A Unique Upside-down Flip-lid Type of Lateral Tibial Plateau Fracture Fragment in a Bicondylar Tibial Plateau Fracture Managed with Dual Plates and Raft Screws

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Abstract

Introduction: Bicondylar fractures are relatively common, yet those involving an elevated lateral tibial condyle fragment pose a unique challenge due to their atypical presentation. Existing classification systems inadequately describe this elevation, leading to varied terminology like “flip lid” or “reverse-Schatzker type” fractures in the literature.

Case Report: We present a case where the anterolateral osteochondral fragment was elevated and inverted, resulting from a rare mechanism where the left knee was crushed between two vehicles without axial force. This unusual mechanism spared typical signs of condylar widening or depression, with the fragment elevating but remaining submeniscal. This presented a challenge for fixation. The rotated fragment was accessed through an anterolateral approach with submeniscal arthrotomy, reduced, and fixed using raft screws of the lateral locking plate. The medial plateau fracture was stabilized through a posteromedial approach using an antiglide plate. Follow-up at 14 months showed satisfactory outcomes.

Conclusion: Unique injury mechanisms can give rise to distinct fracture types. When X-rays depict an elevated rather than depressed articular surface, suspicion should arise for an elevated, “popped up,” or flip lid type fragment. Such cases require a high index of suspicion and a thorough preoperative evaluation using both X-rays and CT scans. Submeniscal arthrotomy is essential to assess meniscus integrity and allow direct visualization of the fracture fragment. Successful outcomes in managing these fractures are based on accurate diagnosis, thorough preoperative planning, and adherence to internal fixation principles.

Keywords: Elevated, popped up, flip lid, reverse tibial plateau fractures.

Learning Point of the Article:

Recognizing unique fracture patterns, such as the flip lid phenomenon, understanding the distinctive mechanisms of injury involved, and navigating the challenges in diagnosis are essential for the effective management of unique tibial plateau fractures.
unique in this case, as the proximal tibia is crushed between the bumpers of two vehicles, with no axial force. Pre-operative diagnosis and the decision of surgical approach are crucial for the reduction and fixation of such rare injuries. Neglecting the articular part during surgery can lead to disability, stiffness, and long-term osteoarthritis [6]. The goal of treating this type of fracture is to achieve articular congruity, absolute stability, limb alignment, and management of associated soft tissue injuries [7].

Case Report

A 26-year-old male sustained an injury to his left knee and was diagnosed with a bicondylar fracture left proximal tibia. Initially managed elsewhere in an above-knee slab, elevation, rest, and analgesics, he was presented to us after 2 weeks. Upon examination, there was wrinkling of the skin suggesting subsidence of swelling and soft tissue compromise at the presentation [8]. Some healed abrasions on the anterior surface of the tibia were noted. Based on X-ray findings, a bicondylar fracture with an elevated lateral tibial condyle fragment was diagnosed, loosely classified as Schatzker type V, and AO/OTA type 31C, without considering the elevated fragment.

On careful evaluation of the CT scan, the anterolateral osteochondral fragment is elevated and almost rotated upside-down (Fig. 1). Luo’s three-column CT-based classification partially described it as type 3 [9, 10]. There is no description of the elevation of fracture fragments in any available classification. Thus, this case cannot be fully described using any of the available classifications. Such a pattern can be challenging to diagnose. Fracture configuration compromised soft tissue envelope, and surgical expertise are crucial in deciding the approach. In this case, a CT scan, showing breaching of the outer cortex in axial view, helped us decide on the anterolateral and posteromedial approach for optimal fragment reduction and plate placing.

The patient is positioned supine, and a tourniquet is applied on the proximal ipsilateral thigh and inflated (tourniquet time 75 mins, pressure 300 mmHg). A sandbag is placed under the knee to make it in slight flexion. The dual incision was used to reduce and fix this fracture. A posteromedial buttress plate through the posteromedial incision was applied. A skin incision at the posteromedial border was made, reduction of the apex of the
fracture end and placement of the buttress plate behind the pes anserinus was done.

An anterolateral incision was placed. Partial elevation of the iliotibial band from the tibia followed by sub-meniscal arthrotomy was done (Fig. 2). A flipped osteochondral fragment was seen as caught below the capsule with the articular surface facing down and the fractured surface facing up. The fragment was delivered out of the wound. The meniscus was seen intact. However, subchondral impaction of the bone was seen, which had to be elevated such that after fixing the fractured fragment the articular surface would label parallel before the fragment was fixed with an anterolateral plate and raft screw through the plate. An attempt was made to place it properly back into the joint, then the wound was closed in layers. The post-operative period was uneventful.

