

## Surgical Management of Tibial Plateau Fractures.

K. Vamshidhar Reddy<sup>1</sup>, Venu Gosikonda<sup>1</sup>, Chokkarapu Ramu<sup>2</sup>, A. Pavan Kumar<sup>3</sup>, Ramesh Gajula<sup>4</sup>

<sup>1</sup>Assistant Professor Department of Orthopaedics, CAIMS, Karimnagar.

<sup>2</sup>Associate Professor, Department of Orthopaedics, CAIMS, Karimnagar.

<sup>3</sup>Associate Professor, Department of Orthopaedics, CAIMS, Karimnagar.

<sup>4</sup>Resident, Department of Orthopaedics, CAIMS, Karimnagar.

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### ABSTRACT

**Background:** Outcomes and complications following surgical treatment of tibial plateau fractures have been widely reported. Objective of the study was to evaluate the functional and radiological outcomes after lateral tibial fractures AO 41- B2 and 41 – B3 treated with minimally invasive bone tamp reduction, bone grafting and percutaneous screw fixation. **Methods:** This study was a prospective study and retrospective review and clinical evaluation of patients treated with minimally invasive bone tamp reduction, bone grafting and percutaneous screw fixation of lateral tibial plateau fracture between 2014 & 2016. Patients completed a clinical and radiological evaluation with modified Rasmussen's criteria. **Results:** A total of 30 patients were operated as per the SCHATZKER'S types and AO classification with minimally invasive percutaneous screw fixation. Maintained anatomical joint reduction and alignment was achieved in 25 cases, gave excellent results with mean radiological and clinical Rasmussen's score of 28.0 and 7.4. **Conclusion:** Tibial plateau fractures AO type 41- B2 and 41 – B3 , SCHATZKER'S type II & III treated with minimally invasive bone tamp reduction, bone grafting and percutaneous screw fixation showed a high rate of anatomical reduction 83% , a low rate of complication 1.6%.

**Keywords:** Tibial plateau, Buttress plate, rasmussen's criteria, bone grafting, schatzker types.

### INTRODUCTION

The incidence of tibial plateau fractures was 10.3 per 1000.000 annually in India Conservative management is not often feasible so the majority of the fractures are treated operatively.<sup>[1,2]</sup> The objective of surgical treatment is joint reconstruction, rigid fixation, and axial alignment.<sup>[2]</sup>

#### Name & Address of Corresponding Author

Dr. K. Vamshidhar Reddy  
Assistant Professor  
Department of Orthopaedics,  
CAIMS,  
Karimnagar.

In general the complication rate after tibial plateau fractures is high,<sup>[3]</sup> complications such as infection deep and superficial, soft tissue damage, DVT ,leading to failure of surgical procedure. Complications following the initial phase include loss of range of motion, ligamentous (or) meniscal injury, knee instability, psuedoarthrosis and post traumatic OA2,<sup>[4]</sup> Minimally invasive procedures

with bone tamp reduction, bone grafting and percutaneous screw fixation may be a treatment option with low risk of complications and high level of anatomical reduction achievement for a selected patient group.

Objective of this study was to evaluate the functional and clinical outcomes after surgical fixation of lateral tibial plateau fractures (AO 41 B2 – 41 B3) treated with minimally invasive procedures with bone tamp reduction, bone grafting and percutaneous screw fixation.

### MATERIALS AND METHODS

All patient's treated surgically for tibial plateau fractures between 2014 & 2016 at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. Included were all patients of

- Closed Tibial plateau fractures of the lateral tibial plateau
- AO type 41 –B2 & 41- B35.

#### Excluded were

- Open fractures

- Patients with other fractures in the same extremity
- Medically unfit for surgery.

**Study Design**

Prospective study for retrospective review and followup. Clinical and radiological outcomes were studied in all patients at follow - up. The base line characteristics consisted of patient demographics and fracture classification (AO) complications and additional damage.<sup>[5]</sup> Post-surgical follow up consisted of functional, radiological, clinical outcomes.

