

OUTCOME ANALYSIS OF TIBIAL PLATEAU FRACTURES FIXED BY SINGLE LATERAL PERIARTICULAR LOCKING PLATE

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ABSTRACT

Introduction: Tibial plateau fractures comprises of 1% of all fractures and 8% of fractures in the elderly. The severity of injury increases classified by schatzker classification. Intraarticular tibial bicondylar fractures are notoriously difficult to treat. Nowadays locking plate technology has allowed for a new approach to this difficult fracture.

Material and methods: This was a prospective study of 47 patients with tibial plateau fractures fixed with single lateral periarticular locking plate over lateral surface of tibia and followed upto 1 year and evaluated by using Rasmussen knee score system.

Results: All patients were followed properly but three patients were lost to follow up so only remaining 44 patients were evaluated. at 1 year of follow up functional outcome was assessed and observed that 79.54% of patients had good to excellent results while 20.45% patients had fair results.

Conclusions: Tibial plateau articular fractures demands anatomical reduction and absolute stability to enhance the healing of articular fragments and make early motion possible. Periarticular locking plates combined with biological techniques have improved outcome with respect to union rate and decrease soft tissue complications.

Key words: Tibial plateau fractures, Schatzker classification, Locking compression plate, Rasmussen knee score

INTRODUCTION

Tibial plateau fractures comprises of 1% of all fractures and 8% of fractures in the elderly.¹ Anatomically medial plateau is concave and larger while lateral plateau is convex and smaller. The majority of tibial plateau fractures are secondary to high speed velocity accidents and fall from heights where fractures results from direct axial compression, usually with a valgus or varus moment and indirect shear forces. The severity of injury increases classified by schatzker classification.² Complex fractures include significant articular comminution and depression, condylar displacement, metaphyseal fracture extension, and open or closed soft tissue injuries.³

Intra-articular tibial bicondylar fractures are notoriously difficult to treat^{2,4} and functional outcome have decreased in spite of experience surgeon.⁵ Goal of treatment are restoration of joint surface, normal limb alignment, stable knee and good range of motion with preservation of surrounding soft tissue blood supply. Closed management of comminuted displaced fragments has proved ineffective, hence usually not recommended.⁶ Open reduction of fracture fragments allow a good control of articular surface and correction of mechanical axis.

Recent advancement in angle-stable locking plate technology has allowed for a new approach to these difficult fractures to achieve goal.⁷⁻¹¹

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Locking plates may decrease the need for dual plating in certain bicondylar fractures of tibia. Lateral LCP fixation in bicondylar fractures might be a stable, enough fixation when medial condyle is not displaced or comminuted.

The purpose of this study was to assess the results of single periarticular locking plate fixation in management of tibial plateau fractures.

MATERIAL AND METHODS

This was a prospective study of 47 patients with tibial plateau fractures at Gandhi Medical College and Hamidia Hospital, Bhopal over a period of 1 year from July 2013 to June 2014. Antero-posterior and lateral radiographs of knee with legs were taken to determine the fracture configuration of every patient of knee injury who participated in study. Fracture was classified by Schatzker classification and for pre-operative planning.² Computed tomography (CT) scan done in cases where more detailed fracture configuration was needed.¹² The patients were stabilized and local soft tissue condition assessed pre-operatively, surgery was delayed till the skin regained wrinkle sign in some cases of severe trauma.¹³ Minimally invasive plate osteosynthesis (MIPO) was used wherever the fracture fragments reduction seems to be acceptable along with good soft tissue condition.¹⁴

Inclusion criteria:

1. Age between 20-70 years.
2. Isolated closed tibial plateau fracture.
3. Comp. grade I (Gustillo-Anderson classification) fracture.¹⁶

Exclusion criteria:

1. Age < 20 and > 70 years.
2. Polytrauma patient.
3. Comp. grade II & III (Gustillo-Anderson classification) fractures.
4. Fracture-dislocation of knee injury.
5. Pathological fracture of tibial plateau.
6. H/O previous osteotomy or fracture over same region.
7. Systemically ill patient.

