractures remain a challenge for orthopaedic surgeons inspite of the advances in the management of intra articular fractures. Decision making in the management of Schatzker type V and VI fractures depends on the degree of articular depression, extent of condylar widening, degree of meta-diaphyseal separation and integrity of soft tissue envelope. Undisplaced or minimally displaced fractures are managed conservatively. Fractures with displacement >4mm in any axis are usually managed surgically.[1] Operative intervention helps in achieving anatomical/good reduction and stable fixation.
- Bicondylar proximal tibia fractures are more frequently linked to high-energy velocity injuries. [2] The objectives of surgical treatment include anatomic reduction, articular congruity restoration, and rigid fixation to permit early motion. There is currently no accepted standard of care for the management of bicondylar tibial plateau fractures, despite the use of techniques like dual buttress plates, locking plates, external fixators, and a combination of internal and external fixation. [3-5]
- Open reduction and internal fixation (ORIF) with dual plating has been biomechanically demonstrated to be an effective method for stabilisation after reduction of both fracture fragments and articular surfaces in highly unstable bicondylar fractures. Dual plating fixation, however, necessitates extensive soft tissue dissection, which raises the possibility of wound complications. [6]
- The present study compared the outcomes of proximal tibia fractures treated surgically with dual-plate. A total of 35 patients with bicondylar proximal tibia fractures were included. The mean age of the patients was 38.51 years, and of total 35 patients 27 were males and 8 were females
- The most common cause of injury for proximal tibia fractures was a road traffic accident (RTA), followed by a domestic fall.
- OKS in dual plating group was found to be excellent in 18.18%, satisfactory in 91.81%. There was a significant increase in OKS at each follow-up.

- According to a related study by Krishna Prasad N et. al., bilateral plating revealed better physical function when functional outcomes were compared between single and dual plating using the WOMAC score.[9]
- Radiologically complete union seen in 96.96%, malunion seen in 3.03%..
- The radiological assessment at 6 weeks and 3 months revealed all the patients to have uniting fractures with implants in situ. At 6 months, there were 32 patients with a united fracture with implant in situ in dual plating. There was 1 patient with a malunited fracture with implants in situ.
- For early mobilisation and the development of a functional knee joint, radiographically speaking, anatomic joint reduction and proper alignment of the lower extremities are essential.[10]
- The common complications reported were extensor lag, surgical site infections, persistent pain, knee stiffness, malunion with varus deformity, and secondary arthritis of the knee joint.
- Most surgeons still struggle with surgically treating high-energy displaced bicondylar fractures of the tibia plateau. Types V and VI of the Schatzker classification are complex fractures that frequently result in soft tissue damage, have a high risk of wound complications, are challenging to reduce, and require additional fixation for stabilisation. Screws, an external fixator, hybrid external fixation, limited internal fixation combined with a tensioned wire, traditional dual buttress plates, a unilateral periarticular locking plate, and hybrid dual plates are all treatment options; the ideal fixation technique, however, is not yet clear (the combination of a locking plate and a buttress plate). [11]
- Furthermore, due to compartment syndrome, severe soft-tissue injury, metaphyseal and articular comminution, frequent associated open wounds, and high-energy fractures of the proximal tibia, treatment is rife with complications. [12]
- Visual reduction and maintaining proximal tibial alignment are two benefits of the dual-plate technique, but soft-tissue complications and damage to the periosteal blood supply are major concerns with this method of internal fixation. [14]
- Three patients (11%) experienced non-union after a year of follow-up, according to Jognath BB et. al.in 2021, The average union rate was 91 percent.[15]
- In 1990, Lachiewicz PF et. al. studied 43 displaced Tibial plateau fractures treated surgically (based on AO-ASIF principles) and followed for an average of 2.7 years. They received excellent or good results in 93 percent of the cases. Procedure errors or a lack of a bone graft were to blame for the poor results.[16]
- Twenty patients with bicondylar tibial plateau fractures underwent surgery in 2019, and Citak C et. al. compared the outcomes of the dual locking plate fixation technique and the lateral locking plate fixation technique. A 24-month average was used for subject follow-up by researchers. Neither the functional nor the radiographic outcomes between the two groups varied significantly during the long-term follow-up. Therefore, it can be said that in bicondylar tibial plateau fractures without a posteromedial fragment, the lateral locking plate fixation technique produced the same clinical and radiological results as the dual locking plate fixation technique.[19]

Advantages- patients demographics and features of pattern of fractures were random.

Limitation- This study had a relatively small sample size, duration of follow up is relatively shorter and no control group.

CONCLUSION- In our study of bicondylar proximal tibia fractures treated surgically with dual plate fixation. Satisfactory functional outcomes and radiological union were achieved. However the number of complications were significant. Hence we conclude that if bicondylar plating is chosen as a modality, it should be performed with a lot of caution. Adequate soft tissue care is of paramount importance

to avoid serious complications like infections and wound dehiscence.

Conflict of Interest - The authors declare no potential of conflict of interest.

