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A Rare Anterior Tibial Plateau Fracture Variant in an Adult: A Case Report

Misagh Osquee Asanjani, Arsalan Ranjbar✉, Masoud Zeynalzadeh and Koosha Sepasi

Department of Orthopaedics, Shohada Hospital, Tabriz University of Medical Sciences, Tabriz, Iran

Corresponding author: Arsalan Ranjbar MD, Department of Orthopaedics, Shohada Hospital, Tabriz University of Medical Sciences, Tabriz, Iran. E-mail: Arsalan.em2a@gmail.com.

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Abstract

Case: A 46-year-old man sustained a direct anterior impact to the proximal tibia by a sharp weapon. The associated wound was superficial at the impact site, but the injury was classified as a Gustilo-Anderson type II open fracture. Radiographs suggested an extra-articular tibial tubercle avulsion-type fragment, and CT was not obtained. After initial irrigation and debridement, staged definitive fixation was performed one day later. Intraoperatively, the fracture was found to be a continuous anterior osteoarticular fragment extending from the anterior tibial plateau to the tibial tubercle, including the patellar tendon insertion. Because the patellar tendon prevented safe plate placement, fixation was achieved with three 4.5-mm partially threaded screws and washers. At 2-month follow-up, the patient had full knee range of motion and a Lysholm Knee Score of 86.

Conclusion: This rare adult anterior tibial plateau fracture variant may mimic a tibial tubercle avulsion injury on radiographs. CT should be considered for fractures near the joint line to avoid underestimation of intra-articular extension and to improve operative planning.

Keywords: Tibial plateau fracture; Anterior tibial plateau; Tibial tubercle; Open fracture; Screw fixation; Case report

Introduction

Tibial plateau fractures represent complex periarticular injuries of the knee and account for approximately 1% of adult fractures [1]. Treatment depends on fracture morphology, articular involvement, soft-tissue condition, and stable fixation that permits safe rehabilitation [2]. Traditional radiographic classifications, including the Schatzker system, remain useful but may underestimate complex or unusual three-dimensional fracture patterns [3]. CT-based concepts such as the three-column classification and updated three-dimensional classifications have improved understanding of fracture morphology and surgical planning [4,5].

Anterior tibial plateau fracture patterns are uncommon and are most often discussed in association with hyperextension or anterior compression/shear mechanisms [6,7]. In contrast, tibial tubercle avulsion fractures are classically adolescent injuries and are rarely encountered in adults [8]. Intra-articular extension can be missed without advanced imaging, and several authors have emphasized the importance of careful assessment for articular involvement in tibial tubercle-type injuries [9,10]. This case describes a rare adult open fracture with a continuous anterior osteoarticular fragment extending from the tibial plateau to the tibial tubercle, including the patellar tendon insertion, and highlights the diagnostic pitfall of omitting preoperative CT imaging.

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Case Presentation

A 46-year-old man sustained a direct anterior impact to the proximal tibia by a sharp weapon. The injury was not interpreted as a penetrating osseous cut; rather, the fracture morphology was considered to result from direct anterior blunt-force trauma. He presented with pain and inability to bear weight.

On initial examination, there was mild swelling and localized tenderness over the anterior proximal tibia. The skin and soft-tissue envelope were otherwise acceptable; however, a superficial open wound was present at the anterior knee impact site, and the injury was classified as a Gustilo-Anderson type II open fracture. Active straight leg raising was not possible, suggesting functional insufficiency of the extensor mechanism. Distal neurovascular examination was normal, with palpable dorsalis pedis and posterior tibial pulses and intact distal motor and sensory function. Formal ligamentous testing was limited by pain and the acute fracture setting; however, no gross coronal or sagittal plane instability was appreciated clinically.

Anteroposterior and lateral radiographs demonstrated a large anterior bony fragment at the tibial tubercle region, initially interpreted as an extra-articular avulsion-type fracture (Figures 1 and 2). Because the injury was presumed to be extra-articular on plain radiographs, preoperative CT imaging was not obtained.

Figure 1: Preoperative anteroposterior radiograph of the knee showing the proximal tibial fracture.

Figure 2: Preoperative lateral radiograph demonstrating a large anterior osteoarticular fragment extending toward the tibial tubercle region.

The patient first underwent irrigation and debridement for the open wound. Definitive fixation was performed as a staged procedure one day later through an anterolateral approach.

