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*Case Report*

# The Application of Posterior Plate in Tibial Plateau Fracture: A Case Report

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## ABSTRACT

**Backgrounds:** Tibial plateau fracture is the most frequent type of fracture caused by motor-vehicle collision. This injury may or may not be associated with soft tissue injury, such as the knee's ligaments. Posterior tibial plateau fractures are a rare subtype that requires surgical intervention. This case report describes the outcome of posterior plating in treating a posterior tibial plateau fracture.
**Case report:** A 41-year-old female patient came to the emergency room (ER) after being involved in a traffic collision. The patient underwent a thorough medical examination, which revealed the tibial eminence avulsion associated with the fracture of the head of the fibula. Surgical treatment was performed using a posterior approach through an inverted L-shaped incision.
**Discussion:** Tibial plateau fractures are serious injuries that often require surgery. However, the decision to operate depends on several factors, including the morphology of the fracture, the patient's profile, the condition of the soft tissues, and the expected recovery of the articular surface and the axis of the limb.
**Conclusion:** A surgical technique using a posterior approach through an inverted L-shaped incision with a small medial T-plate, lateral bone graft, and roof K-wire fixation demonstrates positive outcomes for treating closed posterior tibial plateau fractures and avulsion fractures of the tibial eminence.

**Keywords:** Tibial plateau fracture, Bone graft, Avulsion fracture, Tibial eminence, Human and health

## INTRODUCTION

Tibial plateau fractures are periarticular injuries of the proximal tibia that occur due to high-energy injuries and are frequently associated with soft tissue damage.[1,2] The primary mechanism of injury for this fracture is a varus or valgus load, primarily related to axial loading. This fracture is further classified into lateral, medial, and bicondylar tibial plateau fractures. Accounting for approximately 1.3% of all tibial fracture types, these injuries occur more commonly in males than in females.[3,4]

Posterior tibial plateau fracture is a rare fracture with an incidence rate of only 28.8% of all tibial plateau fractures. Fractures of the tibial plateau posterior have a unique shape that is not included in the Schaetzker classification or the Arbeitgemeinschaft für Osteosynthesefragen (AO)/Orthopedic Trauma Association (OTA) classifications. Therefore, this type of fracture uses the Three Column Classification.[1,5] The patient underwent surgical treatment for reduction and fixation of the fracture using a prone posterior approach, followed by observation of the outcome.[6,7]

Due to the challenging nature of reducing these fractures, articular incongruity did not negatively impact the ultimate functional outcomes. Multiple studies have confirmed that residual articular incongruence is well tolerated by proximal tibial plateau fractures with no functional limitations or arthrosis at a midterm follow-up. This case report utilizes the Surgical Case Report (SCARE) guidelines to present the outcomes of posterior plating in a tibial plateau fracture.

## CASE REPORT

A 41-year-old female shopkeeper came to the emergency room following a traffic incident. She sustained a fall from her motorcycle, landing on her right side. The patient had no history of diabetes mellitus or hypertension. Initial assessments during the primary and secondary surveys revealed a deformity in her right knee. There was no wound in the fracture site. Palpation of the posterior tibial artery and anterior tibial artery was normal, and sensory function was unaffected. X-ray evaluation of the knee demonstrated a posterior tibial plateau fracture line and a collapsed posterior aspect of the tibial plateau. A subsequent CT scan was performed for further evaluation, revealing a tibial eminence avulsion associated with a head of the fibula fracture.

A radiological evaluation was performed to assess the fracture. The follow-up examination revealed satisfactory correction of the fracture line and deformity after the previous surgery. Subsequently, the patient underwent rehabilitation and was discharged from the hospital. At the three-month and six-month post-operative outpatient clinic visits, no evidence of implant failure, nonunion, or infection was observed. The patient reported no complaints and could perform daily activities without difficulty.

