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Functional Outcome of Tibial Platue Fracture Treated by Locking Compression Plate- A Prospective Study

Narendra Kumar (MD)[1], Binay Kumar Sahu (MD)[2], Deepak Kumar Sharma (MD)[3],

[1]*Central institute of Orthopaedics, VMMC& Safdarjung hospital, Delhi.*
[2]*Department of Orthopaedics, P.S.R.I. Hospital, New Delhi.*
[3]*Central institute of orthopaedics, VMMC and Safdarjung hospital, Delhi.*

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ABSTRACT

Introduction: Tibial plateau fractures represent the fractures involving the articular surface of proximal part of the tibia bone i.e. lateral or medial condyle or both, and with varying degrees of articular depression and displacement.Fixation by locking plates has led to dramatic improvement in the treatment of tibial plateau fractures.
Method: It was a prospective study conducted on 30 patients with tibial plateau fractures at a tertiary care hospital in New Delhi, India. Patients were operated with locking compression plates and followed up for 18 months. Union was checked with serial radiographs and functional outcome was assessed with Rasmussen Functional Knee Score.
Result: Twentynine patients achieved union at a mean time of 13.65 weeks, one patient had infective nonunion. Overall mean Rasmussen Functional Knee Score was 27 which is graded as excellent.
Conclusion: Treatment of tibial plateau fractures with open reduction and plating with locking compression plates provides anatomical reduction and desirable functional outcome. Union is earlier and functional results are better for Schatzker type 1-3 when compared to type 4-6. Return to work with greater capacity largely depends on motivation.

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Introduction

Tibial plateau fractures represent the fractures involving the articular surface of proximal part of the tibia bone i.e lateral or medial condyle or both. These fractures are not very common and represent only about 1.66 to 2% of all fractures and 8% in elderly1. These are complex fractures involving the proximal tibia with varying degrees of articular depression and displacement.

These fractures are generally seen in two groups: high energy injuries in younger population and low energy injuries in elderly people due to osteopenia. Being intraarticular fractures, these are especially prone to stiffness and post traumatic arthritis2 Many of these fractures have associated menisceal and ligamentous injuries.Earlier it was thought that MRI have role in diagnosing these soft tissue injuries. But recent studies showed the role of early MRI is controversial3.

Proper classification of these fractures is important to guide treatment and describe prognosis. Tibial plateau fractures constitute a wide range of severity from undisplaced stable fractures with negligible tissue trauma to comminuted unstable fractures with severe soft tissue injury threatening limb viability.

***Corresponding author:** Deepak Kumar Sharma,
Central institute of orthopaedics, VMMC and Safdarjung hospital, Delhi.
E-mail: deepakmlbmc@rediffmail.com
Tel: 919811990421

Locked plates: Fixation by locking plates has led to dramatic improvement in treatment of tibial plateau fractures. Multiple fixed angle locking mechanism created by these plates improve the stability of proximal tibia fractures and support the articular surface 4,5.

They also facilitate early knee range of motions and less postoperative complications. The main purpose of this study to look for functional outcome after fixation of these fractures with locking plates and any complications.

Materials and Method

This is a hospital based prospective study done in a tertiarycentre. Thirty patients with tibial plateau fractures who were operated with locking plates between 2015 and 2016 were followed for 18 months. Consent was taken from each patient before their participation in the study.

After proper evaluation in the emergency department all patients underwent Xrays and CT scan for proper delineation of fracture site.Patients of either sex above 18 years with radiological evidence of tibial plateau fractures were considered for the study. Patients who had pre-existing arthritis of knee, congenital anomalies of knee, any previous surgery of the same knee, open trauma, those with compartment syndrome of the ipsilateral leg and polytrauma patients were not included in the study.

Patients who had pre-existing arthritis of knee, congenital anomalies of knee, any previous surgery of the same knee, open trauma, those with compart ment syndrome of the ipsilateral leg and polytrauma patients were not included in the study.

Depending on the fracture type and site, two aplowing surgery, knee range of motions was started as soon as pain subsided usually after 2nd post op day.Postoperatively all patients were assessed after discharge at 2 weeks. Then four weekly till bony union occurred and after that three monthly till last follow up at 18 months.The functional outcome was evaluated using Rasmussen Functional Knee Score (Table 1) which was further graded according to score into Excellent, Good, Fair and Poor6.Post traumatic arthritic changes were graded according to Kellgren Lawrence grading. At 18 months all patients were checked clinically for limb malalignment.

Patients were also interviewed at 18 months regarding return to work. Sample size was 30. Chi square test and ANOVA test was used to calculate p-value depending on categorical and numerical data. Any p-value calculated < 0.05 was taken to be significant. Standard statistical analysis was done using SPSS version 18.