Intraoperative findings revealed that the fracture line extended proximally into the anterior tibial plateau articular surface. The fragment was a large continuous anterior osteoarticular fragment extending from the anterior plateau distally to the tibial tubercle and included the patellar tendon insertion. The initial plan was to use plate fixation because of the shear-type configuration. However, safe placement of an antiglide or buttress plate was not possible because the patellar tendon and extensor mechanism limited the available anterior surface. Therefore, fixation was performed using three 4.5-mm partially threaded screws with washers, following principles similar to tibial tubercle osteotomy or tibial tubercle avulsion fixation [11]. The construct showed satisfactory compression and stability intraoperatively, and no supplementary fixation was required.

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Intraoperative Imaging and Reduction:

Fluoroscopic anteroposterior, lateral, and oblique views confirmed satisfactory reduction of the anterior plateau surface and stable implant position. No obvious articular step-off was seen intraoperatively (Figures 3-5). The intraoperative photograph demonstrated the anterior fracture fragment and articular extension after exposure and fixation (Figure 6).

Figure 3: Intraoperative fluoroscopic anteroposterior view after fixation with three 4.5-mm partially threaded screws and washers.

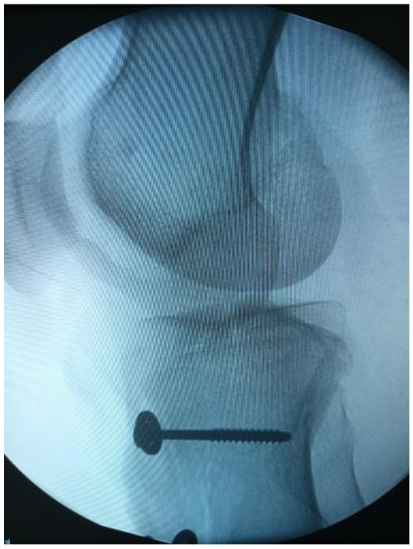

Figure 4: Intraoperative fluoroscopic lateral view revealed that the fracture line extended proximally into the anterior tibial plateau articular surface.

Figure 5: Intraoperative fluoroscopic lateral view demonstrating the final screw-washer construct.

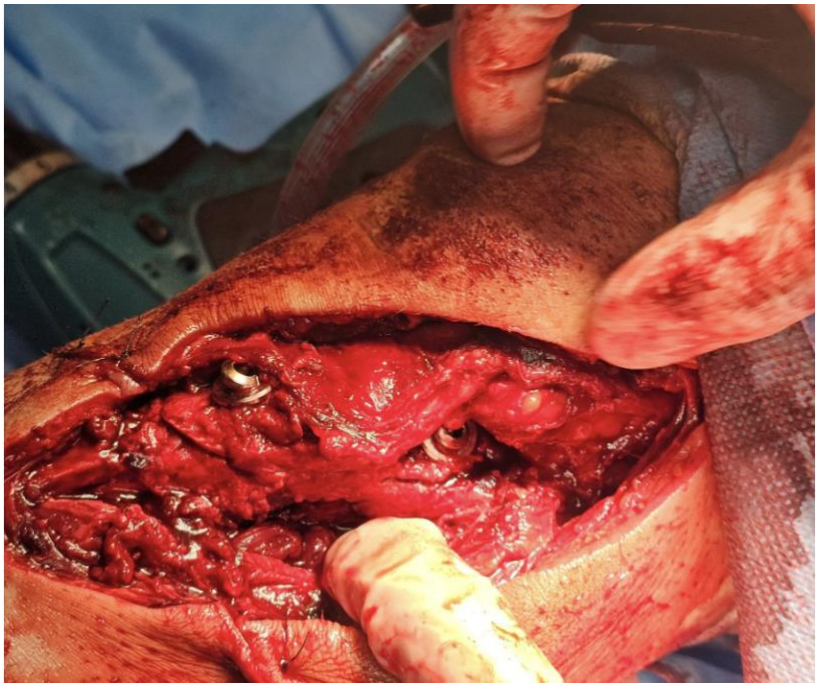

Figure 6: Intraoperative photograph after exposure through the anterolateral approach.

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Postoperative Course and Follow-up:

Because this fracture pattern was rare and had intra-articular extension, no specific rehabilitation guideline was available. Therefore, the postoperative protocol was planned cautiously, similar to tibial plateau fracture management, to avoid loss of reduction. The knee was initially protected in extension, and unrestricted weight bearing was not allowed. Gradual non-weight-bearing knee range-of-motion exercises were initiated after wound stabilization. Protected ambulation with crutch assistance was continued during the early postoperative period.

