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Functional outcome of postero-medial condyle fractures of proximal tibia treated using posteromedial locking compression plate

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ABSTRACT

Background: Tibial plateau fractures are peri-articular knee fractures of the proximal tibia. They comprise approximately 8% of all fractures among those aged over 55 years. Surgical intervention for tibial plateau fractures is essential to achieve articular congruity, proper joint alignment, mechanical stability and support ligamentous integrity, as well as to enable prompt rehabilitation

Methods: A 12 months prospective study was conducted from July 2023 to June 2024 at Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Vijayawada, Andhra Pradesh. The study included 30 patients with Schatzker Type IV, V and VI proximal tibial fractures. Fractures involving the medial condyle were treated using a posteromedial locking compression plate.

Results: The study included participants aged between 23 to 62 years with the mean age being 36 years (22 males and 8 females). Schatzker classification Type IV fractures being the most prevalent (14 cases) followed by Type V fractures (10 cases) and Type VI fractures (6 cases). Right-sided fractures were more common, with 20 cases reported, compared to 10 cases of left-sided injuries. The functional outcome was measured using the Lysholm Knee Score according to age, fracture and gender. It was excellent results in 19 patients, good results in 8 and fair results in 3 at six month follow up.

Conclusions: Fixation of the tibial plateau fractures using locking compression plates allows for early rehabilitation of the patient and has an excellent functional outcome. Restoring stability, articular congruity and alignment ensures long-term joint health and minimizes complications. A well-planned approach to the tibial plateau fracture with importance to the posteromedial fragment has excellent functional outcomes.

Keywords: Medial condyle, Proximal tibia, Posteromedial locking compression plate

INTRODUCTION

Tibial plateau fractures are peri-articular knee fractures of the proximal tibia. They comprise approximately 8% of all fractures among those aged over 55 years.[1] They are complex injuries that can lead to articular depression, malalignment and an increased risk of post-traumatic osteoarthritis.[2] It is also associated with an increased risk of mortality in the long-term.[3] These fractures are commonly caused by high-velocity trauma, having an incidence of 25–30/100,000 and has tended to increase over the last 20 years.[4] They are common in both young individuals and the elderly population, particularly those with osteopenia and other medical comorbidities.

It also has socioeconomic implications, including financial strain, prolonged hospital stays and delayed return to work, especially since they often occur in the productive age group. The tibial plateau is one of the most crucial weight-bearing areas in the body, with the tibia supporting 80% of the load and the fibula carrying the remainder. Any fracture in vicinity of this joint demands meticulous

management to restore articular congruity, a key determinant of functional outcomes. Failure to address these fractures appropriately can result in knee instability and abnormal mechanical forces, leading to early-onset osteoarthritis. Long-term studies emphasize the importance of axial alignment in osteoarthritis development over articular depression.[5]

The Schatzker classification (Figure 1) is widely utilized to categorize tibial plateau fractures. It characterizes the bone injury by identifying a sagittal split, a depressed segment of the articular surface, the existence or lack of a fracture in the medial plateau and whether the tibial plateau remains connected to the tibial shaft.[6] Surgical intervention for tibial plateau fractures is essential to achieve articular congruity, proper joint alignment, mechanical stability and support ligamentous integrity, as well as to enable prompt rehabilitation.[7]

Treatment options for tibial plateau fractures include. Open reduction and internal fixation (ORIF): with plate osteosynthesis. Percutaneous screw fixation or external fixation: using pin or wire fixators. Closed manipulation and casting: often with a cast brace. Staged procedures: starting with external fixators followed by definitive plate osteosynthesis. Other methods: traction with early motion, extensile exposure with arthrotomy and joint surface reconstruction using plate and screw fixation.[8]

Evolutionary adaptations for bipedal locomotion have made the knee prone to wear and tear, especially in the elderly. Thus, achieving optimal alignment and stability is paramount for long-term functional outcomes and this study is planned to assess the same.

METHODS

A 12-month prospective study was conducted from July 2023 to June 2024 at Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Vijayawada, Andhra Pradesh. After obtaining the ethics committee approval, the study included 30 patients with Schatzker Type IV, V and VI proximal tibial fractures. Written informed consent was obtained from all the patients. Fractures involving the medial condyle were treated using a posteromedial locking compression plate. Microsoft Excel was used for analysing the results.