## DISCUSSION

At the time of arrival in the ER, a long leg bivalve cast was applied as the initial treatment for the patient. This type of cast was chosen for immo-

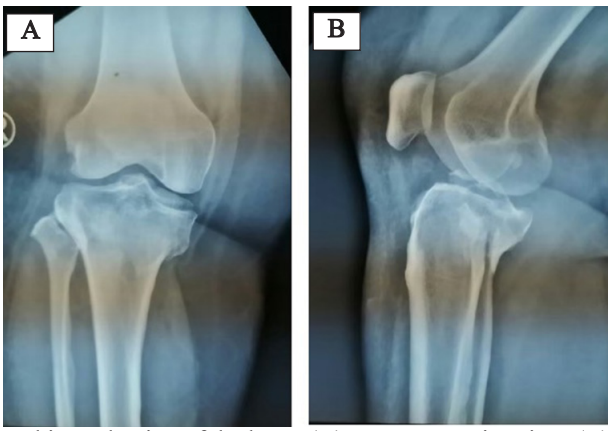


**Figure 1.** Radiographic evaluation of the knee. (A) Anteroposterior view. (B) Lateral view.

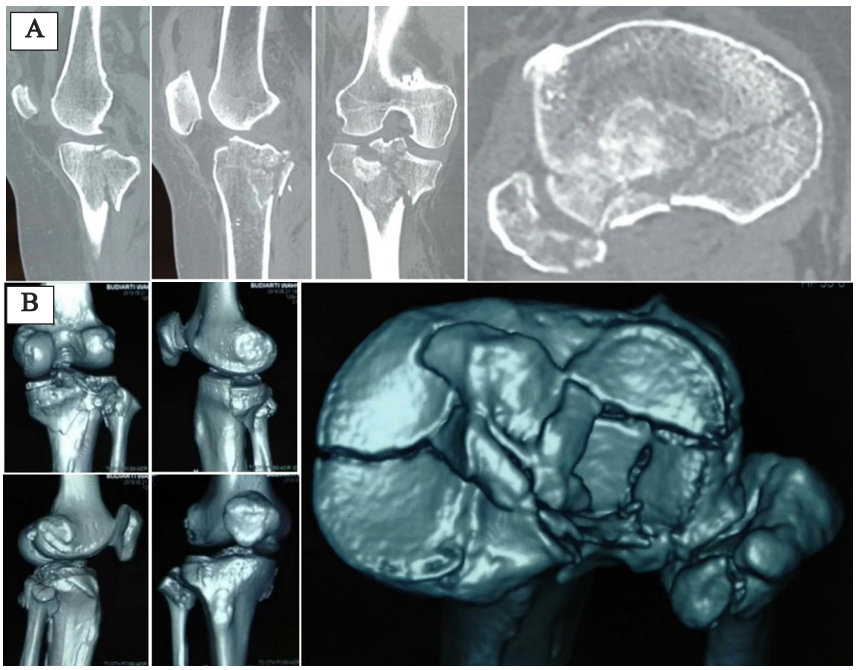


**Figure 2.** (A) CT scan image and (B) 3-dimensional reconstruction of the knee.

bilization before definitive surgery. Subsequently, an open reduction internal fixation (ORIF) with a posterior approach (L-inverted incision) was performed. The procedure involved the placement of a small T-plate posteromedially, a lateral bone graft, a roof K-wire, and a pull-through avulsion eminence with medial parapatellar dissection.[5,8]

In general, surgery is necessary for tibial plateau fractures. However, the decision to operate on a specific fracture should be based on the fracture's morphology, the patient's profile, soft tissue condition, general condition, and the expected recovery of the articular surface and limb axis.[9,10] ORIF is typically performed using a medial or anterolateral approach, depending on the fracture type. However, the three-pronged approach and analysis of fracture fragments have changed the treatment approach for tibial plateau fractures. Proper fixation of posterolateral or posterior medial fragments is not typically achieved with traditional anterolateral and medial approaches.[10]

