

Tibial Tuberosity Avulsion Fracture with Epiphyseal Injury in a Soccer Player: Treatment Options and Challenges

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Learning Point of the Article:

Tibial tuberosity avulsion fractures with epiphyseal injury are prone to develop deformities later in the life; therefore, adequate and prompt diagnosis with good fixation is crucial to provide better clinical outcomes.

Abstract

Introduction: Acute avulsion of the tibial tubercle is an uncommon fracture, with reported incidence rates of 0.4–2.7% of all epiphyseal injuries and <1% of all physeal injuries. Typically, these fractures present with marked displacement of the entire proximal apophysis, with or without intra-articular extension, and variable associated soft-tissue injury. The Ogden classification has historically directed both non-operative and operative treatment of this injury. The overarching objective of several fracture fixation techniques has been outlined as being to restore the joint surface and the extensor mechanism.

Case Report: This case report describes the management of a 14-year-old male who sustained a rare avulsion fracture of the left tibial tuberosity with epiphyseal injury during a soccer game. The fracture was classified as Ogden Type III-B, indicating an intra-articular extension. The patient underwent open reduction and internal fixation with three cannulated screws and tension band wiring.

Conclusion: The fracture united with no residual deformity and return of full range of motion. Tension band wiring provides stable reduction; hence, prompt diagnosis and appropriate surgical intervention in similar cases is important to optimize outcomes.

Keywords: Tibial tuberosity, avulsion fracture, epiphyseal injury, open reduction, tension band wiring.

Introduction

Avulsion fractures of the tibial tuberosity with associated epiphyseal injuries are rare but significant traumatic injuries, typically occurring in adolescents during high-energy activities such as sports. In the management of tibial plateau fractures, health-care professionals have at their disposal a range of treatment options. Non-operative methods often involve the application of a long leg cast in extension for a period of 6 weeks. This approach is typically recommended for type I injuries or those with minimal displacement (<2 mm) that maintain an acceptable alignment following closed reduction and cast

application. Conversely, operative treatment options come into play for more complex cases. These may require open reduction, internal fixation, and sometimes arthrotomy or arthroscopy, along with soft-tissue repair. This surgical intervention is indicated for Type II to IV fractures, where the joint surface needs to be visualized for precise reduction, and evaluation for potential intra-articular pathology is crucial. Moreover, Type V fractures, specifically those involving a periosteal sleeve, often necessitate soft-tissue repair as part of the operative approach. The choice between non-operative and operative methods depends on the specific characteristics of the tibial plateau

Author's Photo Gallery



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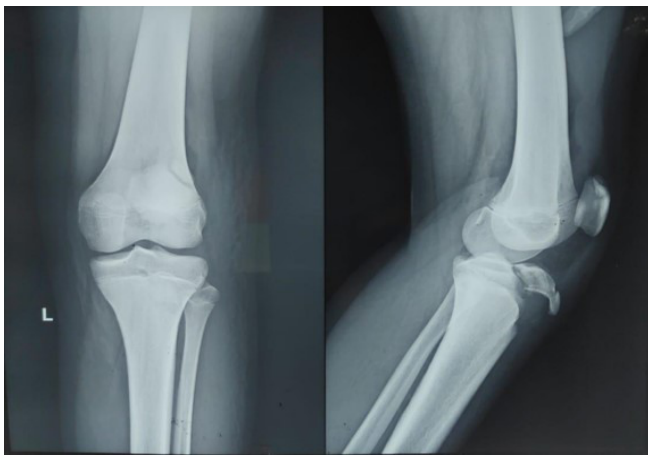


Figure 1: Radiographic image showing the avulsion fracture of the left tibial tuberosity with intra-articular extension post-injury.



Figure 2: Computed tomography sagittal section showing wedge shaped comminuted displaced fracture of lateral tibial plateau of left tibia with no evidence of depression of the articular surface.

fracture and its associated complexities [1].

Ogden Type III-B fractures [2], characterized by intra-articular extension, are particularly challenging to manage. We present a case of a 14-year-old male who sustained an Ogden Type III-B avulsion fracture of the left tibial tuberosity with epiphyseal injury while playing soccer. The patient was managed with open reduction and internal fixation (ORIF) using three cannulated screws and tension band wiring.