**Table 1: Demographic Patient Data.**

Patients, total, N	30
Male/ Female, N	24/6
Age, Surgery, Yrs mean (range)	35.86 (30-60{)
<b>AO classification</b>	<b>'n</b>
41-B2	12
41-B3	18
<b>Schatzker Classification</b>	<b>'n</b>
Type II	14
Type III	16
Associated injury ,n	0

**Operative Procedure**

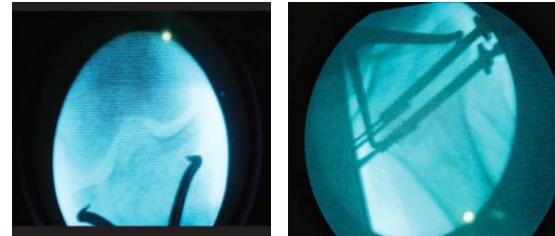
During the study period the department standard guidelines on treatment of tibial plateau fractures as mentioned in [Table 1] with 4 experienced trauma surgeons performed all of the procedures. The choice of surgical procedure and the use of bone grafting were at the discretion of individual surgeons.

After careful preoperative templating drawing fracture line and landmarks on the patient, a 3cm incisions was made facing the anterior of the tibia. The periosteum was held aside and a canal was drilled with an 11mm cannulated coring reamer with collar pin, guided by fluoroscopy. Though the intramedullary canal, the goal was to reduce the joint anatomically, visualised by intraoperative fluoroscopy in multiple planes. Bone autograft chips were prepared from ipsilateral iliac crest. The auto graft chips were introduced and stamped into place below the fracture under C- Arm guidance finally the fracture was fixed with a minimum of 2 percutaneous screws of 6.5mm introduced from the lateral side additional screws were placed as needed. All patients were immobilized in a knee brace with ability to control range of motion and started physiotherapy on the first day of the surgery by attending a post-operative rehabilitation protocol. Patients were kept non-weight bearing for six weeks postoperatively, and radiology was obtained preoperatively and at six weeks post-operatively.

**Outcome Measurements Radiological Outcomes**

Fracture classification was performed according to AO classification. The fractures were assessed preoperatively using CT. Articular depression and condylar widening were evaluated using x rays as described by Rasmussen.<sup>[6]</sup> For this assessment one

x ray was taken six weeks post-operatively and another was taken at the time of follow up. Valgus/Varus malalignment was evaluated as described by Browner et al.<sup>[7]</sup> A Valgus/varus malalignment >50 was considered significant. At follow-up, the X-rays were obtained as bilateral weight-bearing X-rays.

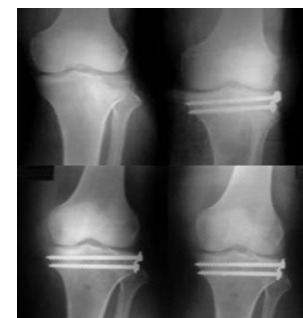


Intraoperative

Intraoperative



Pre-operative



Post-operative

**Table 2: Radiographic Assessment Using Modified Rasmussen's Criteria<sup>12</sup>.**

Articular depression	Points
None	3
<5 mm	2
6-10 mm	1
>10 mm	0
Condylar widening	
None	3
<5 mm	2
6-10 mm	1
>10 mm	0
Varus/valgus angulation	
None	3
<10°	2
10-20°	1
>20°	0
Osteoarthritis	
None/no progress	1
Progression by 1 grade	0
Progression by >1 grade	-1
Maximum score	
Excellent	9-10
Good	7-8
Fair	5-6
Poor	<5

Patient-Reported Outcome Measurements

**Table 3: Clinical assessment was done using Modified Rasmussen criteria<sup>12</sup>.**

Pain	Points
None	6
Occasional	5
Stabbing pain in certain positions	3
Constant pain after activity	1
Significant rest pain	-3
Walking capacity	
Normal walking capacity for age	6
Walking outdoors (>1 h)	5
Walking outdoors (15 min-1 h)	3
Walking outdoors (<15 min)	1
Walking indoors only	0
Wheelchair/bedridden	-3
Knee extension	
Normal	4
Lack of extension (<10°)	2
Lack of extension (>10°)	0
Lack of extension (>20°)	-2
Total range of motion	
Full	6
At least 120°	5
At least 90°	3
At least 60°	1
<60°	-3
Stability	
Normal stability in extension and 20° flexion	6
Abnormal stability in 20° flexion	4
Instability in extension (<10°)	2
Instability in extension (>10°)	0
Power of quadriceps	
Grade 5	2
Grade 3-4	1
Grade <3	2
Maximum score	30
Excellent	28-30
Good	24-27
Fair	20-23
Poor	<20

