

**Functional outcome of unilateral plating with lag screws in bicondylar tibial fractures****Aditya .S. Jagdale<sup>1\*</sup>, K.RPatond<sup>2</sup>, Pramod .A. Jain<sup>3</sup>**<sup>1</sup>*Senior resident, Department of orthopaedics, Mahatma Gandhi Institute of Medical Sciences, sevagram, Maharashtra, India*<sup>2</sup>*Director Professor, Department of orthopaedics, Mahatma Gandhi Institute of Medical Sciences, sevagram, Maharashtra, India*<sup>3</sup>*Professor, Department of orthopaedics, Mahatma Gandhi Institute of Medical Sciences, sevagram, Maharashtra, India***Received: 30-11-2021 / Revised: 27-12-2021 / Accepted: 01-01-2022****Abstract**

**Objective:** Management of Bicondylar (tibial plateau) fractures is a challenge. In literature dual plating is considered to be the treatment of choice for these fractures. In this study we studied the functional outcome of open reduction internal fixation with plating on one side, enhanced by cannulated cancellous screws on the other side. **Method:** From October 2019 to October 2021, we studied 27 patients with bicondylar tibial plateau fractures (schatzker type V and Type VI) treated using plate on one side and cannulated cancellous screws (inserted percutaneously) on the other side. **Result:** The mean age was  $40.03 \pm 11.54$  years. Most common mode of injury was road traffic accidents. We used schatzker classification to classify the fractures. Majority of the fractures (59.26 %) were schatzker type VI fractures. Post operative radiographs were taken at 6 weeks, 3 months, 6 months and 12 months. The average time for union of fractures was  $4.5 \pm 2.28$  months. 2 patients (8.70 %) developed deep wound infections, 1 (4.34%) of these had delayed union. 1 (4.34%) patient had lateral subluxation of knee post operatively with previous primary osteoarthritis. The rate of infection was lower than traditional dual plating. There were no cases of non-union or post operative loss of reduction. **Conclusion:** Per our limited experience we believe that open reduction internal fixation with plating on one side with cannulated cancellous screws on the other, is a better alternative in the management of schatzker Type V and VI tibial plateau fractures.

**Key words:** Bicondylar tibial plateau fractures, Unilateral plating, Schatzker type V, Schatzker type VI, Rasmussen clinical score

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**Introduction**

Bicondylar fractures of tibia are a result of high velocity trauma and occur due to marked axial loading of the tibial plateau as in dashboard injuries, bumper fractures or fall from height. These fractures require restoration of anatomical alignment and articular congruity along with minimal soft tissue invasion and rigid fixation of fracture fragments to allow early mobilization and weight bearing of the joint[1-2]. Several strategies have been advocated for management of bicondylar fractures of the tibia, including conservative and surgical modalities. Minimally displaced (<4 mm of displacement along any axis) bicondylar fractures without diaphyseal extension and ligamentous injuries, can be treated by cast or brace. In these type of fractures Skeletal traction followed by cast or brace treatment is cost effective and has lesser rate of complications with the benefits of a good functional and radiological outcome[3]. Usually, schatzker type V and VI fractures are often accompanied by severe soft tissue injury, limb instability and major displacement. In these cases, conservative methods don't yield proper condylar reduction and there are difficulties in maintaining shaft alignment. Even if acceptable reduction is obtained, a long period of hospitalization and immobilization is required. Hence surgical management of these fractures is preferred as it allows anatomical reduction with stable fixation[4]. Dual plating is the gold standard for the treatment of these fractures as they provide rigid fixation that prevents varus collapse of the fracture. However dual plating is associated with excessive soft tissue dissection leading to wound complications and delayed union or non-union of the fracture[5-7].

Over the years there has been quite a lot of technological advancement and the introduction of Locked plates, fixed angle devices (Less invasive stabilization system) and fixation techniques (Minimally invasive percutaneous plate osteosynthesis) has changed the management of bicondylar tibial plateau fractures.

Several studies have proven that lateral plating with medially applied lag screws to fix the small medial fragments provides a good functional out come in these fracture types[8-10].

We performed a study to determine the functional outcome of Schatzker type V and VI proximal tibial fractures treated with open reduction and internal fixation using plate on one side (the side that has more comminution or is unstable) and cannulated cancellous screws on the other side (applied percutaneously). Comparing our study with previous studies on unilateral plating of bicondylar tibial plateau fractures, we tried to find the clinical effectiveness of this technique in the management of schatzker type V and VI fractures.