Results

This prospective study was conducted at Central Institute of Orthopaedics, Safdarjung Hospital, New Delhi, India during the period of January 2015 to June 2017. Thirty patients withaverage age 42.4yearswith tibial plateau fractures were enrolled for the study which were fixed with open reduction and internal fixation with locking compression plates (Figure 1).

Figure1: FIGURE LIGEND

Table 1: Rasmussen Functional Knee Score.

		Acceptable		Unacceptable	
	Points	**Excellent**	**Good**	**Fair**	**Poor**
A. Subjective complaints					
a. Pain					
No pain	6				
Occasional ache,bad weather pain	5				
Stabbing pain in certain positions	4	5	4	2	0
Afternoon pain, intense, constant pain around the knee after activity	2				
Night pain after rest	0				
b. Walking capacity					
Normal walking capacity (in realtion to age)	6				
Walking outdoors at least 1 hour	4				
Short walk outdoors>15 mins	2	6	4	2	1
Walking indoors only	1				
Wheel chair/ bedridden	0				
B. Clinical signs					
a.Extension					
Normal	6	6	4	2	2
Lack of extension (0 to 10 degrees)	4				
Lack of extension (>10 degrees)	2				
b. Total range of movements					
At least 140 degrees	6				
At least 120 degrees	5				
At least 90 degrees	4	5	4	2	1
At least 60 degrees	2				
At least 30 degrees	1				
0	0				
c.Stabilty					
Normal stability in extension and 20 degrees flexion	6				
Abnormal instability 20 degrees of flexion	5	5	4	2	2
Instability in extension< 10 degrees	4				
Instability in extension> 10 degrees	2				
SUM		≥27	≥20	≥10	>10

Twentythree cases were males and seven were females. All fractures were classified according to Schatzker classification7 (Table 2). Majority of them were Type 2 fractures which accounted for 36.67 % (11 cases) and Type 6 accounted for 30% (9 cases).

Seven patients of type 1, type 2 and type 4 required a complimentary lag screw compression. Two patients of type 3 needed artificial hydroxyapatite bone grafting after elevation of depressed fragment. The mean duration of surgery was 86 minutes (range 60-150minutes) with greater time for type 5 and type 6.

Following surgery, knee range of motions was started as soon as pain subsided usually after 2nd post op day. Partial weight bearing was started at a mean time of 8.1 weeks.

The mean duration for radiological union

was 12 weeks for type 13.09 ,1 weeks for type 14.67 ,2 weeks for type 13.33 ,3 weeks for type 16 ,4 weeks for type 5, and 14.5 weeks for type 6 (Table 3). Overall mean union time was 13.65 weeks. Full weight bearing was started after bony union. Final knee range of motion of all patient at 18 months is given in Table II (also see Figure 1).

Two patients had developed superficial infection which was treated successfully by conservative methods with antibiotics. One patient had developed deep infection with implant exposure which went into nonunion. Five patients had associated lateral meniscus tear with one of them having additional MCL tear of the same side at the time of injury. All of these wereleft unattended at the time of surgery. However, post operatively the patient with MCL tear was kept in a hinged knee brace for a period of 8 weeks.

Table 3: Bar diagram showing individual Schatzker type and corresponding mean union time

Patients were under follow up till 18 months. Radiographical evaluation was done at each follow up till union was evident. At final follow up all patients were evaluated clinically for any malalignment of the operated limb. No clinically significant varus or valgus malalignment was reported.

The functional outcome was evaluated using Rasmussen Functional Knee Score (See Table IV& V) which defined excellent (27-30), good(20-26), fair(10-19), poor(<10). It came out to be excellent in 20, good in 9, fair in 1. All patients at 18 months were also checked for any osteoarthritic changes in the knee joint. Only 4 patients had early post traumatic arthritic changes according to Kellgren Lawrence grading. 2 were grade 1 and other 2 were grade 2. All patients were also interviewed at final follow up at 18 months regarding return to preinjury status or work.

Statistical analysis showed significant association with increasing grades of Schatzker fracture type and low functional score (Table IV& V). However, there was no significant association between Schatzker type and union time.

