



## FUNCTIONAL OUTCOME OF HYBRID EXTERNAL FIXATOR IN SCHATZKER V & VI TIBIAL PLATEAU FRACTURE

**Dr Rakesh Chand Meena\***

Medical officer (Orthopedics), Department of medical and health, Rajasthan.  
\*Corresponding Author

**Dr Vijendra Kumawat**

Senior Resident, Department of Orthopaedics, S.K. Medical College, Sikar, Rajasthan.

**Dr Manish Mehta**

Medical officer (Orthopedics), Department of medical and health, Rajasthan.

### ABSTRACT

**Aim:** The present study is designed to assess functional outcome of hybrid external fixator in Schatzker type V & VI tibial plateau fracture.

**Patients and methods:** 35 cases with Schatzker type V & VI tibial plateau fracture were treated with hybrid fixator at orthopaedic department, S.M.S Medical College, Jaipur from January 2018 to January 2020 were included who fulfilled the inclusion criteria after taking informed written consent.

**Results:** Mean interval of time to radiological union was 24.81 week. In our study, out of 35 cases 5 cases (14.28%) had mal union and 3 (8.57%) cases had non union. Mean range of motion 110.710 (900 to 1400) at 24 week. Normal extension of knee was observed in 33 patients and extension lag was noted in 2 patients. According to Rasmussen's criteria, out of 35 cases 4 patients had excellent, 12 patients had good, 17 patients had fair and 2 patients had poor follow up at 24 weeks. The mean score was 21.08 at 24 weeks follow up.

**Conclusion:** Hybrid external fixator is a safe and effective option for the treatment of difficult Schatzker V and VI tibial plateau fractures. It minimizes soft tissue complication and favors bony union with an acceptable return of function.

**KEYWORDS :** High-energy tibial plateau fractures, Severe soft tissue injury, Hybrid external fixator

### INTRODUCTION:

Fractures of tibial plateau comprise a diverse group of fracture pattern that range in severity from minor injuries that have predictably excellent outcome after simple treatment to fractures at risk for limb threatening complications. Low energy fracture which includes simple split fractures of a condyle, depression of the articular surface, or simple extra articular fractures of proximal tibia. High energy fractures which are recognized radiographically by complex fracture patterns with significant comminution and multiple fracture lines. Both condyles are usually involved, and significant metaphyseal comminution may be noted. Severe articular surface crushing and depression with wide displacement is typical. In addition there is usually serious soft tissue injury, including swelling, bruising, laceration, open fractures, abrasions, and possibly compartment syndromes.

High energy tibial condylar fractures present multifaceted problems of difficulty of achieving accurate joint reconstruction. The goal of treatment is to achieve a stable, aligned congruous joint with painless restoration of motion and function. These fractures vary widely in severity and are treated by different means but none of the methods universally produce good results and the treatment must be planned on individual basis considering not only the bony injury pattern but also other factors like soft tissue injury, age and functional demand of patient, availability of resources and surgeon's expertise.

Hybrid fixator is a treatment modality for tibial plateau fracture, specially with significant metaphyseal comminution with or without diaphyseal extension, severe metaphyseal and subchondral comminution with very small periarticular fragment unsuitable for internal fixation, soft tissue problems like compartment syndrome, open fractures and severe soft tissue injury.

### AIMS AND OBJECTIVES

To evaluate the functional outcome of hybrid fixator in management of Bicondylar tibial plateau fracture schatzker type V & VI in terms of:

#### Time to union

**Proportion of complication:** Infection (pin tract, superficial, deep), Malunion, Nonunion Other

#### Joint function recovery using Rasmussen's knee score

### MATERIAL AND METHODS

This prospective study was on the patients with bicondylar tibial plateau fractures admitted in department of orthopaedics, sawai man singh hospital, jaipur between period of January 2018 to

January 2020 irrespective to age and sex and fulfil the following inclusion criteria listed below:

#### INCLUSION CRITERIA-

1. Patients with Schatzker type V, VI complete articular fractures involving proximal tibia
2. Skeletally mature patient (age  $\geq$  18 years)
3. Patients giving informed consent to take part in study
4. Close fractures

#### EXCLUSION CRITERIA

1. Polytraumatized pts.
2. Surgical contraindications because of medical, anaesthetic or surgical cause
3. Age less than 18 years.
4. Pathological fractures.
5. Patients refusal for surgery.
6. Open fractures.