**Materials and method**

We studied 27 patients with bicondylar tibial plateau fractures (schatzker type V and Type VI) treated using plate on one side and cannulated cancellous screws (inserted percutaneously) on the other side. The study was conducted at MGIMS sevagram, from October 2019 to October 2021. Clearance was taken from the institutional ethics committee prior to commencement of the study. The inclusion criteria was: Age >18 years, radiologically confirmed closed bicondylar fracture tibia classified according to schatzker classification, patients with the above diagnosis who were fit for surgery, patients who were willing to sign a Written informed Consent to undergo the operative procedure.

Standard anteroposterior and lateral radiographs and computerized tomography (CT) scans of the affected part and leg were taken by carefully positioning the patients. All radiographs and Computed tomography scans of the affected knee were evaluated closely to

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assess the fracture configuration and degree of comminution. Fracture was classified using Schatzker's classification system.

Open reduction internal fixation was performed in fluoroscopic control either under General or spinal anesthesia on a radiolucent operating table under all aseptic precautions. Thorough cleaning and draping of the affected leg was done. A medial or lateral incision was made over the fracture site. Fracture reduction was achieved using manual traction and reduction forceps.

Fixation was done by plating on one side and Percutaneous cannulated cancellous screw fixation on the other side of the affected tibia depending upon the stability, degree of comminution, size and articular depression of the medial and lateral fragments. Plating was done for the more unstable fragment.

Post operative immobilization (using a long knee brace or long leg slab) of the affected lower limb was maintained for 6 weeks. The patient was taught static quadriceps drill and ankle toe movements from 2<sup>nd</sup> postoperative day. Stitches were removed at the end of 2 weeks after surgery. Range of motion exercises were started gradually once the patient is relatively pain free. Partial weight bearing was allowed after signs of clinical union appeared (6-8 weeks). Full weight bearing was allowed once radiological union was achieved (12-16 weeks).

Follow up was done at 6 weeks, 3 months, 6 months and 12 months (Fig. 2,3,4). Periodic clinico-radiological assessment was done till signs of clinical and radiological union are noticed. Functional outcome was assessed according to Rasmussen criteria of functional assessment[11] wherein the patient was given a score out of 30.

#### Result

Out of 27, 4 patients were lost to follow up. 1 of these were lost to follow up before 6 weeks, 1 was lost to follow up after 6 weeks and 2 were lost to follow up after 3 months. The reasons for loss to follow up were inability to reach the patient due to incorrect contact

information in 1 case and Inter-state/inter-district travel restrictions due to COVID-19 pandemic in the other cases.

The mean age was  $40.03 \pm 11.54$  yrs. Among the 27 patients, 20 were males and 7 were females (Female: Male ratio of 1:2.85). Road traffic accident (RTA) was the most common mode of injury seen in 85.2% of the cases. Standard anteroposterior radiographs and CT scans of the Affected leg were used to classify the fracture according to Schatzker classification. There were 16 Schatzker type VI fractures and 11 Schatzker type V fractures. 10 patients had associated injuries in the ipsilateral lower limb or other extremities.

All the patients underwent open reduction internal fixation. 20 patients underwent medial plating with Cannulated cancellous screws laterally while 7 patients underwent lateral plating with cannulated cancellous screws medially.

Majority of the patients (77.77%) were immobilized for a minimum of 6 weeks. Mean time of starting partial weight bearing ambulation was  $2.44 \pm 1.09$  months. Mean time of starting full weight bearing ambulation in this study was  $4.06 \pm 2.39$  months post-surgery. Mean time for fracture union being  $4.50 \pm 2.28$  months. The difference in time of union between Schatzker Type V fractures ( $3.23 \pm 0.83$  months) and Schatzker type VI fracture ( $5.45 \pm 2.8$  months) was not significant. 3 patients had complications. 2 patients (8.70% had deep wound infections. Out of these 2, 1 (4.34%) had delayed union (union at 14 months). 1 patient (4.34%) had lateral subluxation of knee in the post operative period with a previous primary osteoarthritis.

In this study functional outcome was assessed based on the score according to Rasmussen clinical criteria at the final follow up (time of radiological union). The functional outcome at final follow-up (time of radiological union) was excellent in 34.78% (8) cases, good in 56.52% (14) of the cases while it was fair in 4.34% (1) of the cases. The mean score at the final follow-up visit was 25.4, which is suggestive of good functional outcome.