The purpose of this case report is to highlight this rare injury and prompt identification of the same.

Case Report

A 14-year-old male presented to the emergency department with severe left knee pain and an inability to bear weight on the left lower limb following an injury sustained while playing soccer. The patient described a twisting mechanism during a tackle while trying to kick the football, resulting in immediate

pain and swelling of the left knee. On physical examination, there was deformity, localized tenderness over the left tibial tuberosity, limited range of motion, and diffuse swelling.

Radiographic evaluation, including anteroposterior and lateral knee views (Fig. 1) and a computed tomography scan (Fig. 2) of the knee, revealed an avulsion fracture of the left tibial tuberosity with intra-articular extension, consistent with an Ogden Type III injury.

Given the displacement of the fracture fragment and the intra-articular extension, surgical intervention was recommended [3]. The patient was taken to the operating room for open reduction and internal fixation under spinal anesthesia.

Surgical Technique

A standard anterior longitudinal incision was made over the left knee. Careful dissection was carried out to expose the fracture site. The fracture was reduced anatomically, and the reduction



Figure 3: Immediate post-operative radiograph demonstrating fixation of the fractured fragments with three cannulated cancellous screws and tension banding with SS-wire.



Figure 4: Three months post-surgery clinical image showing patient squatting comfortably demonstrating full range of motion at the knee.

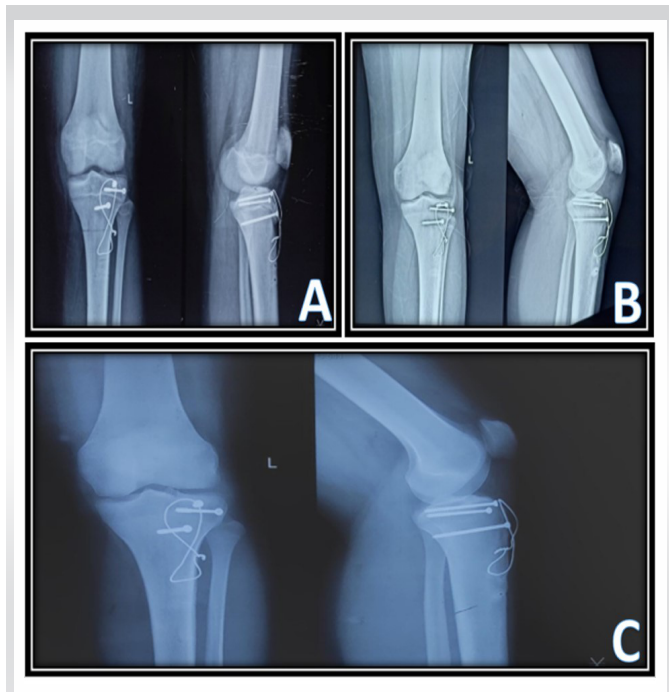


Figure 5: Follow-up radiographs showing signs of fracture union and remodeling at (a) one-month, (b) 6 months, and (c) 1 year.

was maintained with provisional Kirschner wires.

Three 4.5 mm cannulated screws were inserted through the tibial tuberosity, securing it to the proximal tibia. A tension band wire was applied to enhance fixation stability (Fig. 3).

Post-operative care



Figure 6: Radiographic imaging after implant removal (post union).

Postoperatively, the patient was placed in a hinged knee brace with gradual physiotherapy and knee range of motion for 6 weeks. Weight-bearing was restricted for 8 weeks, after which a gradual return to full activity was allowed.

Results

The patient had an uneventful recovery with no surgical site infection or any other complication. Serial radiographs demonstrated progressive fracture healing, and the patient regained full knee range of motion (Fig. 4), including a return to sports activities, 6 months post-surgery.

On the follow-up X-rays, it was observed that the fracture had healed satisfactorily (Fig. 5). This was followed by implant removal 1 year postoperatively (Fig. 6).

