

International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(3): 542-547
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www.orthopaper.com

Received: 05-05-2020

Accepted: 08-06-2020

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Outcome of lateral condyle tibia fractures treated by lateral head buttress plate (LHBP)

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i3i.2250>

Abstract

Introduction: The lateral tibial condyle fracture is one of the common fractures encountered in Orthopaedic practice which usually occur in the road traffic accidents involving pedestrians crossing the road with direct hit on lateral condyle of tibia (Bumper fracture). Tibia plateau fractures constitute 1% of all fractures and 8% fractures in elderly. Isolated injuries to the lateral plateau account for 55 to 70% of tibial plateau fractures. Complex kinematics of its weight bearing positions and also stabilities of collateral ligaments and articular congruency are the main reasons which necessitates the union perfect reduction.

Aim: To determine the outcome of managing proximal tibial lateral condyle fractures by open reduction and internal fixation using Lateral Head Buttress Plate.

Materials and Methods: In prospective study design, total 30 cases of schatzker type I, II, III tibial plateau fractures treated at tertiary care teaching hospital in southern Rajasthan between July 2018 to June 2019 were included. The functional and radiological assessment was done in regular follow up till fracture union.

Results: All the 30 cases achieved solid union between 13 to 16 weeks duration. The radiological and functional outcome was satisfactory in 96.66% and 85.83% respectively including excellent and good results of various parameters analysed.

Conclusion: We conclude that preservation of the optimal function of knee after lateral tibial condyle fractures is satisfactorily achieved after fixing with lateral head buttress plate with a short learning curve and minimal complication risk.

Keywords: Proximal tibial lateral condyle fracture, lateral head buttress plate, LHBP, schatzker, ORIF, plating

Introduction

The rapidly increasing industrialization, urbanization and mechanization has made our life very luxurious. However, at the same time cost is paid by facing increasing rate of road traffic accidents. Crowded cities, irregular traffic arrangement and fast-moving vehicles are the most important contributory factors causing bony injuries, particularly polytrauma, comminuted fractures and also soft tissue injury. Proximal Tibial Lateral condyle fracture is one of them.

Tibia plateau fractures constitute 1% of all fractures and 8% fractures in elderly. Isolated injuries to the lateral plateau account for 55 to 70% of tibial plateau fractures as compared with 10 to 25% isolated medial plateau fractures and 10 to 30% bicondylar lesion. 1 to 3% of these fractures are open injuries. The stationary lower limb maybe struck by a moving object which is a common pedestrian injury called as 'Bumper Fracture', since the bumper of most vehicles being placed roughly at knee joint.

Intra-articular fractures of proximal tibia are difficult to treat. Age, skin conditions, osteoporosis further increase the obstacles in the healing process. In the elderly age group the bone has osteopenia and osteoporosis, so these fractures occur by trivial fall only. Low and high energy tibial plateau fractures present a variety of soft tissue and bony injuries that can produce permanent disabilities and their treatment is often challenged by severe fracture comminution.

Lateral tibial plateau fractures are often associated with other soft tissue injuries like cruciate and collateral ligament injuries and meniscal tears. Complex kinematics of its weight bearing

positions and also stability due to collateral ligaments and articular congruency are the main reasons why this fracture concerns surgeons and also cause disability to the patients if not treated adequately.

There are various treatment modalities available for proximal tibial lateral condyle fractures such as conservative treatment like traction, close reduction with cast application and surgical treatment like open reduction and internal fixation with cancellous screws, lateral head buttress plate. Surgeons should be familiar with the different treatment options available. Fractures must be evaluated on individual basis and treatment tailored accordingly. The gold standard of treating any intra articular fracture is ORIF specially with plating and bone grafting if needed.

Materials and Methods

The presented study was prospective, therapeutic study conducted over 30 patients after approval from institutional research ethics committee on the patients of proximal tibial lateral condyle fracture who were treated with open reduction and internal fixation with lateral head buttress plate (LHBP) in the department of orthopaedics at tertiary care teaching hospital in Rajasthan between July 2018 to June 2019.

The inclusion criteria of cases were age above 18 years of both sex, closed fractures, preoperative duration of up to 2 weeks, schatzker ^[1] type I, II, III. The exclusion criteria were pathological fractures, unfit for surgery, unwilling for participation.

All patients were evaluated for skeletal injuries apart from tibial plateau fractures at time of admission with special attention given to skin condition and swelling of the limb. All patients were applied above knee plaster of paris slab and lower limb was kept elevated. Ice packs were applied to all patients to reduce swelling. Patients were also explained to keep moving their toes to prevent chances of deep vein thrombosis. One dose of broad-spectrum antibiotic was given in all patients pre-operatively.

