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A study on outcomes of posteromedial buttress plating in tibial plateau fractures

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Abstract
Introduction: Bicondylar tibial plateau fractures with posteromedial fragment have always posed a challenge to the surgeons. Time to time, with better imaging modalities, the understanding of these fractures have improved and fixation modalities have changed. The morphology and position of the posteromedial fragment is such that lateral locking plate alone may not be sufficient to hold this fragment, leading to late varus collapse. To counter this problem, a separate posteromedial buttress plate is now been used by surgeons and our study aims at analysing the functional outcomes in patients treated with these posteromedial buttress plate.
Materials and method: This was a prospective study carried out between June 2016 to June 2019 at Civil hospital Ahmedabad. 30 patients with Schatzker type IV, type V and type VI injuries with posteromedial fragment were included. They were operated with posteromedial buttress plate and lateral locking plate or screws. These patients were followed up at 15 days, 1.5 months, 3 months and 6 months and outcome was assessed according to Rasmussen's radiological and functional scoring.
Results: The most common age group in these patients was 20-39 years with male predominance. Road traffic accident was the commonest mode of trauma. Excellent outcome was found in 67%, good in 26%, fair in 7% and no case of poor outcome. There were no cases of loss of reduction, malalignment or late varus collapse. The rate of complication was low.
Conclusion: Posteromedial fragment in tibial plateau fractures is best managed with a separate posteromedial buttress plate rather than relying on lateral based fixation device. Properly planned fixation with accurate anatomical articular reduction and rigid fixation results in overall excellent outcome with low rate of complication.

Keywords: posteromedial buttress, tibial plateau fractures

Introduction
Fractures of proximal tibia that extend into the knee joint are termed as the tibial plateau or condylar fractures. Proximal tibial fractures are one of the common intra articular fractures, resulting from direct axial or indirect coronal compressive forces. It comprises 1% of all fractures & 8% of the fractures in elderly [1, 2]. The majority of tibial plateau fractures are caused due to high speed motor vehicle accidents, violent trauma & fall from height where fractures result from direct axial compression, usually with a valgus (more common) or varus moment & indirect shear forces. These fractures encompass many varied fracture configurations that involve medial, lateral or both plateaus with many degrees of articular depressions & displacements. Each fracture type has its own characteristic morphology & response to treatment. Barei *et al.* [2] using a computed tomography (CT) scan study demonstrated the presence of the posteromedial fragment in nearly 33% of bicondylar fractures. The presence of a posteromedial fragment was first mentioned in 1967 by Hohl [3]. The standard practice for operative internal fixation in these injuries has been medial and lateral plating to reconstruct the lateral joint surface and prevent the varus collapse of the medial column. Placement of lateral locking plate has been currently advocated in these fractures. Proponents of this idea state that the locking screws placed laterally can support the medial plateau and thereby reduce the need for a medial dissection and the incidence of soft tissue complications [4]. However, laterally applied plate/screw devices may not effectively neutralize the posteromedial fragment and require alternate or supplemental exposures and/or

fixation strategies [5]. A separate posteromedial buttress plate to address this osseoarticular fragment has been hence advocated to prevent late varus collapse [6, 7]. Our study aims at evaluating the outcomes of these fracture patterns that are treated with posteromedial buttress plate.

Materials and Methods

This was a prospective study in which patients with tibial plateau fracture with posteromedial fragment that presented to the Orthopaedic department at Civil hospital, Ahmedabad between June 2016 to June 2019 were included. A total of 30 patients were included in this study. The patients presented with tibial plateau fractures in casualty department were first assessed and managed according to the ATLS protocol. Once the patient was stable, necessary x-rays were taken and these fractures were classified according to the Schatzker classification [8]. Schatzker type IV, type V and type VI injuries with posteromedial fragment were included in this study. Patients younger than 18 years and open injuries Gustilo-Anderson type 2 and type 3 were excluded from this study. All patients of the study underwent CT scan for better understanding of the injury pattern. Patients were taken up for surgery once the general condition of the patient and local condition of the limb was acceptable. Patients with severe swelling were put on temporary knee spanning external fixator and taken up for final fixation once swelling subsided. All the patients had undergone open reduction through an anterolateral approach, and open posteromedial approach, and internal fixation with a lateral plate, and posteromedial plate. Surgeries were performed under fluoroscopic control to aid and assess the reduction. Details of the operative technique such as the position of the patient, surgical incisions employed, reduction techniques, use of bone grafts, implants used for fixation, and techniques for assessment of reduction were also recorded. Post operatively, x-rays were taken, regular dressings done and physiotherapy and mobilization started as per the patient condition, fracture pattern and stability of the fixation. Patients were discharged and follow up was done at 15 days, 1.5 months, 3 months and 6 months. Further follow up was done as per the fracture consolidation, mobilization status and patient condition. At 6 months follow up, the outcome assessment was done according to the Rasmussen's Score [10].

