

# Tillaux Fracture in Adults. Case Report and Literature Review

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## ABSTRACT

**Introduction:** The fracture of the anterolateral region of the distal tibial epiphysis, or Tillaux-Chaput tubercle, is known as Tillaux fracture. It is an exceptional entity in adults, but it has significant importance because it affects the tibiotalar joint surface, the stability of the syndesmosis, and, in some cases, the fibular notch. We present the case of a 45-year-old woman treated in the Emergency Service due to rotational trauma to the left ankle and functional impairment and pain in the anterolateral region of the ankle. The radiographs led to the suspicion of a fracture line corresponding to the Tillaux-Chaput tubercle. Therefore, a CT scan was performed, which confirmed a Tillaux fracture with a >2 mm displacement and involvement of the fibular notch. The patient underwent open reduction and internal fixation. The fracture consolidated after 3 months. One year after surgery, her clinical and functional status was excellent. **Conclusion:** Diagnostic suspicion through meticulous physical examination and anamnesis and confirmation by imaging studies are essential for the proper management of rare fracture patterns, such as Tillaux fractures.

**Keywords:** adult, fracture fixation, Tillaux fracture, ankle

**Level of Evidence:** IV

## Fractura de Tillaux en adultos. Reporte de un caso y revisión de la bibliografía

## RESUMEN

**Introducción:** La fractura de la región anterolateral de la epífisis distal de la tibia, o tubérculo de Tillaux-Chaput, es conocida como fractura de Tillaux. Se trata de una fractura extremadamente rara en los adultos, pero tiene una importancia fundamental, porque compromete la superficie articular tibio-astragalina, la estabilidad de la sindesmosis, y, en algunos casos, la incisura peronea. Se presenta el caso de una mujer de 45 años con un traumatismo rotatorio del tobillo izquierdo e impotencia funcional y dolor en la región anterolateral del tobillo. Las radiografías generaron la sospecha de un trazo de fractura correspondiente al tubérculo de Tillaux-Chaput. Por lo tanto, se realizó una tomografía computarizada que confirmó una fractura de Tillaux, que tenía un desplazamiento >2 mm y compromiso de la incisura peronea. La paciente fue sometida a reducción abierta y fijación interna. La fractura consolidó a los 3 meses. Al año de la cirugía, su estado clínico y funcional es excelente. **Conclusión:** La sospecha diagnóstica que surge de una completa anamnesis y un meticuloso examen físico, y la confirmación mediante estudios por imágenes son esenciales para abordar correctamente patrones de fracturas raras, como la fractura de Tillaux.

**Palabras clave:** Adulto; fijación de fractura; fractura de Tillaux; tobillo.

**Nivel de Evidencia:** IV

## INTRODUCTION

Tillaux fracture is the fracture of the anterolateral region of the distal epiphysis of the tibia, known as the Tillaux-Chaput tubercle, the insertion site of the anterior inferior tibiofibular ligament (AITFL), the anterior component of the syndesmosis ligament complex.<sup>1-4</sup> A Tillaux fracture can be isolated or part of a more complex fracture pattern. Some authors consider this fragment as a fourth malleolus or anterior malleolus.<sup>4</sup> The isolated form is more frequent in the adolescent population, during the period of closure of the physis, an entity included within transitional fractures; even so, it has a prevalence of only 2.5% of all ankle fractures.<sup>1,4,5</sup> On the contrary, in the adult

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population, the isolated Tillaux fracture is very rare.<sup>4,6-9</sup> This is because the most common mechanism of injury is supination and external rotation, which causes stress and tear in the AITFL almost constantly, because the ligament has less strength than bone.<sup>6-9</sup> When Tillaux-Chaput's tubercle is affected, the stability of the syndesmosis and the congruence of the tibiotalar articular surface and the fibular notch are usually compromised.<sup>3,4,10,11</sup> Therefore, if this fracture is not treated adequately and timely, it can cause pain, functional impairment, and post-traumatic osteoarthritis.<sup>3,4,10,11</sup>

In the literature, there is scant information on Tillaux's fracture in adults. The objective of this presentation is to report a case of a Tillaux fracture in an adult and to analyze the most important aspects of diagnosis and therapeutic options.