Fig. 1: AP/Lateral X rays of schatzker type V Bicondylar tibia fractures



Fig. 2: 11 month follow up X rays (AP/Lat view) RT knee



Fig. 3a

Fig. 3b

3a- Photograph showing flexion (10 degree) at RT knee at 12 months follow up.  
3b- Photograph showing complete extension at RT knee at 12 months follow up

Table 1: Patient information and Fracture characteristics

Parameter	Result
Female:Male	7:20 (1:2.85)
Mean age	40.03 ± 11.54 years
Mechanism	
- RTA	23 (85.2%)
- Fall	4 (14.8%)
Schatzker Classification:	
- Schatzker Type V	11 (40.74%)
- Schatzker Type VI	16 (59.26%)
Left:Right	14:13

Table 2: Surgical details

Parameter	No. of cases
Medial plating + Lateral Cannulated cancellous screws	20
Lateral plating + Medial Cannulated cancellous screws	7
Interfragmentary screws	2

Table 3: Complications encountered in this study

Complication	No. of patients	Percentage
Deep wound infection	2	8.7%
Secondary arthritis of knee joint	1	4.34%
Delayed union	1	4.34%
Malreduction	0	0%
Loss of reduction post-operatively	0	0%
Total	4	17.38%

**Table 4: Comparison between this study and other studies**

Parameter	This study	Ehlinger et al[9]	Spagnolo et al[10]	Gosling et al[8]
Mean age	40.03 ± 11.54 years	47 years	39 years	41.4 years
Female:Male	1:2.85	1:1	1:5	1:1.94
Time of union	4.5±2.8 months	2.5 months	4.3 months	3 months
Complications:				
- Wound complications	8.70%	5 %	11.1%	6.50%
- Delayed union/non union	4.34%	0%	11.1%	1.60%
- Loss of reduction	0%	0%	0%	14.5%
- Malreduction	0%	25%	0%	0%

## 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[12]. Operative intervention helps in achieving anatomical/good reduction and stable fixation. The most important factor in determining the outcome is adequacy of reduction. The surgical procedure used, type of implant applied and period of immobilization are also crucial. Osteoarthritis can develop despite of the best articular reduction due to initial articular cartilage and meniscal injury. Postoperative physiotherapy plays a key role in the rehabilitation of the patient.

The goal of fracture surgery is to impart mechanical stability to the fracture while minimizing soft tissue injury[13]. Traditional dual plating has infection rates as high as 50% while external and ring fixators have produced mixed results with their own set of complications. Young and barrack published a study on a series of bicondylar tibial plateau fractures. They divided the fixation into 2 groups – Group 1 (Unilateral plating) and group 2 (Dual plating). 88% (7 out of 8) patients in the dual plating group had deep infections while none of the patients in the unilateral plating group had infections[6].

Horwitz et al[14] showed that 3.5 mm buttress plate applied medially was as stable as dual plating.

In the last few decades, a lot of emphasis has been put on biological fixation methods. These methods involve minimal periosteal stripping hence preserving the vascularity. This has led to the advent of unilateral locking plates for the fixation of bicondylar tibial plateau fractures[8].

Unilateral plating of bicondylar tibial plateau fractures with the less invasive stabilization system has had mixed results. In a study by Gosling T et al[8] bicondylar tibial plateau fractures were fixed using a single lateral LISS plate, the post operative infection rates were low but the rates of malreduction were high. The cause for the high malreduction rates can be the inability of the screws in the fixed angle plate (applied laterally), to hold the small medial fragments. On the other hand, Spagnolo and Pace[10] first reduced and fixed the medial plateau fracture using cannulated cancellous screws and then applied a fixed angle plate with locking screws laterally. This method yielded a much lesser rates of malreduction in the post operative period.

The application of a unilateral plate using the open reduction technique (instead of Less Invasive Stabilization System) provides a lower rate of malalignment in the immediate postoperative period and a stable fixation with good-excellent functional outcomes in bicondylar fractures. The malreduction rates on follow up visits are higher in bicondylar fractures with a posteromedial fragment[15]. Maintenance of axial alignment in high energy tibial plateau fractures is difficult with only a single plate. High rates of varus collapse and

posterior tilt are seen in fractures fixed with the traditional lateral plating system. In bicondylar tibial plateau fractures a unilateral locked plate with additional medio-lateral screw fixation, reduces the need for an additional plate and is a good alternative to the traditional dual plating.

## Conclusion

Taking the above findings into consideration we can conclude that Open reduction internal fixation of bicondylar fractures of the tibial plateau with plate on one side and enhancement of fixation with cannulated cancellous screws on the other side, yields good-excellent functional outcome. The time of union was comparable to other studies with similar treatment protocol. There is less soft tissue stripping with a lower rate of delayed union compared to other studies where unilateral plating was performed for bicondylar tibial plateau fractures. There were no cases of non union. The rate of wound complications was considerably lower than traditional dual plating, and was comparable to similar studies where unilateral plating was performed.

There was no loss of reduction or malreduction in the post operative period in our study, suggestive of the stability of the construct used in the study. The method described in this study is a better alternative for treatment of problematic fractures associated with soft tissue damage or extensive metaphyseal/diaphyseal fracture comminution. Further studies with bigger sample size and longer study duration are warranted for further validating these results.

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