Inclusion criteria

Age>18 years (after physeal closure), closed injury, fractures<2 weeks old, involvement of medial and posterior columns, especially posteromedial fragments.

Exclusion criteria

Age≥60 years, exclusively lateral column fractures, fractures>2 weeks old, presence of infection or medical contraindications for surgery.

Pre-operative assessment

Patients underwent routine investigations such as complete hemogram, renal function tests, chest X-ray, ECG etc. Standard trauma series radiographs (anteroposterior and lateral views) were also taken.

Procedure

Patients were positioned supine with a sandbag under the contralateral hip. The posteromedial approach was utilized for medial condyle fractures. An incision was made following the posteromedial border of proximal tibia after exposing the posteromedial aspect of the affected knee. The plane is between the gastrocnemius and pes anserinus. There is no true internervous plane.[9]

Step 1: Reduction and plate placement

Fragments were reduced and the plate was positioned.

Step 2: Cortical screw application

A 3.5 mm cortical screw was placed in the neck of the plate in the elongated combi-hole. The elongated hole allows for adjustment of the plate position.

Step 3: locking screw fixation

3.5 mm self-tapping screws were placed in the shaft of the plate. Combi hole allows for placement of cortical screws if plate to bone compression is desired. Reduction of the fracture fragments was verified before locking screws were applied.

Step 4: K-wire placement

1.5 mm K-wire were placed in the holes of head portion of the plate to confirm proper screw length and joint penetration under fluoroscopy.[10] The surgical wound was sutured using antimicrobial triclosan coated polyglactin 910 suture (Trusynth plus neo, Healthium Medtech, India).

Post operative protocol

After the surgery, a removable knee immobilizer like knee brace was used. Physical therapy in the form of quadriceps exercises and gentle active-assisted exercises commenced on post-operative day 1.

Drain was removed and walker-assisted mobilization began on postoperative day 2. Mobilization was delayed in case of any soft tissue devitalization or fractures of the tibial tubercle and the patients were advised non-weight bearing for 10-12 weeks until the radiological and clinical signs of union.

Follow-up visits were scheduled at one, three and six months, with outcomes assessed using the Lysholm Knee Score.[11]

RESULTS

The study included participants aged between 23 to 62 years with the mean age being 36 years. Among the participants, there were 22 males and 8 females, suggesting a predominantly male population (Table 1). The study focused on different types of fractures, with type IV fractures being the most prevalent, occurring in 14 cases. This was followed by type V fractures, which appeared in 10 cases and type VI fractures, which were present in 6 cases.

Table 1: Gender of the patients.

Gender distribution	Number of patients
Male	22
Female	8

Table 2: Time interval between injury and surgical intervention.

Injury to surgery time interval	No. of cases	%
<2 days	18	60
2-5 days	3	10
5-14 days	9	30

In terms of injury laterality, right-sided fractures were more common, with 20 cases reported, compared to 10 cases of left-sided injuries. The study also noted the presence of associated injuries in a few participants. Specifically, two patients had a distal radius fracture in addition to their primary injuries and one patient had a distal humerus fracture along with the tibial plateau fracture.In all cases, tibial plateau was addressed first and then upper limb in subsequent sitting. The time interval between initial injury and surgery is mainly decided by the soft tissue status of the limb. In case of unfavorable skin conditions, the surgery was deferred till soft tissue edema subsides (Table 2).

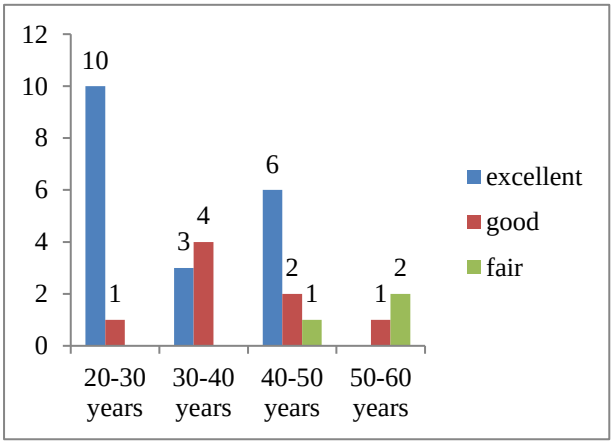

Figure 1: Lysholm knee score according to age.