X-rays of the knee joint were taken in AP and Lateral views for all patients. All patients also underwent CT scan for further assessment of type of fracture, depression of articular surface and also to decide plan of treatment based on displacement.

Surgical steps

After spinal anaesthesia, patient was given supine position. After paint and drape, S-Shaped (Hockey Stick) incision starting approximately 3 to 5 cm proximal to the knee joint line, staying lateral to the border of the patellar tendon was taken. It was curved anteriorly over Gerdy's tubercle and then extended distally, staying about 1 cm lateral to the anterior border of the tibia.

The exact length of the incision varies according to the need of the fracture. There is no internervous plane in this approach. The dissection is essentially epi-periosteal and does not disturb the nerve supply to the extensor compartment. The incision was deepened proximally through subcutaneous tissue to expose the lateral aspect of the knee joint capsule. Below the joint line, the incision was deepened through subcutaneous tissue and the fascia overlying the tibialis anterior muscle incised. Finally, the muscle was either elevated or split to expose lateral tibial condyle.

If the articular surface was depressed then a cortical window

was made over lateral surface of tibia and surface was elevated using radius ulna punch and the void remaining after elevation was filled by either iliac crest bone graft. After this LHBP was fixed to the lateral surface of tibia by k wires and then locking screws were applied to fix the fracture. Fracture reduction and plate position were checked under the image intensifier. Wound was irrigated with normal saline. Incision was sutured in layers and sterile dressing was applied.

Postoperatively, patients were followed up at 2 weeks, 2 months, 3 months, 6 months duration. Patient was advised not to put weight on the operated leg for at least 4 weeks. Patient was advised for toe movements and active and passive straight leg raising. Patients were put on passive knee flexion machine to achieve passive knee flexion of at least 90 degree. Patient was allowed to sit bed side depending on pain tolerance. At home patients were asked to do active and passive knee range of motion exercises, quadriceps strengthening exercise and ankle pump exercise.

Radiological outcome was assessed analysing parameters like Plateau Tilt (degrees), Articular Step off (mm), Varus/valgus angulation, Degeneration (Table 1). Functional outcome was assessed analysing parameters like Extensor lag, Flexion Range, Thigh atrophy, Stability (Table 2). Also, the outcome was analysed using Klemm and Borner scoring system ^[2] (Table 3).

Table 1: Radiological Criteria

Radiological criteria	
Plateau Tilting (degree)	Excellent (None)
	Good (1-5)
	Fair (6-10)
	Poor (>10)
Articular step off (mm)	Excellent (None)
	Good (1-3)
	Fair (4-6)
	Poor (>6)
Varus/Valgus (degree)	Excellent (None)
	Good (1-5)
	Fair (6-10)
	Poor (>10)
Degeneration	Excellent (None)
	Good (<50%)
	Fair (>50%)
	Poor (Obliterated)

Table 2: Functional Criteria

Functional criteria	
Extensor Lag (degree)	Excellent (None)
	Good (1-5)
	Fair (6-10)
	Poor (>10)
Flexion range (degree)	Excellent (130)
	Good (110-129)
	Fair (90-109)
	Poor (<90)
Thigh Atrophy (cm)	Excellent (None)
	Good (0-1)
	Fair (1-3)
	Poor (>3)
Stability	Excellent
	Good
	Fair
	Poor

Table 3: Outcome by Klemm and Borner scoring system

Overall outcome according to the Klemm and Borner scoring system ²	
Excellent	Full knee and ankle motion
	no muscle atrophy
	Normal alignment
Good	Slight loss of knee and ankle motion (<25%)
	Muscle atrophy of <2cm
	Angular deformity of <5°
Fair	Moderate loss of knee and ankle motion (>25%)
	muscle atrophy of >2cm
	angular deformity of 5°-10°
Poor	Marked loss of knee and ankle motion
	Marked muscle atrophy
	Marked Angular deformity

Results

A total of 30 proximal tibial lateral condyle fractures were included in this study. In our study type of injury closed type in 30 patients (100%). We did 6 months of follow up in all patients. No patient was lost in the follow up.