Rasmussen's radiological scoring [9]:

Subjective	Points
A. Articular depression	
Not present	6
<5 mm	4
6–10 mm	2
>10 mm	0
B. Condylar widening	
Not present	6
<5 mm	4
6–10 mm	2
>10 mm	0
C. Angulation (valgus/varus)	
Not present	6
<10°	4
10–20°	2
>20°	0
Maximum	18
Excellent	18
Good	12–17
Fair	6–11
Poor	<6

Rasmussen's functional scoring [9]

		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 at rest	0				
b. Walking capacity					
Normal walking capacity (in relation to age)	6				
Walking outdoors at least 1 hour	4	6	4	2	1
Short walks outdoors > 15 minutes	2				
Walking indoors only	1				
Wheel-chair/bedridden	0				
B. Clinical signs					
a. Extension					
Normal	6				
Lack of extension (0–10 degrees)	4	6	4	2	2
Lack of extension > 10 degrees	2				
b. Total range of motion					
At least 140	6				
At least 120	5	5	4	2	2
At least 90	4				
At least 60	2				
At least 30	1				
0	0				
c. Stability					
Normal stability in extension and 20 degrees of flexion	6				
Abnormal instability 20 degrees of flexion	5				
Instability in extension < 10 degrees	4				
Instability in extension > 10 degrees	2				
Sum (minimum)		27	20	10	6

Results

30 patients were included in this study. The most common age group was 20-39 years (50%) with male pre dominance, male: female ratio being 7:3. The most common mode of trauma was road traffic accident (73%). There were 8 cases of Schatzker type IV, 12 cases of type V and 10 cases of type VI injuries. Out of total 30 cases, there was infection in 5 cases. They were managed by blood investigation and culture sensitivity report. Antibiotic and regular dressing done. There was no need of debridement or implant removal in any patient.3 patients complained about persistent pain and 1 patient had range of movement less than 90 degrees. There were no cases of mal-alignment. There were no cases of arthritis during 15 months follow up. No patient had loss of reduction and varus deformity. In our study according to Rasmussen's functional scoring [10], we have achieved excellent outcome in 67%, good in 26%, fair in 7% and no case of poor outcome.

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Functional Results (Rasmussen's Scoring)	No. of Case	Percentage
Excellent	20	67%
Good	8	26%
Fair	2	7%
Poor	0	0%

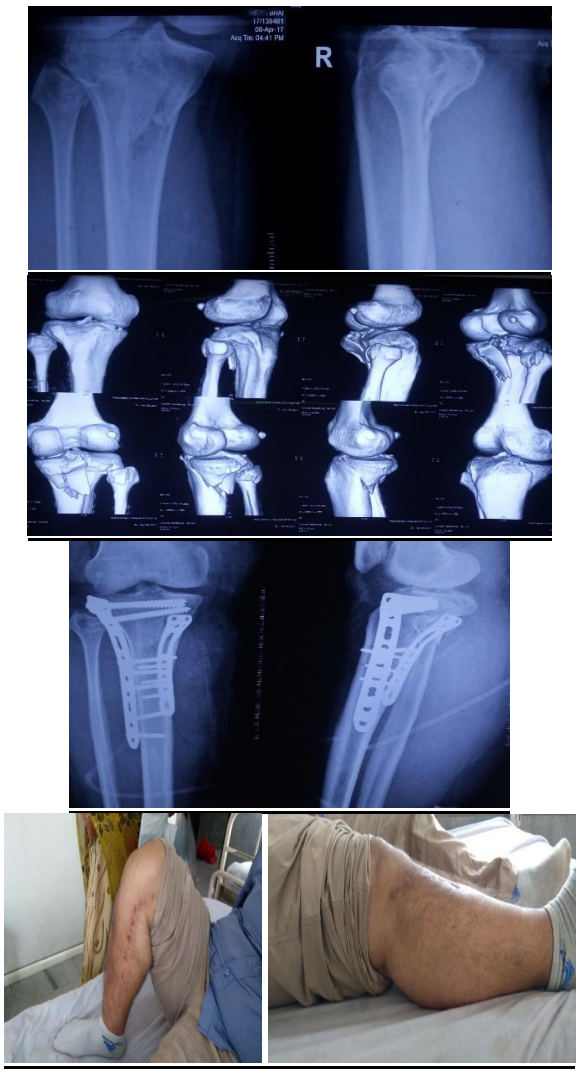

Fig 1: A case of posteromedial butress plating and lateral raft plate with excellent outcome