**Objective Outcome Measurements**

Knee range of motion (ROM) was evaluated using active extension and flexion of the knee with patient lying supine on the examination [Table]. Patients were asked to do maximal flexion and extension and the angle was measured with goniometer.

**RESULTS**

A total of 30 patients were surgically treated..The mean age at the time of surgery was 35.86.The mean follow up time was 6 months.

A total of 30 fractures were classified as AO type 41-B2 were 12 patients and 41-B3 were 18 patients.Complications were present in one patient developed CRPS,and 3 patients with knee stiffness and one with varus deformity.

**Radiological Outcomes**

Post-operatively 25 patients achieved anatomical joint reduction and alignment.At the time of follow-up anatomical joint reduction and alignment was serially monitored and follow up done s for 6 wks with radiographs.

**Objective Outcomes**

Mean knee flexion range was 130with a range of 115-1400.the mean movement deficit was 10.00and five patients were presented with knee stiffness in the initial follow up period and were improved after physiotherapy and monthly follow up.



Postoperative at 2 months follow up

Knee range of flexion at 2 months follow up



Knee range of flexion at 6 months follow up



Knee range of extension at 6 months follow up

**Table 4: Clinical and Radiographical results.**

Follow up	Mean Functional Score Modified Rasmussen's Criteria ( 28.0 )	Mean Radiological Score Modified Rasmussen's Criteria ( 7.6 )
6 weeks	23 ( 20-30 )	6 ( 5-10 )
2 months	27 ( 20-30 )	7 ( 5-10 )
4 months	30 ( 20-30 )	8 ( 5-10 )
5 months	30 ( 20-30 )	8 ( 5-10 )
6 months	30 ( 20- 30 )	9 ( 5-10 )

**Table 5: Complications.**

Complications	Number of patients
CRPS	1
varus deformity	1
Knee stiffness	3
Total	5

After 6 months we achieved mean functional score (28.0) and mean radiological score (7.6) with 5 cases of reported complications.

**DISCUSSION**

This study shows that treatment of a selected patient group with lateral tibial plateau fracture using minimal invasive percutaneous with bone grafting is a safe and reliable method that has good union and a low rate of complication.

The patients in the present study were treated with minimally invasive bone tamp reduction, bonegrafting and percutaneous screw fixation. Subsequently 83% achieved anatomical reduction, which is in line with or better than other studies reporting this surgical method.<sup>[8,9]</sup> These results are comparable to those reported for other surgical methods.<sup>[4,5,8]</sup>

All the patients in this study mostly had an adequate anatomical reduction of the fracture of AO Type 41-B2 Type and totally we achieved a

high anatomical reduction and alignment with mean functional score of 28.0 and mean radiological score of 7.4 and low complication rate of 1.6%.

Operative treatment of tibial plateau fractures is associated with a number of complications, including deep and superficial infection, compartment syndrome, pain, ROM restrictions and post-traumatic OA. All of these complications lead to restrictions in activity and poor functional outcome. The incidence of complications following operative treatment for tibial plateau fractures is reported to be between 3% and 56%.<sup>[2,10]</sup> High energy trauma patients with soft tissue injuries are reported to have the highest incidence of complications.<sup>[2,10]</sup> The patients included in the present study had a low complication rate of 1.6%. This study cannot predict the post traumatic osteoarthritis due to lack of long term follow up for 2 years and also the quality of life on long term basis. Volpin et al reported the incidence of post-traumatic OA following intra-articular fractures of the knee tended to develop from six to eight years after injury.<sup>[11]</sup>

## CONCLUSION

This study shows a high rate of anatomical reduction (83%), a low rate of complication (1.6%) in a selected group treated with minimally invasive bone tamp reduction, bone grafting and percutaneous screw fixation.

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