Discussion

Avulsion fractures of the tibial tuberosity with epiphyseal involvement, especially those classified as Ogden Type III-B fractures, pose a complex surgical dilemma due to their specific characteristics, notably the intra-articular extension. To ensure favorable outcomes and minimize the risk of enduring complications, such as growth disturbances, it is crucial to promptly diagnose these injuries and implement appropriate surgical strategies [4, 5]. These injuries are easily missed if minimally displaced, and on the other hand, they can lead to recurvatum deformity if displaced [6].

Acute tibial tubercle avulsion fractures may be linked to further knee injuries, such as anterior cruciate ligament, medial collateral ligament, lateral collateral ligament, and meniscus injuries [7, 8]. However, we did not encounter any such injuries in our case.

The aim of management of acute tibial tubercle avulsion fracture is restoration of the extensor mechanism and articular congruency of the tibial articular surface. This is accomplished by anatomically reducing the fracture fragment, avoiding any medial or lateral placement of the tuberosity fragment. A systematic review by Pretell-Mazzini et al. reported that up to 88% of cases of tibial tubercle fractures are candidates for surgery, with open reduction and internal fixation (ORIF) accounting for 98% of surgical correction [9]. Treatment with ORIF is recommended for tibial tubercle fractures of Types IIIA, B, and IV to restore congruency of the articular surface and address other intra-articular injuries, such as disruption of the extensor mechanism [10].

The surgical approach employed in this particular case involved open reduction and internal fixation, which proved to be an effective solution. This technique entailed the utilization of three cannulated screws, along with tension band wiring, to

achieve stable fixation. We did tension band wiring to augment the fixation. Although no literature is available about the use of tension band wiring in these kinds of injuries, in our case, it proved to be a worthwhile intervention and helped in an early return to sports activities. The selection of this approach was likely influenced by several factors, including the fracture's severity, the patient's age, the patient's keen interest in returning to sports activity as soon as possible, and the surgeon's expertise. The use of cannulated screws in the fixation process is advantageous because they can be accurately placed through small incisions, minimizing soft-tissue disruption. However, augmentation of fixation with tension band wire (TBW) converts the distracting forces into compression forces on the avulsed fragment, thereby promoting stability and consequently early physiotherapy and uncomplicated bone healing. Addition of TBW requires extension of incision.

One of the noteworthy benefits of this surgical intervention is that it permits the early initiation of the rehabilitation process. Early rehabilitation is essential in such cases to prevent joint stiffness, muscle atrophy, and other complications associated with prolonged immobilization. It allows the patient to regain strength and function more rapidly, improving their overall quality of life during the recovery period.

The successful recovery of the patient in this case underscores the critical importance of timely intervention, augmentation with tension band wiring, and adherence to postoperative rehabilitation protocols. Timely intervention ensures that the fracture is appropriately managed before it leads to long-term complications such as recurvatum deformity, growth disturbances, and limb length discrepancies, which can be

especially concerning in younger patients with open growth plates.

Conclusion

Tibial tuberosity avulsion fractures with epiphyseal injuries are uncommon but can be severely disabling, particularly in teenagers playing high-impact sports. This case report underscores the importance of surgical intervention, specifically open reduction and internal fixation, to achieve anatomic reduction and stable fixation in Ogden Type III-B fractures. Tension band wiring for tibial tuberosity avulsion fractures has drawbacks such as invasiveness, hardware issues, non-union risk, limited versatility, complications, and additional cost concerns. Augmented fixation using cancellous screws and TBW is a novel concept which enhances the stability and thereby, early physiotherapy and uncomplicated bone healing, on the cost of extension of surgical incision. More studies will be indispensable to compare the augmented fixation using cancellous screws and TBW with the already existing techniques for a definitive opinion. Patient suitability and careful evaluation are essential. Proper post-operative care and rehabilitation are crucial for optimal outcomes.

Clinical Message

This article summarizes the management of Ogden Type IIIB Tibial tuberosity fractures, their identification, diagnosis, and fracture fixation. Tension Band Wiring helps toward better fixation outcomes in such fractures by providing stability and enhanced bone healing.

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.

Conflict of interest: Nil **Source of support:** None

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