Table 4: Functional outcome versus Schatzker type

RASMUSSEN FUNCTIONAL GRADE	SCHATZKER TYPE						NO OF PATIENTS
	1	2	3	4	5	6	
EXCELLENT	3	11	1	3	1	1	20
GOOD	-	0	2	-	-	7	9
FAIR	-	-	-	-	-	1	1
POOR	-	-	-	-	-	-	-
TOTAL	3	11	3	3	1	9	30

Table 5: Schatzker type versus mean functional score

SCHATZKER TYPE	NO. OF CASES	MEAN RASMUSSEN FUNCTIONAL SCORE
1	3	29.33
2	11	28.09
3	3	26
4	3	27
5	1	28
6	9	25.11

Discussion

The knee joint is the largest joint in the body. Meticulous articular reduction is needed for good functional outcome. Those treated surgically have overall better functional results 8. Tibial plateau fractures are more common in males than females. In our study, the mean age was 42.4 years, which was similar to studies done by Moore et al.9and Mahajan et al10.

In our study the average time for radiological union was 13.65 weeks which is comparable to studies done by Cole et al11and by Weigel et al12. No significant association was found between union time and Schatzker type (p = 0.26).

In our study, functional outcome for Schtazker type 1-3 were better than for Schatzker type 4-6 (See Table IV& V), which is similar to the studies performed by Rademakers et al.13and Barei et al14.Thus it can be concluded that the higher the type of fracture, the lesser is the functional come (p = 0.0087). But if we take the mean of all individual Rasmussen functional score then it comes out to be 27 (See Table II) which is defined as excellent. Hence the general view that can be made from the present study is that tibial plateau fractures have most desirable functional result when treated by locking plates.

In our study, articular step was accepted upto 2mm. However,this is varying in many studies as authors like Honkonen et al.15accepted articular step off up to 3mm. Moreover,articular step is insignificant in determining functional outcomes as showed by Stevens et al16. Further Honkonen17 showed that development of degenerative arthritis is independent of articular step.

Few studies have tried to show the relationship between post-operative malalignment of the limb and functional outcome18. In our study, all patients at final follow up at 18 months were assessed for malalignment of the limb clinically. No gross malalignment was clinically found in any of our patients. However, on radiographic evaluation 5 patients of Schatzker type 6 were found to have minimal varus malunion(See Table II). More studies are needed in this regard.

Postoperative complications like infections and arthritis lead to poor functional outcome19. In our study two patients had superficial infection which were successfully treated by antibiotics. One patient with pre-existing type 2 diabetes mellitus had suffered deep infection with implant exposure. The deep infection rate in our study was 3.33% (1 in 30) which is quite better when considered to other studies like Yang et al.20 which had deep infection rate of 13.63%. We had evidence of post operatively early degenerative arthritis in four cases. Two of them had Kellgren Lawrence grade 1 and other two had grade 2 arthritis. However, it can'tbe corelated as it is unlikely to develop arthritis in such small time period and the changes might have been present pre injury. Usually post traumatic arthritis develop at 3-7 years after injury17.

Ligament and meniscus injury are frequently associated with tibial plateau fractures21. MRI however is not routinely done. Athletes with their mode of injury usually require MRI of the injured knee. Most common intraarticular soft tissue lesion was injury to lateral meniscus in our study followed by MCL. Five out of six patients who had MRI knee done had shown tear of lateral meniscus with one patient having additional MCL tear. These structures were not repaired primarily and later on found to have no impact in the outcome.

Their repair is still controversial as said in various studies by Shepherd et al.22 and Marsh et al23.However, MCL was treated conservatively in a hinged knee brace for 8 weeks. Recent advancement for tibial platue fracture is Three dimensional printing which gives an accurate anatomical structure of the fracture for preoperative planning and significant reduction in surgical time and the surgeon's exposure to radiation.24,25 Regarding return to work or preinjury status, all patients were interviewed at final follow up at 18 months. Only 30% i.e. nine patients were able to return to full capacity. Three patients (10%) who were above 60 years were themselves not any active professionals previously, and are now living a sedentary life. Fifteen patients (50%) were able to do their previous activities at half capacity. Remaining three patients (10%) were working at less than half their previous capacity. The main reason cited was their fear of re-injury. We think less motivated patients are prone to delayed or in lesser capacity return to work.

Our study has several limiting factors. The sample size was small with only 30 patients. Follow up period was 18 months which is inadequate to reveal long term issues like arthritis or anywork-related problems.Also, not all patients underwent MRI scan of the knee which could have shown missed ligament or meniscus injury.

Conclusion

Treatment of tibial plateau fractures with open reduction and plating with locking compression plates provides anatomical reduction and desirable functional outcome.Functional outcome is excellent for low energy Schatzker type 1-3 fractures and less favourable but still good functional result for high energy Schatzker type 4-6 fractures. Many patients return to work either fully or in partial capacity. Return to work with greater capacity largely depends on motivation.

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Conflict of interest

There is no any kind of conflict of interest in this article.

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