Discussion

High energy intra-articular fractures of tibial plateau cause ongoing management problems and remains challenging for orthopaedic surgeons even to date. In the operative treatment of fractures of the tibial plateau emphasis has been placed on the strict adherence to the principles of anatomical reduction, rigid fixation and early mobilization. In recent years, with rapid development of imaging technology, clinicians have gradually improved the diagnosis and treatment means of posterior tibial plateau fracture. The fracture line is located at coronal plane of a knee joint in case of posterior tibial plateau fracture, especially posterior-medial tibial plateau fracture. For such fractures, since posterior-anterior and lateral X-ray film easily results in missed diagnosis, an additional oblique X-ray is needed to further understand medial and lateral fracture morphologies. Three-dimensional reconstruction of a spiral CT scanner, which could intuitively, three-dimensionally, multi-angularly shows location, severity and displacement of the fracture and is better than X-ray examination in detection rate and classification judgment of the fracture, has been widely used in diagnosis and treatment. Gosling *et al*. [10] evaluated the LISS plate used alone to treat 69 bicondylar tibial plateau fractures and reported that 16 patients had a significant malreduction and 9 patients had a loss of reduction these three had posteromedial fragment not caught by locking screw. This is due to the inability of locking screws with predetermined trajectories relative to the plate to engage the posteromedial fragment [11]. In our study of 30 cases, there was mainly a large posteromedial fragment which could not be fixed without a posteromedial buttress plate. Here plate works as an anti-gliding mechanism and maintain intra articular reduction and prevents varus collapse. Out of 30 case, 8 were of type IV Schatzker, so only posteromedial buttress plating done. Remaining case were managed by dual plate; lateral plate and medial buttress plate. In our study the mean delay between day of injury and day of surgery was 2.4 days (Range 1-10 days) which is comparable to Radheshyam *et al*. [12] in 2012 of 2 days (range 1-5 days), 9.2 days by Barei *et al*. [13] in 2010 and 10.4 days by Z.Yu *et al*. [14] in 2009. The mean duration of surgery in our series was 100 min which was comparable to 113 min by Hasnain *et al*. [15] in 2012. In our series 86% of the patients were mobilized within 10 days of surgery and remaining 14% were kept protected until 3 weeks and gradual mobilization was started. The period of immobilization was again individualized depending on the security of rigid fixation and other circumstances demand. The benefit of early knee motion includes lesser knee stiffness and improved cartilage healing (regeneration). However, these benefits are to be cautiously balanced by risks, including loss of fracture reduction, failure of internal fixation and compromised ligament and soft tissue healing. All the patients were followed up for the mean duration of 14 months (Range 6-28 months) which is less in our series as compared to 35.78 months (Range 24-68 months) by Mathur *et al*. [16] in 2005, 32 months (Range 12-48 months) by Radheshyam *et al*. [12] in 2012 and 29 months (Range 12-84 months) by Ebraheim *et al*. [17] in 2004. In our study according to Rasmussen'sw31 functional scoring, we have achieved excellent outcome in 67%, good in 2%, fair in 7%, which is comparable to the standard studies as shown in the following table.

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Series	Excellent	Good	Fair	Poor
Our series	67%	26%	7%	0%
Mathur *et al*. [16]	8%	81%	11%	0%
Y-S. Chan *et al*. [18]	28%	61%	11%	0%
Chih-hao chiu *et al*. [19]	44%	48%	8%	0%
R.Sundaramoorthy *et al*. [20]	77%	11%	8%	4%

Conclusion

From this study we could conclude that medial side buttress plating is desirable in fracture pattern with unstable medial condyle, to prevent delayed medial collapse and undesirable varus deformity. Posteromedial buttress plating yielded good functional and radiological outcome in most of the cases with very few complications. With the advancement in imaging modalities, particular fracture anatomy detail can be obtained and accordingly operative planning can be done and accurate articular reconstruction and limb force line can be maintained. Whatever may be the modality of treatment early active adequate physiotherapy and maintenance of rehabilitation protocols proved to be the independent factor influencing functional result.

Limitation of Study

There is no control gruop in this study, so the outcomes cannot be compared with other treatment modalities. The sample size is relatively small. A larger sample size with a longer follow up can give better understanding about this treatment modality and its outcomes. The effects of associated injuries like lateral condyl fracture and/or ligamentous injuries also needs to be studied.

Conflicts of Interest: None

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