Proper shrinkage of the posterior medial fragment and placement of the buttress requires a direct posterior approach, which can be performed in both supine and prone positions. The postero-medial method in the supine position with the legs externally rotated offers the added benefit of accessing the tibial plateau through a separate incision without repositioning the patient. Galla and Lobenhoffer first introduced and documented the use of the prone posteromedial approach. By making a longitudinal incision on the medial aspect of the gastrocnemius muscle rather than through the knee fossa, this approach allows lateral movement of the muscle to reach the posterior medial tibia.[11] Luo et al. described a posterior approach using an inverted L-shaped incision, with the patient lying on their side, allowing for easy adjustment of the knee's position as needed.[12] This technique also permits lateral movement of the medial head of the gastrocnemius, providing visualization of the entire posterior aspect of the tibia without the need to cut the muscle.[1,10]

The vulnerable backward approach has several strengths. Firstly, it allows for early detection of tibial subluxation in tibial condyle fractures. Secondly, properly reducing posteromedial tibial condyle fractures can decrease the likelihood of post-operative tibial subluxation. This is achieved by extending the knee excessively while the patient is in a prone position, making it easy to reduce the posterior medial fragment of the fracture. Finally,

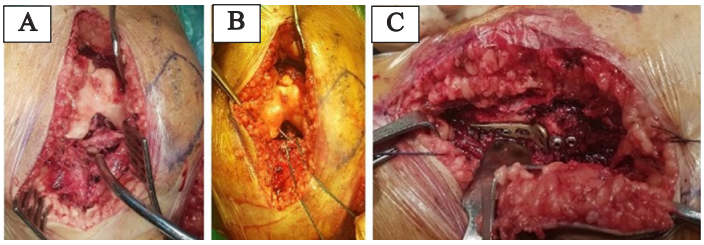


**Figure 3.** (A) Avulsion fracture of the tibial eminence, (B) Pullout method for fixation of tibial eminence fracture, and (C) Clinical picture of a posterior tibial plateau fracture fixed with a plate.

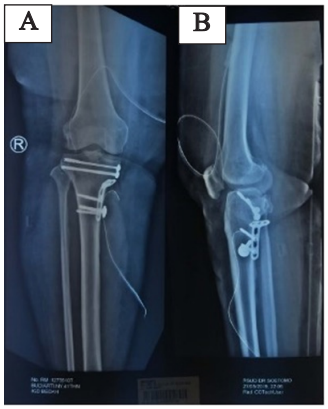


**Figure 4.** X-ray post-surgery of the knee. (A) Anteroposterior view, (B) Lateral view.

a non-slip plate can be used to firmly fix the subluxated tibial fracture or dislocation after the posterior medial component has been reduced.[9,10] The patient's prone position facilitates fracture reduction and the placement of non-slip buttress plates. Once removed, the reverse anterior screw provides easier retention. However, one major limitation of this method is that patients with head, chest, or abdominal injuries may not be effectively monitored while in the prone position.[1,4]

Sassoon et al. introduced a new method for reducing and stabilizing posterior impaction of the lateral tibial plateau using an intraosseous fibular allograft using an anterolateral route. If there is posterolateral cortical shearing, a posterolateral approach may be required to fix the cortex using buttress plates.[13] Tao et al. presented a revised L-shaped incision technique to access the back part of the lateral plateau by navigating via the spaces between the medial gastrocnemius, lateral gastrocnemius, popliteus, and soleus muscles.[14]

The posterolateral approach allows for anatomical reduction, bone grafting, and direct internal fixation from the back for tibial plateau fractures. For solitary posterolateral fractures, buttress plates offer the most effective biomechanical fixation. Using an artificial bone fracture model, Zhang et al. studied the biomechanical properties of four internal fixation methods for stabilizing posterolateral shearing tibial plateau fractures. They found that the posterolateral buttress plate is the most biomechanically robust fixation for this fracture type. The straight posterolateral plate is vital for maintaining the reduction of the posterolateral fragment and providing support to the articular surface. The anterior plate fixation was not enough to resist axial strain, and using screws from anterior to posterior posed a high risk of failure.[15]

## CONCLUSION

The complex procedure of using a posterior approach with an L-inverted incision, a small medial T-plate, lateral bone graft, and roof K-wire can be employed to treat patients with a closed fracture of the posterior column of the right tibial plateau and an avulsion fracture of the right tibial eminence, resulting in favorable outcomes.

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