REFERENCE –

1. Cole P, Levy B, Schatzker J, Watson Jt, Tibial Plateau Fractures : Browner B , Levine A, Jupiter J, Trafton P, Krettek C , Eds. Skeletal Trauma : Basic Science And Management And Reconstruction . Philadelphia, Pa : Saunders Elsevier , 2009: 2201-2287.
2. Krieg JC. Proximal tibial fractures: current treatment, results, and problems. *Injury*. 2003 Aug;34 Suppl 1:A2-10.
3. El-Gafary K, El-adly W, Farouk O, Khaled M, Abdelaziz MM. Management of high energy tibial plateau fractures by Ilizarov external fixator. *Eur Orthop Traumatol* 2014;5(1):9-14.
4. Ariffin HM, Mahdi NM, Rhani SA, Baharudin A, Shukur MH. Modified hybrid fixator for high-energy Schatzker V and VI tibial plateau fractures. *Strateg Trauma Limb Reconstr* 2011;6(1):21-6.
5. Babis GC, Evangelopoulos DS, Kontovazenis P, Nikolopoulos K, Soucacos PN. High energy tibial plateau fractures treated with hybrid external fixation. *J Orthop Surg Res* 2011;6(35).
6. Suresh Kumar RN, Neelakrishnan R., Barathiselvan V, Dhiviyaraj D. Management of tibial plateau fractures by dual plating and unilateral locking compression plate. *ijmrr* oct 2015;27(3):972-975.
7. Lee MH, Hsu CJ, Lin KC, Renn JH. Comparison of outcome of unilateral locking plate and dual plating in the treatment of bicondylar tibial plateau fractures. *J Orthop Surg Res*. 2014 Jul 20;9:62.
8. Neogi DS, Trikha V, Mishra KK, Bandekar SM, Yadav CS. Comparative study of single lateral locked plating versus double plating in type C bicondylar tibial plateau fractures. *Indian J Orthop*. 2015 Mar-Apr;49(2):193-8.
9. Krishna Prasad N, Jognath B, Nanda Gopal V, Sreenivasa Chowdary J. Comparative study of functional outcome of unilateral locking plate and dual plating in the treatment of bicondylar proximal tibia fractures. *Indian Journal of Applied Research*. 2017; 7(2):168-170.
10. The Canadian Orthopaedic Trauma Society: Open reduction and internal fixation compared with circular fixator application for bicondylar tibial plateau fractures. Results of a multicenter, prospective, randomized clinical trial. *J Bone Joint Surg Am*. 2006; 88:2613-2623.
11. Ali AM, Yang L, Hashmi M, Saleh M. Bicondylar tibial plateau fractures managed with the Sheffield Hybrid Fixator. Biomechanical study and operative technique. *Injury*. 2001 Dec;32 Suppl 4:SD86-91.
12. Phisitkul P, McKinley TO, Nepola JV, Marsh JL. Complications of locking plate fixation in complex proximal tibia injuries. *J Orthop Trauma*. 2007 Feb;21(2):83-91.
13. Çağlar C, Akcaalan S, Özaskan Hİ, Bozer M, Emre F, Uğurlu M. Comparative Analysis of Single Lateral Locked Plate and Double Locked Plate Application in the Treatment of Bicondylar Tibial Plateau Fractures. *Cureus*. 2021 Nov 5;13(11):e19298.
14. Gösling T, Schandelmaier P, Marti A, Hufner T, Partenheimer A, Krettek C. Less invasive stabilization of complex tibial plateau fractures: a biomechanical evaluation of a unilateral locked screw plate and double plating. *J Orthop Trauma* 2004;18(8): 546-51. 114. Musahl V, Tarkin 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. *J Bone Joint Surg Br* 2009;91(4):426-33.
15. Jognath BB, Jagadeeswar Reddy K. Comparative study of functional outcome of unilateral locking plate and dual plating in the treatment of bicondylar proximal tibia fractures. *Int J Orthop Sci* 2021;7(3):189-193.
16. Lachiewicz PF and Funik T. Factors influencing the results of Open reduction and internal fixation of tibial plateau fractures. *Clin Orthop* 1990;259:210.
17. Ballmer FT, Hertel R, Notzli HP. Treatment of tibial plateau fractures with small fragment internal fixation: a preliminary report. *J Orthop Trauma* 2000;14(7):467-74.
18. Hsu CJ, Chang WN, Wong CY. Surgical treatment of tibial plateau in elderly patient. *J Orthop* 2001;15(5):312-20.
19. Citak C, Kayali C, Ozan F, Altay T, Karahan H, Yamak K. Lateral Locked Plating or Dual Plating: A Comparison of Two Methods in Simple Bicondylar Tibial Plateau Fractures. *Clinics in Orthopedic Surgery*. 2019;11(2):151-8.
20. Ehlinger M, Rahme M, Moor B, Di Marco A, Brinkert D, Adam P et. al. Reliability of locked plating in tibial plateau fractures with a medial component. *Orthopaedics & Traumatology: Surgery & Research* 2012;98(2):173-79.