#### METHODOLOGY

All patients were evaluated clinically at the time of admission to elicit mode of injury, date of injury, previous history and any other associated medical or surgical illness. Vital parameters monitored and fluid and blood transfusion was given if required.

Particular attention was given to compartment syndrome which is very common in such type of injury. Peripheral circulation was checked, attention was also given to any neurological deficit. If massive swelling develops a lower tibial pin was passed and traction was applied on Bohler Braun splint with continuous attention on peripheral circulation of involved limb.

Initial radiograph was including anterior-posterior and lateral views of involved knee taken. Computed tomography with 3D reconstructions was done to evaluate the degree of displacement.

#### SURGICAL TECHNIQUE OF HYBRID FIXATOR:-



**Step 1:** Reduction of the fracture was done either by traction ligamentotaxis on a fracture table or by manual traction. If reduction was not achieved a 2.5mm k wire introduced in fractured fragment under image IITV and used as jockey stick to push and lift the fragment to maintain articular surface under image IITV and reduction was held with pointed reduction forceps.

**Step 2:** Three olive wires was passed from postero-lateral(L-M), postero-medial (M-L) and transverse (L-M) direction to the proximal tibia at the level of 5-10 mm distal and parallel to the joint line across the two displaced major fragment under image.

**Step 3:** A 5/8<sup>th</sup> of a circle illizarov external fixator ring connecting to all olive wires and with help of tensioner, tension given under image.

**Step 4:** Two external fixator cortical schanz pin introduced antero-medial aspect of distal tibia and connected to medial side of proximal assembly via rod, clamp and post.

**Step 5:** A cortical pin introduced anterolateral of distal tibia and connected to lateral side of proximal assembly via rod, clamp and post.

**Step 6:** Another cortical pin introduced anteroposterior just distal to fracture site and connected to medial n lateral rod via clamp for prevention of posterior sagging.

**Post Operative Rehabilitation Protocol:-**

- Isometric quadriceps exercise and knee mobilization from post op day one.
- The goal is full extension and 90 degree of flexion of knee joint as soon as possible.
- Partial weight bearing after 6-10 weeks and full weight bearing 10-20 weeks.

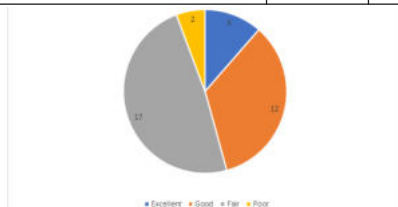
**OBSERVATIONS AND RESULT:**

The youngest patients in this study at the time of sustaining injury was 18 years and oldest patient was 62 year. The mean age 38.62 year with 32 male and 3 female and male-female ratio :: 10.6: 1. Right knee was involved 18 patients (51.42%) and left knee was in 17 patients (48.57%). Road traffic accident in 82.85, followed by slip n fall 8.57%, fall from height ,blast injury and assault 2.85% cases respectively. Schtzkar type VI (51.42%) is more common than type V (48.57%). Mean injury-surgery interval was 6.31 days. Mean interval between surgery and partial weight bearing was 11.14 weeks and 17.82 weeks for full weight bearing. Mean interval of time to radiological union was 24.81 week. In our study, out of 35 cases 5 cases(14.28%) had mal union and 3 (8.57%) cases had non union. Mean range of motion 110.71<sup>o</sup> (90<sup>o</sup> to 140<sup>o</sup>) at 24 week. Normal extension of knee was observed in 33 patients and extension lag was noted in 2 patients. According to Rasmussen's criteria, out of 35 cases 4 patients had excellent, 12 patients had good, 17 patients had fair and 2 patients had poor follow up at 24 weeks. The mean score was 21.08 at 24 weeks follow up.