At the 2-month follow-up, the patient had no limp, no swelling, no locking, and no subjective instability. He reported only mild residual pain. The knee was clinically stable, and full knee range of motion had been regained. Crutch use was continued because of prescribed weight-bearing restriction rather than functional instability. The Lysholm Knee Score was 86, indicating a good functional outcome. Follow-up radiographs were not available for inclusion; therefore, radiographic union could not be objectively documented in this report.

Discussion

This case represents a rare adult anterior tibial plateau fracture variant that mimicked a tibial tubercle avulsion injury on initial radiographs but had clear intra-articular extension. The injury should be differentiated from previously described anterior tibial plateau injuries. Hyperextension-related plateau fractures usually involve anterior compression failure and may be associated with posterior tension failure or ligamentous injury [6,7]. Coronal plane fracture patterns differ from the present case because they are defined by a dominant coronal fracture line and usually involve condylar or posterior column fragments rather than a continuous anterior osteoarticular fragment.

Tibial tubercle avulsion fractures are usually adolescent injuries related to forceful quadriceps contraction across an open apophysis [8,9]. In contrast, our patient was skeletally mature and sustained a Gustilo-Anderson type II open injury from direct anterior trauma. The fracture consisted of a continuous anterior osteoarticular fragment extending from the anterior tibial plateau articular surface to the tibial tubercle, including the patellar tendon insertion. This combination of adult age, direct open trauma, plateau articular involvement, and inclusion of the tibial tubercle/patellar tendon insertion makes the fracture pattern unusual.

This morphology was not adequately described by the Schatzker, AO/OTA, or three-column systems. It was not a typical split, split-depression, pure depression, medial plateau, bicondylar, or metaphyseal-diaphyseal dissociation pattern. Although CT-based classifications improve recognition of anterior and posterior fragments, rare transitional anterior plateau-tubercle patterns may still require individualized interpretation and operative planning [3-5].

A key pitfall in this case was the lack of preoperative CT imaging. Because the fragment appeared extra-articular and resembled a tibial tubercle avulsion on radiographs, CT was not obtained. Intraoperatively, however, the fracture was found to extend into the articular surface. This case therefore supports a low threshold for CT evaluation in fractures close to the joint line, even when plain radiographs suggest an extra-articular injury [2,3,9].

The surgical strategy was determined by intraoperative anatomy. Plate fixation was initially considered for the shear-type component, but the patellar tendon insertion was incorporated within the fragment and prevented safe placement of a small anterior antiglide or buttress plate. Attempting to place a plate would have required excessive manipulation of the extensor mechanism and could have increased the risk of tendon irritation, implant prominence, or soft-tissue compromise. Because the fragment was large enough to accept screws and resembled a tibial tubercle osteotomy or avulsion-type fragment, compression screw fixation with washers was selected. This provided stable interfragmentary compression while avoiding interference with the patellar tendon [11].

This report has limitations. Preoperative CT imaging was not performed, and postoperative CT was not obtained because final intraoperative fluoroscopic views showed acceptable reduction and implant position.

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Immediate postoperative and serial follow-up radiographs were not available for inclusion; therefore, radiographic union and detailed postoperative articular congruity could not be objectively documented. Nevertheless, intraoperative fluoroscopy confirmed satisfactory reduction, and the patient demonstrated favorable early clinical recovery at 2 months.

Conclusions

This report presents a rare adult anterior tibial plateau fracture variant resembling a tibial tubercle avulsion but with unexpected intra-articular extension. The case emphasizes the importance of preoperative CT scanning in fractures adjacent to the joint line, regardless of initial radiographic interpretation. When plate fixation is not feasible because of patellar tendon involvement and limited anterior working space, screw-and-washer fixation may be an appropriate alternative for a large tubercle-like osteoarticular fragment.

Learning Point of the Article: Anterior tibial plateau fractures may mimic tibial tubercle avulsion injuries in adults; therefore, CT imaging should be considered for fractures near the joint line to avoid underestimation of intra-articular extension.

Clinical Message: Adult anterior tibial plateau-tubercle fracture variants can be underestimated on plain radiographs. CT evaluation should be considered for periarticular proximal tibial fractures, and fixation should be individualized according to fragment morphology and the local soft-tissue constraints around the patellar tendon.

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Conflict of Interest Statement: The authors collectively declare that no financial, personal, or institutional relationships exist that could influence or be perceived to influence the submitted work.

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