

## Results of Single Lateral Locked Plate in Complex Schatzker Type V and VI Tibial Plateau Fractures Using Minimally Invasive Fixation Technique-Surgical Experience in 46 Fractures.

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### ABSTRACT

**Background:** Bicondylar tibia plateau fractures are difficult to manage due to complexities of comminution of articular surfaces, extensive soft tissue injuries, infection and risk of compartment syndrome associated with it. Various modalities including cast, traction or open reduction and internal fixation using single to dual plate fixation technique are now days used. We report our results of single lateral locked plate in management of these complex Schatzker V and VI tibial plateau fracture using minimally invasive technique.

**Material And Methods :** A prospective study was conducted to assess the result of 49 cases with Schatzkar type V and VI tibial plateau fracture compounding up to Gustilo-anderson type III A treated by single lateral locked plate by minimally invasive technique during period April 2010 to January 2015 at a tertiary level medical institute. Follow up was range from 8-24 months. Functional and radiological assessment done according to Rasmussen's knee score.

**Result:** Out of 49 cases, 3 cases were lost during follow up. Mean age of patient was 36.35 years (range 20-70 years). All the fractures united in our study in 16.93 weeks (range 18-23 weeks) with malunion observed in 4 cases. Range of movement at time of union was 116.760 (range 80-1300). Infection occurred in 6 cases (13.04%) and in 1 case implant removal was required. According to Rasmussen knee scoring 84.78% had excellent, 13.04% good clinical out come.

**Conclusion:** Excellent clinico-radiological outcome can be achieved with single lateral locked plate in complex tibial Schatzker type V & VI fractures using minimal invasive techniques by preventing further soft tissue injuries and envelope.

**Key Words :** Complex tibial plateau fractures, single lateral locked tibial plate, Schatzker type V, VI fractures, minimally invasive fixation technique.

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### INTRODUCTION

Incidence of injuries around knee is on the rise. Even small irregularities in articular surfaces in this complex joint leads to instability and stiffness with below normal range of motion. Compounding or complex tibial plateau injuries, associated with considerable soft tissue injury, are usually a result of high velocity trauma due to axial loading combined with valgus / varus forces <sup>(1)</sup>. High energy tibial plateau fractures are difficult to manage. Problem with treatment is not only achieving union but also restoration of joint anatomy and joint mobility. Various methods of treatment for complex and compound fractures are being used now days for restoration and maintenance of reduction with ultimate aim of prevention of occurrence of late degenerative arthritis. These injuries severely affect the selection of implant, surgical procedure. Complications are more if complex fractures of tibial plateau are not adequately managed. Casting and traction in these situations produce poor results. Till date common consensus has not developed regarding management of complex tibial plateau fractures. With better understanding of injuries and fracture patterns with CT scan and MRI imaging techniques,

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management is rapidly evolving from extensive open reduction and internal fixation to arthroscopic assisted minimally invasive surgery. Currently such injuries are being managed by single/dual plating, fixator (hybrid, ring, JESS fixator) depending upon need of injury pattern and surgical expertise of surgeons. Locking plates are now days preferred <sup>(2)</sup> and techniques of fixation are continuously in process of evolution from LISS (less invasive stabilization system) to periarticular

locking compression plate system (LCP) <sup>(3,4)</sup>. We have analyzed our results of single lateral locked plate in management of these complex comminuted intra / juxtra articular fractures with aim to achieve a high degree of functional and cosmetic results.

## **MATERIAL AND METHOD**

Total 49 patients from April 2010 to January 2015, all bicondylar tibial plateau fractures (Schatzker type V, VI) admitted and treated with single lateral locked proximal tibial plate at tertiary level medical institute with level-I trauma centre having following inclusion and exclusion criteria were included in study.

### **Inclusion criteria**

- Schatzker type V, VI.
- Open fractures up to Gustilo-Anderson type III A
- Age above 20 years.

### **Exclusion criteria**

- Fracture associated with neuro-vascular deficit
- Fracture associated with dislocation of knee joint
- Any previous pathology or fracture around knee joint
- Any previous history of surgery around knee joint

3 cases were lost during study and follow up. With total 46 patient available for study mean of age of patients was 36.35 years (range from 20-70). 41 patient were male and 5 female. 35 patient has right side tibial plateau fractures as compared to 11 patient who sustained injury on left side. 10 patient presented with open injury up to Gustilo Anderson grade III A, rest 36 patient had closed fracture with most of them having either bruising or blisters. There were 18 patients with schatzker V fracture pattern as compared to 28 patients of schatzker type VI (Figure1). 36 patients sustained this complex tibial plateau fracture as result of road traffic accidents remaining 10 patients had a history of fall at home. 28 patients presented within 72 hour of injury and rest 18 patient presented late after either referred from other hospital or after primary management on plaster cast / slab.