**Final Result in Rasmussen knee score**

**Table 1**

	No.	%
Excellent	4	11.42
Good	12	34.28
Fair	17	48.57
Poor	2	5.71
Total	35	100.0



**DISCUSSION:**

In 1979, Schatzker et al. introduced a classification for tibial plateau fractures that distinguished low-energy split depression fractures from higher energy bicondylar (Schatzker V and VI) fractures<sup>[1]</sup>. Many authors have attempted to define these complex fractures based on the bony injury or the degree of soft tissue injury<sup>[2-4]</sup> Watson eloquently

defined high-energy tibial plateau fractures based on the presence of large degree of articular depression, displaced multiple condylar fracture lines, and meta-diaphyseal comminution or extension in association with open injuries or extensive soft tissue injury<sup>[5]</sup> These injuries were also designated as "severe or complex fractures".

The goals of operative treatment of these fractures include anatomic reduction for restoration of articular congruity and alignment, and stable fixation to allow early motion. However, the classic dual plate osteosynthesis has been associated with potentially devastating complications such as fixation failure, malunion, nonunion, joint stiffness, secondary post-traumatic osteoarthritis, infection, and most importantly severe soft tissue complications ranging from 23 to 87.5%<sup>[4,6-9]</sup>.

Over the past few decades, a number of evolving treatment modalities ranging from traction to cast immobilization to open reduction and internal fixation have been used with mixed results. No treatment modality has produced consistently good results, nor has any allowed both stable fixation and preservation of remaining soft tissue<sup>[7,8]</sup>. In an attempt to achieve both stable fixation and preserving the remaining soft tissue, many surgeons have chosen to use indirect reduction and external fixation. Hybrid external fixation has been introduced and shown to be effective in the treatment of these difficult fractures<sup>[10-13]</sup>.

Watson et al. applies the term of hybrid fixation quite loosely by stating that hybrid fixation denotes no single or universally accepted treatment strategy or device<sup>[14]</sup>. The term hybrid has also been used when Schanz pins are mounted on the frame distally for diaphyseal fragment fixation. Kumar and Paige differentiate conventional Illizarov frame from hybrid Illizarov frame by using Schanz pins rather than wires through the distal ring for fixation of the diaphysis<sup>[15]</sup>. With the evolution of technique and hardware used, the current hybrid frames consists of small tensioned wires on a proximal ring frame to maintain and reduce the metaphyseal fragments, while the remainder of the distal frame is attached to the shaft using standard external fixator's half pins<sup>[16]</sup>.

The indications for hybrid external fixation are Schatzker V and VI tibial plateau fractures, significant metaphyseal comminution with or without diaphyseal extension, severe metaphyseal and subchondral comminution with very small periarticular fragment unsuitable for internal fixation, soft tissue problems like compartment syndrome, open fractures, and severe soft tissue injury in osteoporotic patients<sup>[10, 16]</sup>. The hybrid external fixator offers several advantages that include minimizing further injury to the soft tissue envelope, feasible surgery even in the presence of badly injured soft tissue, adequate stability to allow early post-operative mobilization, and minimizing risk of stiffness. The disadvantages include the need for constant pin site care, pin sites infection and the risk of septic arthritis from incidental intracapsular pin placement and potential risk of common peroneal nerve injury from poor pin placement. Gaudinez et al. reported the use of Monticelli-Spinelli hybrid frame only for indirect reduction technique in a series of 18 Schatzker V and VI tibial plateau fractures<sup>[11]</sup>.

They recommended the technique due to its advantage of minimal soft tissue complication and allowing early range of motion. In a matched cohort study on the treatment of high-grade tibial plateau fractures comparing internal fixation and ring fixator, Veri et al.<sup>[17]</sup> noted high rates of wound complications and reoperation in the open reduction internal fixation utilizing single incision with dual plates group. Their results also suggested that hybrid external fixation is an effective and safe method with a low wound complications rate and early functional return. Pin tract infection was the main drawback when using an external fixator to treat fractures. In meta-analysis of 10 studies with a total of 381 patients, Hutson et al. encountered 38 cases superficial pin tract infection (10%), 5 septic arthritis (1%), and 13 deep infection(4%)<sup>[18]</sup>.