The average age in our study was 40.36 years (range from 18 to 70 years). For males and females, it was 39.25 and 44.83 years respectively. Majority of the patients belonged to the age group <30 years (30%) followed by 31-40 years (26.66%). The males and females were 24 (80%) and 6 (20%) respectively. In our study road traffic accident was most common mode of injury. The mode of injury was trauma (road traffic accident) in 24 patients (80%) and trivial fall in 6 patients (20%) (Fig. 1). Out of 30 patients, 13 patients (43.33%) had fracture of Schatzker type I, 9(30%) had type II and 8 (26.66%) had type III fracture (Fig. 2). Regarding displacement of fracture fragment in 30 patients, 4 patients (13.33%) had 0-1 mm, 14 patients (46.66%) had 1-2 mm and 12 patient (40%) had >2mm displacement. Left side was affected in 16 patients (53.33%) and right in 14 patients (46.66%) in our study. Out of 30 cases, 25 (83.33%) were taken for surgery 1 day after injury, while 5 patients (16.66%) were taken after two days.

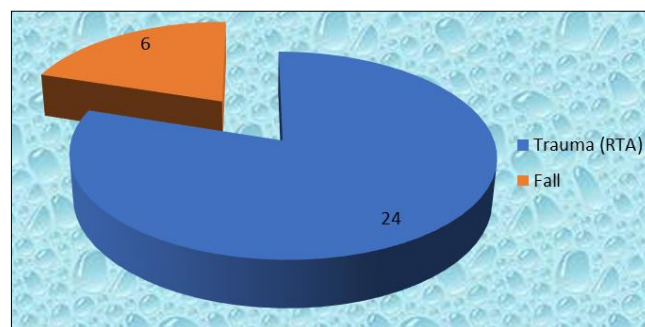
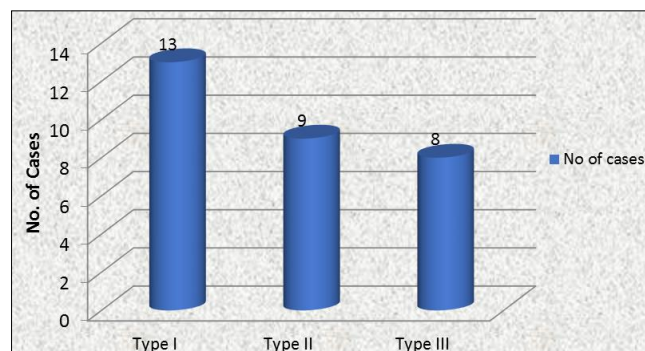
Average time between injury and surgery was 1.16 days. In this study, 8 patients (26.66%) stayed between 1 to 5 days in hospital. 20 patients (66.66%) stayed between 6 to 10 days while 2 patients (6.66%) stayed for more than 10 days in hospital. Out of 30 cases, 14 patients (46.66%) had radiological union in 10 to 14 weeks and 16 patients (53.33%) had radiological union in 15 to 18 weeks.

In radiological evaluation, 25 patients (83.33%) had no plateau tilting post operatively while 5 patients (16.66%) had tilting. 18 patients (60%) had no articular step off, 8 patients (26.66%) had 1 to 3mm articular step off, 3 patients (10%) had 4-6 mm articular step off and 1 patient (3.33%) had more than 6 mm step off. Regarding alignment correction, 28 patients (93.33%) had no varus or valgus deformity post reduction while 2 patients (6.66%) had some varus or valgus deformity. None of our patients showed post traumatic degeneration of the articular cartilage till 6 months of follow up (Fig. 3).

In Functional evaluation of our study, 25 patients (83.33%)

had no extensor lag postoperatively, 4 patients (13.33%) had 1 to 5 degrees extensor lag, 1 patient (3.33%) had 6 to 10 degrees lag. Regarding flexion range, 17 patients (56.6%) had 130 degree flexion postoperatively, 10 patients (33.3%) had 110-129 degree flexion, 3 patients (10%) had 90-109 degree flexion. The atrophy of thigh was absent in 18 patients (60%) on last follow up, 7 patients (23.3%) had 0-1 cm atrophy, 4 patients (13.33%) had 1-3cm atrophy and 1 patient (3.3%) had more than 3 cm atrophy. When considering stability postoperatively, 15 patients (50%) had excellent, 7 patients (23.3%) had good, 7 patients (23.3%) had fair and 1 patient (3.3%) had poor stability (Fig. 4).

In our study 28 patients (93.33%) had no complications, while 2 patients (6.66%) had post-operative urinary retention complications.

