

Case report

Tillaux Fracture of The Distal Tibia (Salter-Harris Type III) In an Adolescent: A Case Report

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Abstract

A Salter-Harris Type III fracture represents a rare intra-articular growth plate injury in pediatric patients, characterized by a fracture line that traverses the physis and extends into the epiphysis, reaching the articular surface. A Tillaux fracture is a specific variant of this injury, occurring due to incomplete closure of the distal tibial growth plate and involving the anterolateral tibial epiphysis. This fracture pattern is unique to adolescents, as the relative strength of the anterior tibiofibular ligament compared to the partially fused physis predisposes the tibial fragment to avulsion. In the present case, a 13-year-old female presented to the emergency department following a twisting mechanism of injury to the left ankle. Initial plain radiographs (X-rays) demonstrated findings consistent with an acute, undisplaced Salter-Harris Type III fracture. Subsequent CT imaging of the left lower leg confirmed a Tillaux fracture of the distal tibia with approximately 2 mm displacement, which had been subtly overlooked on the initial radiographs. Management included closed reduction followed by percutaneous screw fixation, resulting in satisfactory stabilization of the fracture. This case highlights the importance of advanced imaging modalities, particularly CT scans, in differentiating Tillaux fractures from other ankle pathologies that may not require operative intervention. It also underscores the need for accurate diagnosis and timely surgical management to optimize outcomes in adolescent patients with transitional growth plate injuries.

Keywords. Salter-Harris Type III Fracture, Tillaux Fracture, Intra-Articular Growth Plate Injury, Distal Tibial Epiphysis.

Introduction

A Tillaux fracture is a distinctive ankle injury seen in adolescents. It involves an intra-articular break of the anterolateral distal tibia and is categorized as a Salter-Harris Type III fracture. This occurs during the transitional phase when the growth plate (physis) closes unevenly, typically triggered by supination combined with external rotation. When the foot rotates outward relative to the leg, the anterior talofibular ligament (ATFL) tightens, sometimes avulsing its tibial attachment. This mechanism produces a fracture through the anterolateral portion of the distal tibial epiphysis, accounting for about 2.9% of juvenile growth plate injuries [1]. Because the physis closes from the medial to the lateral side, the lateral region remains vulnerable, predisposing it to this characteristic Type III fracture. The ATFL's traction on the anterolateral tibial epiphysis can lead to varying degrees of displacement. Management depends on severity: fractures displaced less than 2 mm are treated conservatively with closed reduction and casting, while those displaced more than 2 mm require surgical intervention [2].

Clinically, patients present with pain and swelling over the anterolateral ankle, difficulty bearing weight, and the injury is often misdiagnosed as a simple sprain. Tillaux fractures and ATFL sprains are most frequently observed in athletes, who place greater mechanical stress on the ankle joint [3]. The purpose of this study is to evaluate adolescent ankle growth plate injuries both clinically and radiologically, with CT scans used to detect subtle displacements that may be overlooked on standard X-rays. Accurate diagnosis and appropriate treatment are essential to ensure favorable outcomes, as missed cases can result in premature arthritis or growth disturbances.

Case Presentation

A 13-year-old female patient was walking down the stairs, missed the last step, and sustained a twisting left ankle injury. She presented to the emergency department with pain and prominent swelling on the anterolateral aspect of the left ankle. On physical examination, the ankle showed markedly restricted motion in both eversion and inversion, with pain elicited even on gentle palpation. The initial plain radiograph revealed incomplete fusion of the growth plate,

accompanied by a vertical lucency traversing the distal tibial epiphysis (Figure 1). These findings were initially interpreted as consistent with an undisplaced Salter-Harris Type III fracture of the distal tibial physis. To obtain a clearer visualization and confirm the diagnosis, a CT scan was subsequently arranged on an outpatient basis.



Figure 1. Plain radiographic images from the patient's initial visit to the emergency department. (A) AP view, (B) lateral view. AP: anterior-posterior.

A non-contrast CT scan of the left ankle was performed three days following the initial injury. The lucency previously observed on plain radiographs was confirmed as an acute fracture. The fracture configuration was further characterized as a Salter-Harris Type III injury, demonstrating widening of the distal tibial physis with lateral extension. Displacement was evident along the lateral aspect, consistent with the radiologic features of a Tillaux fracture (Figure 2).



Figure 2. CT scan of the right lower extremity. (A) Coronal view CT shows a vertical fracture line through the anterolateral distal tibial epiphysis. (B) Sagittal view CT demonstrates displacement of the distal tibial fragment, consistent with a Tillaux fracture. (C) Axial/3D view CT confirms the isolated anterolateral epiphyseal fragment with intra-articular extension.

A 3D reconstruction of the patient's left ankle revealed a fragment displacement exceeding 2 mm, necessitating closed reduction and percutaneous screw fixation. On the fifth day post-injury, the patient underwent closed reduction and percutaneous pinning (CRPP) in the operating room. Using an image intensifier, the Tillaux fracture was visualized,

reduced, and stabilized with a bone clamp. Reduction was achieved by placing the foot in dorsiflexion, followed by internal rotation. A K-wire was advanced across the distal tibial epiphysis from medial to lateral, serving as a guide for screw placement. A 4.5 mm partially threaded cannulated screw was then inserted without a washer, providing stable fixation. Confirmation of excellent reduction and secure fixation was obtained through C-arm fluoroscopy in both anterior-posterior (AP) and lateral projections.