**CONCLUSION:**

We enjoyed the short learning curve on the use of hybrid fixator in management of tibial plateau fracture. The indications for external fixation are tibial plateau fractures, significant metaphyseal comminution with or without diaphyseal extension. The results are improved with experience, careful pre-operative planning, and a thorough knowledge of neurovascular anatomy. Good intra-operative imaging is needed to decrease the incidence of mal-reduction, position of olive wires while learning.

**REFERENCES**

1. Schatzker J, McBroom R, Bruce D (1979) The tibial plateau fracture: the Toronto experience 1968–1975. *Clin Orthop* 138:94–104
2. Burri C, Bartzke G, Coldewey J et al (1979) Fractures of the tibial plateau. *Clin Orthop* 138:84–93
3. Benirschke SK, Agnew SG, Mayo KA et al (1991) Open reduction internal fixation of complex proximal tibial fractures. *J Orthop Trauma* 5:236
4. Lansinger O, Bergman B, Courmner L et al (1986) Tibial condylar fractures: a 20 year follow-up. *J Bone Joint Surg Am* 68:13–18
5. Watson TJ (1994) High energy fractures of the tibial plateau. *Orthop Clin North Am* 25:723–752
6. Young MJ, Barrack RL (1994) Complications of internal fixation of tibial plateau fractures. *Orthop Review* 23:149–154
7. Schatzker J (1996) Fractures of the tibial plateau. In: Schatzker J, Tile M (eds) *The rationale of operative fracture care*, 2nd edn. SpringerVerlag, Berlin, pp 419–438
8. Wiss DA, Watson JT, Johnson EE (1996) Fractures of the knee. In: Rockwood CA, Green DP, Buchholz RW, Heckman JD (eds) *Fractures in adults*, 4th edn. Lippincott-Raven, Philadelphia New York, pp 1919–1999
9. Moore TM, Patzakis MJ, Harvey JP (1987) Tibial plateau fractures: definition, demographics, treatment rationale, and long results of closed traction management or operative reduction. *J Orthop Trauma* 1:97–119
10. Stamer DT, Schenk R, Staggers B et al (1994) Bicondylar tibial plateau fractures treated with a hybrid ring external fixator: a preliminary study. *J Orthop Trauma* 8(6):455–461
11. Gaudinez RF, Mallik AR, Szporm M (1996) Hybrid external fixation of comminuted tibial plateau fractures. *Clin Orthop* 328:203–210
12. Ali AM, Lang Y, Hashimi M, Saleh M (2001) Bicondylar tibial plateau fractures managed with Sheffield hybrid fixator: biomechanical study and operative technique. *Injury* 32:86–89
13. Piper KJ, Won HY, Ellis AM (2005) Hybrid external fixation in complex tibial plateau and Plafond fractures: an Australian audit of outcomes. *Injury* 36:176–184
14. Watson TJ, Ripple S, Hoshaw SJ, Fyhrie D (2002) Hybrid external fixation for tibial plateau fractures: clinical and biomechanical correlation. *Orthop Clin North Am* 33:199–209
15. Kumar A, Paige WA (2000) Treatment of complex (Schatzker type VI) fractures of the tibial plateau with circular wire external fixation: retrospective case review. *J Orthop Trauma* 14:339–344
16. McLaurin TM (2005) Hybrid ring external fixation in the treatment of complex tibial plateau fractures. *Tech Knee Surg* 4:226–236
17. Veri JP, Blachut P, O'Brien P, Pirani S (2000) High grade tibial plateau fractures: a matched cohort study comparing internal fixation and ring fixator methods. *J Orthop Trauma* 14:153
18. Hutson JJ Jr, Zych GA (1998) Infections in periarticular fractures of the lower extremity treated with tension wires hybrid fixators. *J Orthop Trauma* 12:214–218