**Fig 1:** Mode of Injury**Fig 2:** Type of Fracture (Schatzker classification)

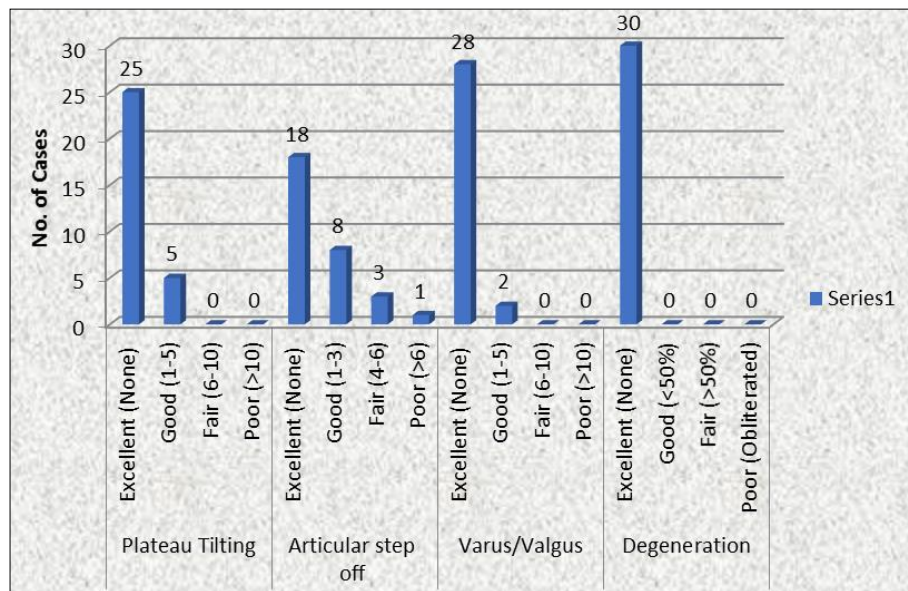
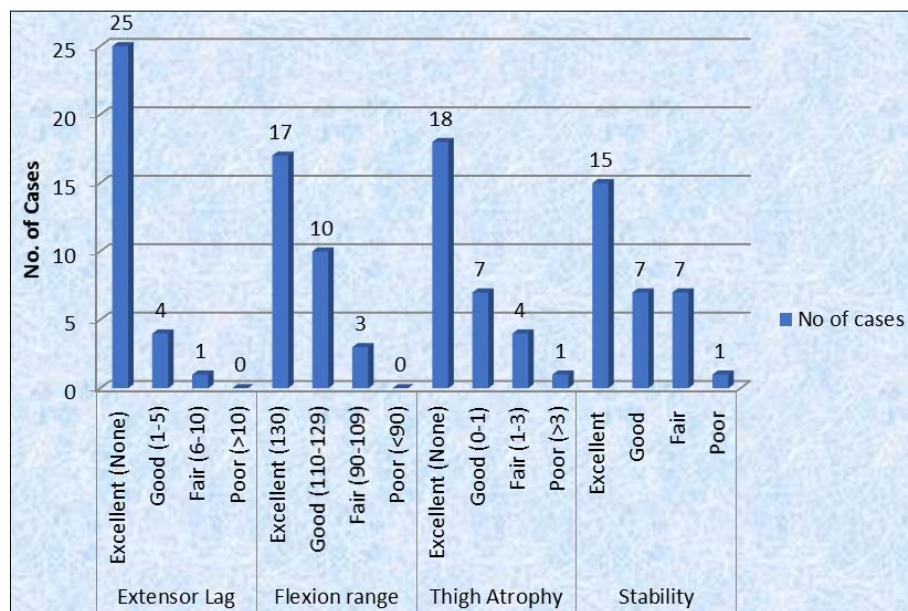
**Fig 3: Radiological Criteria****Fig 4: Functional Criteria****Fig 5: Preoperative Xray****Fig 6: Postoperative Xray**



Fig 7: Range of motion at final followup

Discussion

The management of tibial fracture has always been a subject of debate because of their wide variety of modalities and complexity. Despite many advances in the care of intraarticular fractures, tibial condylar fractures continue to be a difficult surgical problem. Objective of treatment of tibial plateau fractures is precise reconstruction of articular surfaces, stable fragment fixation, allowing early motion and repair of all the concomitant lesions.

The mobility and stability of lower limb mostly depends upon the integrity of the knee joint. Lateral condyle forms a part of knee joint, so any incongruity in fracture reduction leads to uneven force or stress distribution and may lead to early arthritis.