All surgeries performed under spinal anesthesia under fluoroscopy control. Intravenous antibiotic protocol was 3rd generation cephalosporin 1 hr before to surgery and upto 7 days followed by oral antibiotics upto suture removal. Post operative x-rays were done and assessed for malreduction. Malreduction was defined as an intra-articular step-off up to 2 mm or greater or a malalignment in the frontal and sagittal plane of greater than 5 degree. Intermittent passive knee mobilization was started 2nd postoperative day followed by active knee mobilization after suture removal which usually take 10-12 days from surgery. Above knee POP slab given upto 3 weeks. Non weight bearing crutch walk allowed after 3 weeks and progressive weight bearing was allowed according to the callus formation assessed on further followup radiographs which usually take 6-8 weeks. Full weight bearing (FWB) was allowed only after clinicoradiological appearance of union which usually take 12-16 weeks. Further followup done upto one year to see results. Union was defined as bridging of 3 of the 4 cortices and disappearance of the fracture line on x-rays for a patient who was able to FWB. Delayed union was defined as fracture in process of union but not united upto 6 months. If fracture did not heal within a year defined as a nonunion. Follow up done on 8, 12, 16 weeks then every 2 months upto one year, complications were observed in every visit of patient. Final functional outcome was evaluated by using the Rasmussen knee score¹⁶ at one year of followup.

RESULT

There were 47 patients with tibial plateau fractures treated with periarticular locking plate system. Two patients were lost to follow up before one year and one patient died due to unrelated cause therefore 44 patients made the report of this study with a mean age of 40.9 years. The mean follow up was 9 months (range 6-12 months). 40 patients had history of RTA and 7 had domestic fall. There were 9 open fractures all of which were Gustillo Anderson grade I type, rest 38 patients were closed fractures. All fractures were classified according to the Schatzker classification. 35

patients were treated with ORIF and 12 patients were by MIPO technique. Bone grafting was not performed in any case. Out of 47 patients 38 were male and 7 were female, age wise maximum number of patients were belonged to 41-50 years that was 12 patients (see Figure 1).

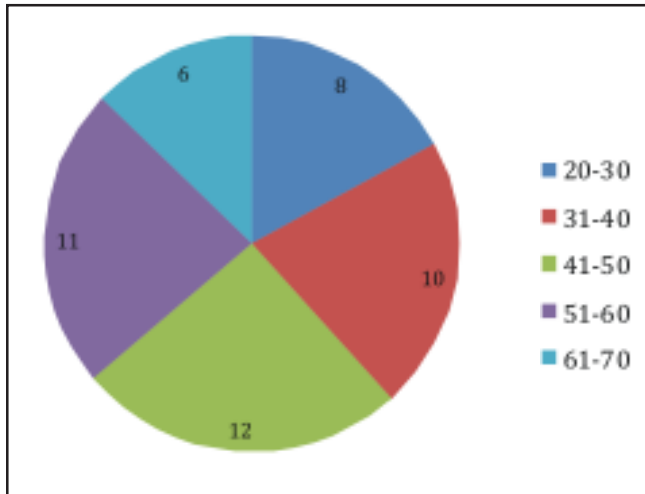


Figure 1 : Age wise distribution of patients



Figure 2 : Pre operative X-rays



Figure 4 : After 10 months follow up



Figure 3 : Immediate post operative x-rays

Table 1

RTA: Domestic fall	5.7 : 1
M : F	4.2 : 1
Close : Open fracture	4.2 : 1
ORIF : MIPO	3: 1
Avg. age	40.9 years
Avg. ROM	15-105 degree
Avg. union time	20.3 weeks

Table 2
Fracture classified percentagewise

Schatzker type	Number of pt.	Percentage
I	0	0
II	6	12.77
III	5	10.64
IV	9	19.15
V	12	25.53
VI	15	31.91

Wound infection was observed in the 5 cases, 3 were superficial infection which were controlled with an extended course of intravenous antibiotics and 2 were deep infection and positive culture had a open fracture with extensive comminution which underwent two times debridement and healed by secondary healing. There were 2 cases of malreduction belonged to schatzker type V and VI where medial condyle was not achieved satisfactory reduction which further resulted as varus, malunion and stiff knee. No delayed union or implant failure was observed upto 1 year of follow up (see Table 3). The average time to union was calculated to be 20.3 weeks (range 16-24 weeks).