## **PROCEDURE**

All the patients were managed using single lateral anatomical contoured locked plate. Patient position was supine on a standard operating table with single small mini lateral incision with infra meniscal arthrotomy was performed using tourniquet in all most all cases. Elevation of depressed fragments done and articular surface checked using c-arm intensifier and held using k-wires. Bone graft was done in 8 cases taking graft from iliac crest. Lateral pre-contoured anatomical locked plate was secured using locking screw (Figure2). Medial screws were inserted percutaneously to secure medial tibial plateau fixation. Passive and active range of motion exercises were encouraged as soon as possible. Partial weight bearing was permitted after 8 weeks. Full weight bearing allowed after clinical or radiological union. Patient were followed up for 11months (Range 8-24 months) (Figure-3) and evaluated clinico-radiologically as per Rasmussen's knee score <sup>(5)</sup>.



Figure - 1 : Showing pre-op radiograph AP/Lat view



Figure - 2 : Showing immediate post-op radiograph AP/Lat views.



Figure - 3 : Showing follow up radiograph AP/Lat views at 14

**RESULTS AND OBSERVATIONS**

All the fractures united in average 16.93 weeks (range 18-23 weeks) with malunion observed in 4 cases (8.69%). Infection occurred in 6 cases (13.04%) out of which 2 cases were simple and 4 cases were compound (p<.05) (Table-1). One patient required removal of implant due to deep seated infection. 3 patients having compound fractures later developed wound dehiscence (p<.05). No nonunion was seen in our study. Average range of motion of knee joint at union was 116.76° (Range 80-130°). Stiffness in knee joint was observed in 2 cases (4.34%). According to Rasmussen’s knee score, 39 patients (84.78%) had excellent, 6 patients (13.04%) had good while 1 patient (2.17%) had fair clinical outcome. And radiological assessment shows 37 patients (80.43%) had excellent whereas 9 patients (19.46%) had good radiological outcome (Table-2) [figure 4].

**Table 1: Showing occurrence of complications in our study.**

Complications	Simple n=36	Compound n=10	Percentage (%) n=46	Chisquare test (p value)	RR (95% CI)	OR (95% CI)
Infections	2	4	13.04%	p= .004 (<.05)	0.139 (0.019 – 0.793)	0.088 (0.008–764)
Malunion	3	1	8.69%	p= 0.088 (p>.05)	0.833 (0.085–20.602)	0.818 (0.060-3.083)
Stiffness	2	0	4.34%	p= 0.446 (>.05)	Infinite (0.071–infinite)	Infinite (0.061-infinite)
Breakage	0	0	0	--	--	--
Non Union	0	0	0	--	--	--
Wound Dehiscence	0	3	6.52%	p= 0.001 (<.05)	0.000 (0.000-0.575)	0.000 (0.000-.549)
Removal of Implant	1	0	2.17%	p= 0.594 (p>0.05)	Infinite (0.016–infinite)	Infinite (0.015-infinite)

**Table 2: Showing Clinico-Radiological Outcome According To Rasmussen’s Knee Score**

**Discussion**

Clinical Outcome			
Result	Score	No. of patient	Percentage
Excellent	28-30	39	84.78
Good	24-27	6	13.04
Fair	20-23	1	2.17
Poor	Nil	Nil	Nil
Radiological Outcome			
Excellent	9-10	37	80.43
Good	7-8	9	19.56
Fair	5-6	Nil	Nil
Poor	<5	Nil	Nil

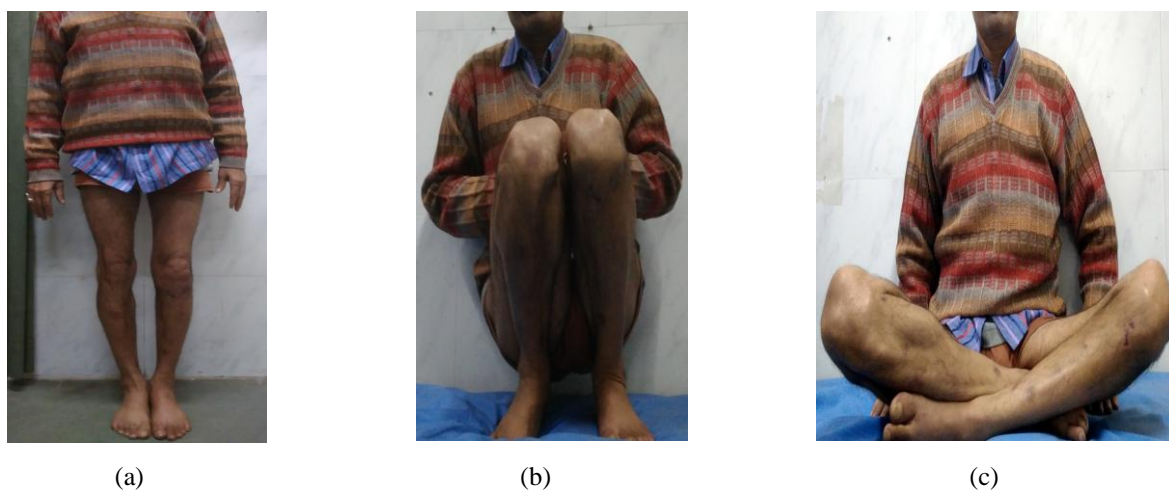


Figure - 4: Showing clinical photograph (a) standing, (b) squatting and (c) cross legged