Various techniques have been used to stabilize the fracture of lateral tibial condyle including cannulated cancellous screws, k-wires, above knee plaster cast, plates like locking condylar plate and LHBP. In order to decrease the incidence of complication, particularly of fixation failure, loss of stability, collapse, locking compression plate have been developed to improve stability and enable early post-operative mobilization [3]. Lateral head buttress plate (LHBP) is pre contoured to anatomy of lateral condyle of tibia and helps in internal fixation of the fractures. Early detection and appropriate treatment of this fracture are critical in minimizing patient's disability and risk of documented complications, particularly post-traumatic arthritis [4].

Open reduction and internal fixation of the fracture lateral condyle of tibia with LHBP is very frequently used and during follow up there was maintained anatomical reduction and no collapse of articular surface. For displaced fracture, traditional treatment with LHBP plate has been associated with high rates of satisfactory results and no complications in osteoporotic bones.

In our study we have included only lateral condyle tibia fracture which were fixed by LHBP. Usually LHBP is inserted providing a raft of proximal locking screws to support the articular surface, buttressing the lateral wall of proximal tibia and extending distally to adequately support the construct.

In our study of total 30 patients, average age of patient was 40.36 years with range from 18-70 years. Average age of female was 44.83 years, higher than average age in male patients which was 39.25 years. Read maker *et al.* [5] in their study on tibial condyle fractures had mean age of 46 years. Jensen *et al.* [6] in their study had average age of 55 years. The average age reported by various works is between 47-57 years. Bakalim and Wilppula *et al.* [7] have reported a incidence for males between 40-67 years and for females between 33-60 years. This is due to the fact that this is the

working age group with increased mobility outdoors. Hence, they are more exposed and consequently more injured.

In this study, the males and females were 24 (80%) and 6 (20%) respectively (male to female ratio 4:1). Higher male to female ratio in our study is due to fact that in our country males are more involved in outdoor activities and they are earning members of the family, and predisposed to road traffic accident with high energy trauma.

Road traffic accident was the major cause of lateral tibial condyle fractures in our study. In present study 80% fractures were caused by road traffic accidents and remaining 20% were by falls. M. Hohl [8] in his study on tibial plateau fractures cited the road traffic accident were the main cause of tibial plateau fractures. This supports our finding. Also, Bakalim and Wilppula [7], Rasmussen [9] have noted that automobile accidents accounts for 40-60% of tibial plateau fractures.

In our study majority of the patients presented with type I fracture that is split fractures representing 43.33% of the fractures while type II fractures that is split with depression accounted for 30% fractures with type III that is pure depression being 26.6% only. This may be due to the fact that type I and II fractures occur when the bone quality is good as in young adults and in our study most of the patients are in young age group while type III fractures occur in elderly age group when there is osteoporosis. This fact was also mentioned in Schatzker *et al.* [1] study, which mentioned that type II fracture is the most common and type I is the least common. In his study of 70 patients only 4 patients had type I fracture. Hohl [8] also found the same observation that type I is the least and type II is the most common.

In our study pre-operative articular step off was calculated using CT scan. In that 40% fractures had more than 2mm step off or displacement while 13.33% fractures had between 0-1mm, 46.66% had displacement or step off between 1-2mm. Patients with 0-1mm displacement, 1-2mm displacement >2mm displacement had excellent to good outcome. So initial displacement didn't have any association with final outcome in our study. Biyani AE *et al.* [10], Conolly JF [11], Duwelius PJ [12] *et al.*, Honkonen SE [13], Lansinger O [14] *et al.* Redmakers MV [5] *et al.*, Schwartzman R [15] *et al.* thought that limb alignment was more important than articular step off.

The Radiological outcome was satisfactory in 96.66% cases and Functional outcome was satisfactory in 85.83% cases including excellent to good results.

In our study out of 30 patients 28 patients had an uneventful postoperative period, while 2 patients had urinary problem post operatively. None of our patient had infection or loss of reduction. Parkkinen *et al.* [16] in their study also had no infection and loss of reduction.

We found that out of 17 patients less than 40 years had excellent to good results. In 13 patients above 40 years had excellent to fair result. Rademakers MV *et al.* [5] also found that increasing age has no negative effect on functional outcome.

Conclusion

The proximal tibial lateral condyle fractures are commonly encountered in young age group due to increase in number of RTA. Stable internal fixation with proper alignment is the key for successful outcome. The open reduction and internal fixation of proximal tibial lateral condyle fractures with use of Lateral Head Buttress Plate (LHBP) yields reliable results when utilized correctly. We concluded that LHBP can be satisfactorily used for fixing isolated lateral tibial condyle fractures with good functional and radiological outcome. LHBP allows fixed stable fixation with early mobilization and rehabilitation. It decreases the risk of early osteoarthritis.

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