The lysholm knee score system is a patient-reported instrument that consists of subscales for pain, instability, locking, swelling, limp, stair climbing, squatting and the need for support. Scores range from 0 (worse disability) to 100 (less disability). The functional outcome was measured using the Lysholm Knee Score according to age, fracture and gender. It was excellent results in 19 patients, good results in 8 and fair results in 3 at six month follow up (Figure 1-3).

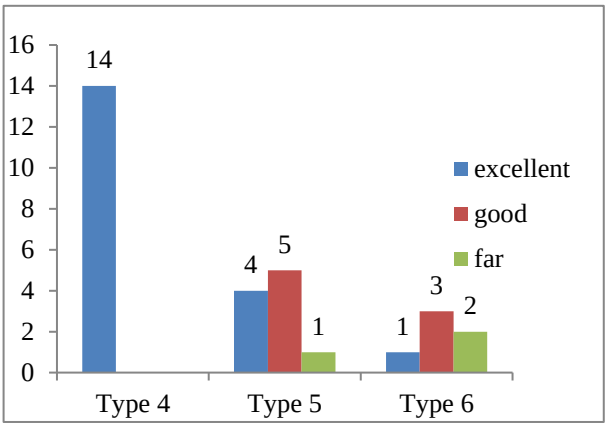

Figure 2: Lysholm knee score according to type of fracture.

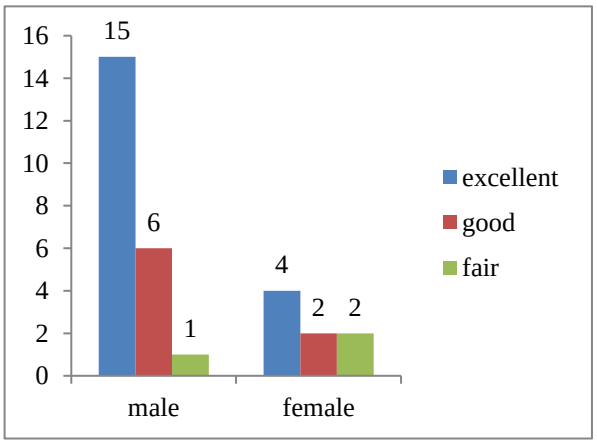

Figure 3: Lysholm knee score according to gender.

Figure 4 (a & b): Pre-operative X-ray of the patient.

A 38 years old male presented with Type IV schatzker fracture left proximal tibia after a history of RTA (Figure 4). On admission his vitals were stable with no

neurovascular deficit of the limb. Patient was initially stabilized with above knee POP slab.

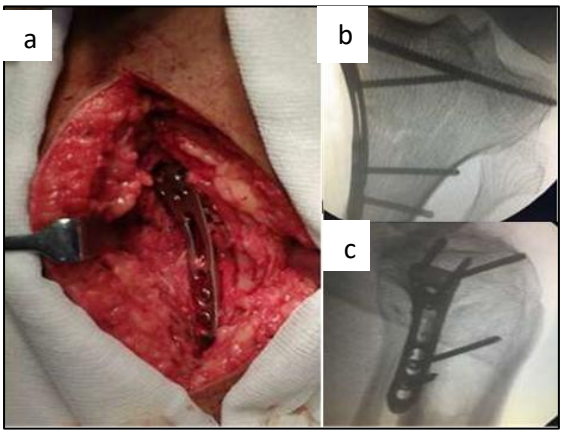

Figure 5 (a-c): Intra-operative pictures.

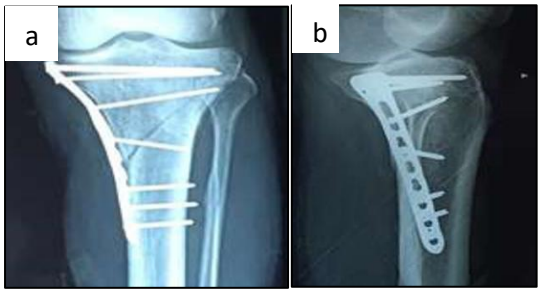

Figure 6 (a & b): Post-operative 3 months X-rays.