## DISCUSSION

Management of tibial plateau fractures associated with extensive soft tissue injuries or impending compartment syndrome is real challenge to surgeon and puts him in dilemma. Key to successful treatment is early joint mobilization which promotes cartilage nutrition and healing<sup>(6)</sup>. High energy trauma is major concern in treatment and responsible for poor result in these cases. Healing of tibial plateau fracture with severely damaged soft tissue is very poor is an established fact. Management decision varies from surgeon to surgeon depending upon clinico- radiological condition of patient. For close bi-condylar tibial plateau fractures routine practice of treatment is open reduction and fixation of articular surface with condylar buttress plate with or without bone grafting depending on need of fracture configuration<sup>(7)</sup>. For open fractures external fixator likes of Ilizarov's ring fixator, hybrid fixators, knee spanning fixators have been preferred. Proximal ring of Ilizarov's ring fixator restricts full range of motion and knee spanning fixator do not allow early range of motion.

Casting and traction are least preferred in these situations due to poor patient compliance, high rates of joint stiffness, risk of loss of reduction malunion, non union and prolonged morbidity associated with them.

Staged management to these complex injuries is now days preferred. Surgeon depending upon the clinico-radiological condition treat such injuries first with external fixators followed by plating, nailing to minimize the complication and patient morbidity associated with management of these complex injuries. More than 2mm of articular step in articular surface requires surgical intervention to prevent arthritis. Open reduction internal fixation to achieve anatomical reduction and restoration of joint surface necessitates soft tissue stripping further compromising soft tissue envelope and increasing incidence of complications e.g. infection, wound dehiscence and stiffness<sup>(8)</sup>.

Surgeons are using single/dual plate constructs. The results published in literature are conflicting. Yoo et al<sup>(9)</sup> and Jiang et al<sup>(10)</sup> used dual plate in their study and found axial load tolerance was high with lateral 3.5 mm compression plate and postero-medial 1/3 tubular plate. Other studies like muller et al<sup>(11)</sup> Gosting et al<sup>(12)</sup>, Higgins et al<sup>(13)</sup> in their experimental study found similar results in both dual plating and lateral single locked plating. Published data and experimental studies support the effectiveness of single lateral locking plate in treatment of complex tibial plateau fractures.

Results of our study were comparable with outer studies of plating group by Krupp et al<sup>(20)</sup>, Ebrahim Ghayem et al<sup>(21)</sup>, Peter A cole et al<sup>(22)</sup> and Willium M Ricci et al<sup>(23)</sup> (Table 3).

Minimally invasive technique further prevents soft tissue envelope and reduce the chance of infections and soft tissue complications<sup>(11-20)</sup> also medial fragment fixations can be done with additional screws to stabilize the fracture in coronal plane. Less invasive stabilization system offers no or minimal compression to articular injury and its role is limited for schatzker type I to type IV tibial plateau fractures and variants. Therefore reduction and fixation of articular fracture should be done before plate and locked screw fixation. Ehlinger et al<sup>(14)</sup> in their study on reliability of locked plate recorded an articular step off rate of 25% without any secondary displacement and concluded that a lateral locked plate is appropriate to provide stable radiological results and good functional recovery.

**Table - 3: Showing comparison of plating results with other studies.**

Features	Krupp et al	Ebrahim Ghayem et al (dual Plate)	Peter A Cole et al	William M. Ricci et al	Our study
No. of pt.	28	22	77	38	46
Mean age group	47 years (22-76)	35 year (19-67)	45 year (16-82)	53 year (19-85)	36.35 year (20-70)
Mean follow up	10 month (6-24)	-	14 month (3-35)	23 month (12-48)	11 month (8-24 month)
Meantime of union	6 month (3-14)	15 week (12-23)	-	-	16.93 week (18-23 week)
Non union	3	0	2	0	0
Malunion	4	-	13	1	4 (8.69%)
Knee range of motion	109° (75-150°)	--	1-122°	---	116.76° (80-130°)

In our study we found single lateral locking tibial plate using minimally invasive technique gives excellent results as the technique help to prevent soft tissue envelope and medial fragment can be additionally fixed with screw in coronal plane. In few cases of open wound or with poor skin condition fixator can be applied before taking up for final plating to reduce the incidence of infections and other complications.

**CONCLUSION**

With considerable experience of articular fracture management Schatzker V, VI complex tibial plateau fracture can be effectively treated with single lateral locking plate by minimally invasive technique. It give satisfactory stable fixation to fragments and good clinical results.

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