Postoperative standard radiographs demonstrated satisfactory screw placement and appropriate alignment of the fracture (Figure 3). The patient was immobilized in a long leg cast for four weeks to control the rotational component of the injury. At her outpatient follow-up visit four weeks post-procedure, the cast was removed, and imaging confirmed complete healing of the Tillaux fracture. Clinically, she reported no pain on palpation and demonstrated full, pain-free range of motion during both active and passive ankle movements. A subsequent four-week course of physical therapy enabled her to restore baseline strength in the left lower leg and ankle. The patient achieved full recovery; however, she was counseled to remain vigilant for potential late complications, including progressive ankle pain suggestive of early arthritis and the possible development of varus deformity secondary to growth arrest.



Figure 3: Postoperative plain radiographs following reduction and fixation of the Tillaux fracture. (A) Anterior-posterior (AP) view and (B) lateral view demonstrate satisfactory alignment. The cannulated screw traversing the distal tibia is clearly visible in both projections, confirming reduction of the displaced fragment. AP = anterior-posterior.

Discussion

Tillaux fractures are traumatic ankle injuries seen in the pediatric population, defined as Salter-Harris Type III fractures involving the anterolateral distal tibial epiphysis. During early adolescence, the combination of a strong anterior talofibular ligament (ATFL) and an incompletely fused tibial physis predisposes patients to this injury, which occurs exclusively in this age group [7]. Clinicians should maintain a high index of suspicion for Tillaux fractures in adolescents presenting with anterior ankle swelling and impaired weight-bearing ability [2]. Failure to recognize this injury can result in significant long-term complications, making accurate diagnosis and timely management essential. These fractures are frequently overlooked, often mistaken for minor ankle sprains [6], and can be difficult to detect radiographically due to their subtle appearance [4]. In the present case, CT imaging was necessary to clearly delineate the fracture line. Early recognition of Tillaux fractures is particularly critical in patients aged 12–14 years, when the physis is most vulnerable. Standard radiographs are less reliable than CT scans in identifying these fractures. If missed, the consequences may include premature growth arrest and early-onset arthritis, leading to permanent functional impairment. Such complications are often resistant to corrective surgery, underscoring the importance of prompt and accurate diagnosis.

Current evidence in the literature supports open reduction and internal fixation (ORIF) as a common approach for managing Tillaux fractures and medial malleolar fractures [5,8]. In this case, however, the fracture was successfully treated with closed reduction and percutaneous pinning (CRPP) using a 4.5 mm partially threaded cannulated screw. Compared to ORIF, which is associated with higher complication rates—including fixation failure and increased postoperative pain [9]—CRPP provided effective and efficient correction of the displacement. Importantly, this technique achieved stable fixation without the need for a skin incision, thereby avoiding the morbidity associated with open reduction.



Figure 4: Follow-up plain radiographic imaging at 6 weeks. (A) Anteroposterior view shows maintained alignment of the distal tibia and fibula with preservation of the ankle mortise and evidence of early callus formation. (B) Lateral view demonstrates satisfactory tibiotalar alignment with reduced fracture line visibility, consistent with progressing union. (C) Anteroposterior/oblique view confirms stable fracture alignment and preserved articular congruity without displacement. (D) Lateral hindfoot view shows maintained joint congruity and no radiographic signs of delayed union or post-traumatic complications.

Conclusion

A Tillaux fracture is an uncommon ankle injury that occurs almost exclusively in adolescents approaching skeletal maturity (typically between 12 and 14 years of age). It represents a Salter-Harris Type III fracture of the anterolateral distal tibial epiphysis, often resulting from an ankle sprain with external rotation. The injury arises because the distal tibial growth plate (physis) closes in a predictable sequence—first centrally, then medially, and lastly laterally. During this transitional phase, the bone is stronger than the ligament; thus, when the ankle twists, the anterior talofibular ligament can avulse a fragment from the still-open lateral physis, producing the characteristic Tillaux fracture. Clinically, adolescents presenting with anterior ankle swelling should be carefully evaluated for this injury. Risk stratification requires consideration of the mechanism of trauma, patient age, and fracture location. Tillaux fractures are frequently misdiagnosed as simple ankle sprains in reported cases, highlighting the need for appropriate imaging in high-risk patients. Physicians should remain vigilant when plain radiographs are inconclusive, as CT imaging provides superior visualization and is recommended to confirm or exclude subtle fractures. Early and accurate diagnosis is critical to prevent missed injuries that could lead to long-term complications. Diagnosis involves X-ray/CT scans, and treatment ranges from casting for non-displaced fractures to surgery (CRPP/ORIF) for significant displacement, aiming to stabilize the joint and prevent long-term issues, as well as to improve the patient's quality of life.

Consent to participate

Written informed consent was obtained.



Conflict of interest. Nil

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