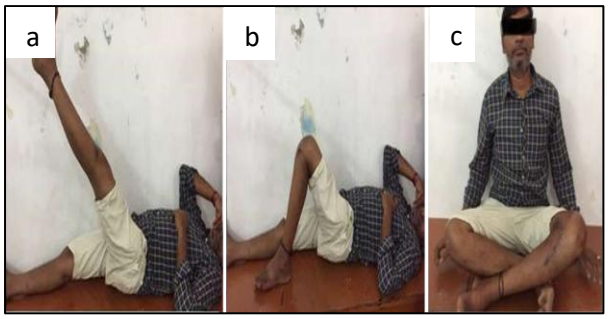

Figure 7 (a-c): Six months follow up clinical photo.

Patient was treated with posteromedial locking compression plate (Figure 5) and was discharged on POD-5 and early on bed mobilization advised. Patient mobilized on POD–10 weeks after radiological union. Postoperative three month follow up x-ray is shown in Figure 6 and six month follow up with functional outcomes is shown in Figure 7.

DISCUSSION

The anterolateral approach is commonly used for tibial plateau fractures, but complex cases may require a posteromedial approach alone or combined with the anterolateral. The posteromedial approach involves a longitudinal incision along the posteromedial tibia, accessing the bone between the hamstring tendons and the medial gastrocnemius.[7] Schatzker Type IV fractures, involving the medial plateau, can be managed with a single lateral locking plate if minimally displaced. However, displaced, comminuted or posterior fragment fractures necessitate a separate posteromedial approach and plating.

Open reduction and internal fixation using a posteromedial approach proved safe and effective, avoiding complications associated with anterior or direct posterior approaches. Understanding the anatomy and biomechanics of the knee remains vital in achieving favourable functional outcomes.[12]

Newer three column concept of the proximal tibia by Luo et al signifies the importance of the posteromedial and posterolateral corners of the knee joint.[13] The goal of treatment of these fractures aims at stability and perfect articular reduction, both are not possible without reduction and fixation of the posteromedial fragment.

Anatomical reduction and stable fixation of tibial plateau fractures restore joint stability, alignment and congruency, enabling early mobilization and rehabilitation. While achieving perfect congruency may not always be possible in cases of severe comminution, restoring the three-dimensional alignment of the split wedge fragments and the tibial plateau rim ensures functional knee recovery. Loss of congruency can lead to post-traumatic osteoarthritis later, but stability and alignment are key for effective rehabilitation and preventing joint subluxation.[14]

Advancements in imaging modalities like CT scans and MRI have significantly improved the detection and management of complex tibial plateau fractures. CT scans are essential for all cases and guide management, while MRI is often overlooked in evaluating fractures. MRI provides detailed information on soft tissue detail, cartilage damage and associated bony injury. It is valuable for preoperative assessment, detailed planning and long-term prospective observations, helping to interpret the impact of soft tissue injuries in tibial plateau fracture management.[14]

Medium-term outcomes after tibial plateau fractures are generally excellent if anatomy and stability are restored. Around half of patients may return to recreational sports, though this is less likely in cases of high-energy or open fractures and among male patients.[18] About one-third of patients may develop post-traumatic arthritis within five years, with risk factors including bicondylar or comminuted fractures, meniscal removal, residual instability, malalignment or inadequate reduction.[6] Deep surgical site infections occur in approximately 6% of cases, with higher risk in smokers, obese patients, those with open fractures or those requiring fasciotomy for compartment syndrome.[19,20] Other complications include stiffness, septic arthritis and persistent neurovascular injury.[6]

Table 3: Comparison of Outcomes in various other studies.

Study	No of cases	Union	Outcome			No. of cases with complications
			Excellent	Good	Fair	
Chen et al[15]	36	12 weeks	21	13	2	3
Lobbenhoffer et al[16]	21	10 weeks	12	8	1	3
Berber et al[17]	13	8 weeks	7	4	2	1
Our study	30	9.7 weeks	19	8	3	3

This study highlights the critical role of addressing the posteromedial fragment in tibial plateau fractures. The concave congruent medial condyle supports 80% of the mechanical load. Thus, accurate reduction and buttressing the fragment are essential for optimal outcomes.

CONCLUSION

Fixation of the tibial plateau fractures using locking compression plates allows for early rehabilitation of the patient and has an excellent functional outcome. Restoring stability, articular congruity and alignment ensures long-term joint health and minimizes complications. A well-planned approach to the tibial plateau fracture with importance to the posteromedial fragment has excellent functional outcomes.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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