The range of motion exercise started on the 3rd post-operative day, after the subsidence of surgical pain. Partial weight-bearing started after 5–6 weeks and full weight-bearing started after 11–12 weeks post-operatively. Upon follow-up in the 5th month, the radiological union was visible. The range of motion of the left knee is 0–100°, painless with no crepitus (Fig. 3). He can do almost all his household activities though he was not able to use the Indian toilet and had difficulty sitting with the crossed leg on the floor. During the final follow-up at 14 months, the range of motion is increased to 0–110°. He can walk, play games, and run without any difficulty (Fig. 4).

**Discussion**

There are a few unclassified fractures described in the literature like this case. Ho et al. reported a flip type of lateral tibial plateau fracture where the osteochondral fragment was elevated but unlike our case, it was not rotated upside-down and associated with lateral meniscus tear [5]. Chang et al. described a pivot-type lateral tibial plateau fracture, but unlike us, the flipped fracture fragment is associated with anterior cruciate ligament injury and no medial condyle fracture [4]. Another fracture that is not classified by the available classification system is known as the "reverse-Schatzker type IV" fracture. This term was first used by Yeoh et al., caused by instant fracture dislocation and characterized by valgus knee position with lateral plateau dislocated completely out and medial plateau in position [3]. This case can be described as a bicondylar fracture with the

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**Figure 3:** (a) Immediate post-operative Anteroposterior (AP) and lateral X-ray (b) AP and lateral X-ray at 6 months follow-up, (c, d, e, f) Clinical photographs at 6 months follow-up.

**Figure 4:** (a) Anteroposterior and lateral X-ray at 14 months follow-up, (b, c, d, e) Clinical photographs at 14 months follow-up.
extreme type of flip lid or pivot fracture of the lateral plateau where the articular fragment of the lateral condyle is completely rotated upside down.

The most common mechanism resulting in tibial plateau fracture is a valgus force with axial load, usually after a RTA [11]. The mechanism of injury is unique; in this case, the patient also sustained a fracture due to RTA when the proximal tibia compressed between two 2-wheelers with no axial force. Therefore, there was no condylar widening or depression rather the fracture fragment popped up and stayed submeniscal [12].

The elevated articular surface raises the challenge of diagnosis. Keeping a high degree of suspicion and the CT scan should be ideal for dealing with diagnostic dilemmas and pre-operative planning. CT helps in classifying the fracture and formulation of the surgical plan based on the sagittal, axial, and coronal cut of the CT scan [9, 10]. Associated meniscus injury is not uncommon in tibial plateau fractures. Kolb et al. reported that there is more than 80% risk of lateral meniscal lesions/impingement, in the case of significant widening or depression of lateral tibial plateau fracture [13]. It was suspected here due to the elevated lateral plateau fragment [14]. The magnetic resonance imaging (MRI) scan is recommended to rule out ligamentous or meniscal injury pre-operatively [15].

Arthroscopy as well as submeniscal arthrotomy is a well-known method for inspection of tibial plateau fracture as well as to diagnose ligament and meniscus tear intraoperatively as performed by Ho et al. [5,16, 17]. Neither MRI nor arthroscopy was done in this case. We have done lateral submeniscal arthrotomy to confirm the diagnosis intraoperatively as well as inspection of the meniscus which was found to be intact. Unlike our case, Ho et al. also needed to repair the meniscus arthroscopically [5].

A dual plate was used in this case as recommended for bicondylar fracture. The lateral locking plate is neither ideal nor the screws through the plate would have an adequate grip and stabilizing effect on the opposite tibial plateau fracture fragment [18]. The risk of loss of reduction if a single plate is used for bicondylar fracture fixation [19-21].

**Conclusion**

This case presents a unique fracture pattern due to a distinct injury mechanism. The exact cause is challenging to determine but likely involves both valgus and varus forces, without axial force, as the knee was caught between two motorbikes. The rotated and elevated fracture fragment raises suspicion of meniscus injury, prompting consideration for pre-operative MRI or arthroscopy. Successful management relies on accurate diagnosis, achievable even with limited resources through careful imaging interpretation. Intraoperative confirmation can be obtained through submeniscal arthrotomy. Addressing the reduction of such fragments poses a challenge, but fixation becomes relatively straightforward with internal fixation, aiming for absolute stability.

**Clinical Message**

Recognizing and addressing unique fracture patterns are crucial for the effective management of complex tibial plateau fractures. Understanding the distinct mechanisms of injury involved, which may deviate from typical presentations, can aid in accurate diagnosis and treatment planning. Clinicians should remain vigilant and consider advanced imaging modalities like CT scans and arthroscopy to confirm the diagnosis and ensure optimal management and satisfactory outcomes of such fractures.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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