Table 3
Observed Complication

Complications	Number of pateint	Percentage
Superficial infection	3	6.38
Deep infection	2	4.26
Stiffness (< 90 degree flexion)	2	4.26
Malreduction	2	4.26
Malunion	2	4.26
Nonunion	3	6.38
Delayed union	0	0
Implant failure	0	0
Varus	2	4.26

In this study Rasmussen knee score¹⁶ was used to evaluate the final functional outcome at

one year of follow up. After evaluation it was observed that 35 (79.54%) of patients had good to excellent result while 9 (20.45%) patients had fair results (see Table 4).

Table 4
Observed Rasmussen Knee Score

Score	Result	Number of patient	Percentage
27-30	Excellent	19	43.18
20-26	Good	16	36.36
10-19	Fair	9	20.45
< 10	Poor	0	0

DISCUSSION

Tibial plateau fractures are serious injuries and can result in considerable morbidity. These injuries are caused by high energy trauma with comminution and significant soft tissue damage. Stable fixation without compromising the soft tissue envelope is often difficult¹⁷ and poor results are seen in 20-50% of all tibial plateau fractures.¹⁸ Schatzker type V & VI notoriously difficult to treat that lead to high complication and poor clinical outcome, inspite this surgical treatment is the current standard of care.⁴ Now a days internal fixation of tibial plateau fractures widely performed by use of locking plates with MIPO technique.^{11,19-23} Krettek et al²⁴ described disadvantages of LCP fixation over lateral surface of tibia as (1) devitalisation of the fracture due to elevation of muscle from bone; (2) injury to superficial peroneal nerve; (3) increased risk of compartment syndrome; and (4) difficulties in placement of the implant into confined spaces. However, none of the above disadvantage was seen in our study.

Our study represent the subset of population presenting with complex fracture pattern (Schatzker type V & VI) accounting for 57.44% of cases which was due to high energy trauma, which had only 14% in study of Rademakers et al²⁵ in Netherland. This was attributed to excellent road safety measures which lowers the incidence of high energy trauma.

Regardless the treatment the reported complications include: Wound dehiscence; Deep infection (2.8 to 80%); DVT (3.6 to 10%); Compartment syndrome ; Non union; Peroneal palsy, Implant failure and Stiffness.^{17,18,24,26-33}

The mean time to union in our study was 20.3 weeks, which was comparable to contemporary studies with locked plating.^{11,34,35} In our study infection was observed in 10.64% cases (n=5) which was reported by Lee et al 34 (8%), Gosling et al 9 (6%), Stannard et al 11 (5.9%) and Phisitkur et al 19 32% (n=12) in their series.

Coley et al 36 stated that postoperative malreduction are due to surgeons unfamiliarity with closed reduction technique. The increase in articular angulation of 6 degree in two patients (4.26%) revealed in this study appeared not to play an important clinical role, as the overall range of motion averaged 15-105 degree and was compatible with other reported outcomes.^{10,11,36}

An analysis of functional outcome using Rasmussen knee score showed that 43.18% (n=19) excellent and 36.36% (n=16) good result, which was comparable with study of Mathur et al³⁷ treated with conventional plates showed excellent score in 37% (n=10) and good in 52% (n=14.); Jain et al.³⁸ treated with locking plates showed 41.2% (n=14) excellent and 41.2% (n=14) good results.

CONCLUSION

Tibial head articular fractures demands anatomical reduction and absolute stability to enhance the healing of articular fragments and make early motion possible. Periarticular locking plates combined with biological technique have improved outcome with respect to union rate, and decrease soft tissue complication. Single plating with locking head screws seems a reasonable option for treatment of complex tibial plateau fractures. It might not replace conventional ORIF dual plating technique as the standard treatment, but because of the minor infection rates and high union rates without bone grafting, it is an excellent alternative for treating complex tibial plateau

fractures. Periarticular locking plates may decrease the need for dual plating in certain bicondylar fractures pattern; when medial condyle is not comminuted and there is no separate posteromedial fragments. Though long term follow up is required to complete recovery, still we feel that locking compression plate fixation is very useful in stabilization of these kind of fractures.

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