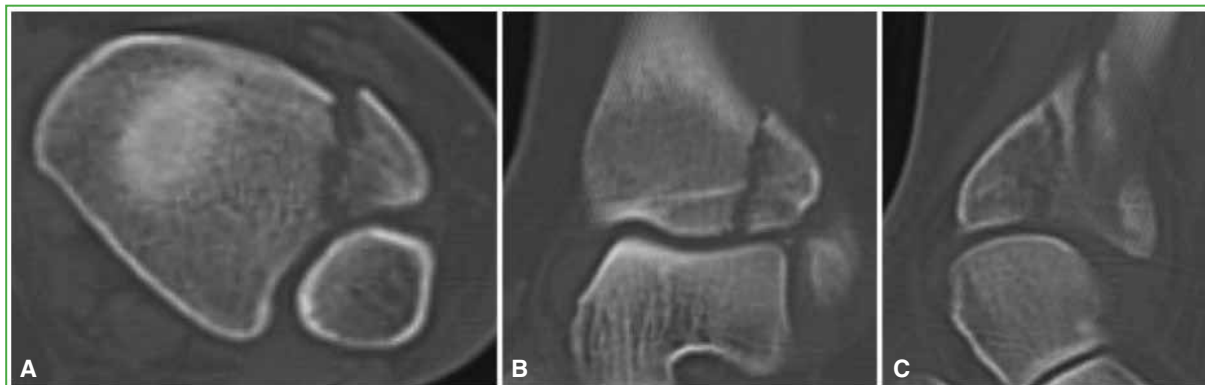
## CLINICAL CASE

A 45-year-old woman, with no relevant medical history, suffered a left ankle injury due to a rotational mechanism. She was initially treated in the emergency service. The physical examination evidenced the patient's inability to bear weight on that limb, functional impairment in the ankle, and mild edema and pain located in the anterolateral region. The neurovascular examination was normal. Anteroposterior and lateral ankle radiographs were requested, showing a fracture line in the distal anterolateral region of the tibia (Figure 1). To confirm the fracture, a CT scan was requested, which revealed an isolated fracture in the anterolateral region of the tibia, corresponding to Tillaux-Chaput's tubercle (Figure 2).

As it was an intra-articular fracture with a displacement  $>2$  mm and involvement of the fibular notch, surgery was indicated, which was performed four days after the trauma.



**Figure 1.** **A.** Preoperative anteroposterior radiograph of the left ankle. A vertical fracture line (arrow) is observed in the lateral region of the distal epiphysis of the tibia. **B.** Preoperative lateral radiograph of the left ankle. There is a superposition of the Tillaux-Chaput fragment (dotted line) and the distal epiphysis of the tibia in the anterior region.



**Figure 2.** CT scan of the left ankle, axial (A), coronal (B) and sagittal (C) slices, showing displacement, articular gap, and integrity of the Tillaux-Chaput fragment.

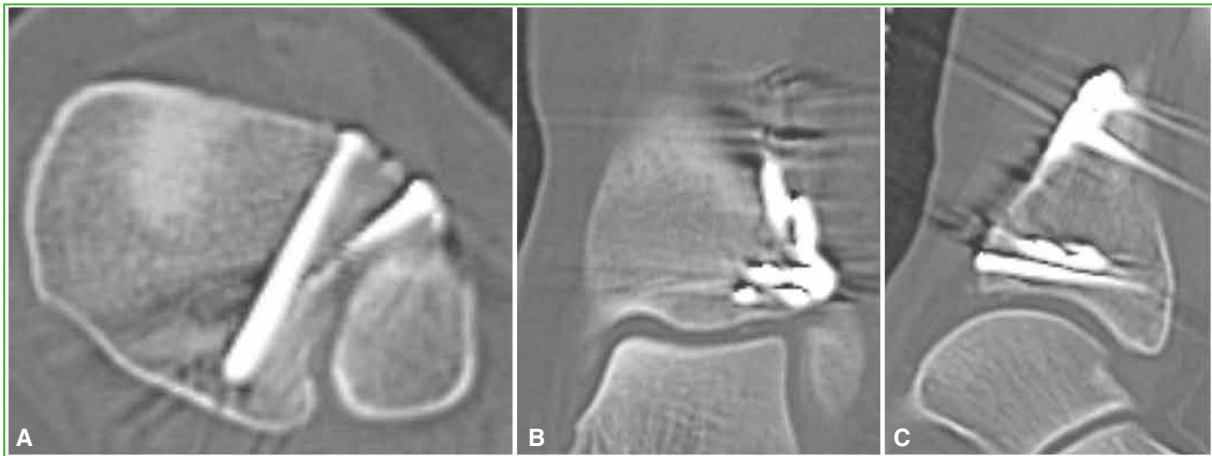
### Surgical technique

The patient was placed in the dorsal decubitus position, and anesthesia was administered, which consisted of neuroleptanalgesia and regional anesthesia of the limb. An anterolateral approach was performed, dividing between the extensor digitorum longus and the fibularis tertius by planes, and the superficial fibular nerve was repaired laterally. Subsequently, when the fracture line was identified, the focus was curetted, and reduction was achieved with a clamp. It was temporarily stabilized with pins and an adequate reduction was verified under direct vision and by fluoroscopy. Two 2.0 mm full-thread cannulated screws were then placed applying compression; and a 2.7 mm 'T' locking plate was added to increase support (Figure 3).



**Figure 3.** Intraoperative clinical image. The reduction and stabilization achieved through an anterolateral ankle approach are shown.

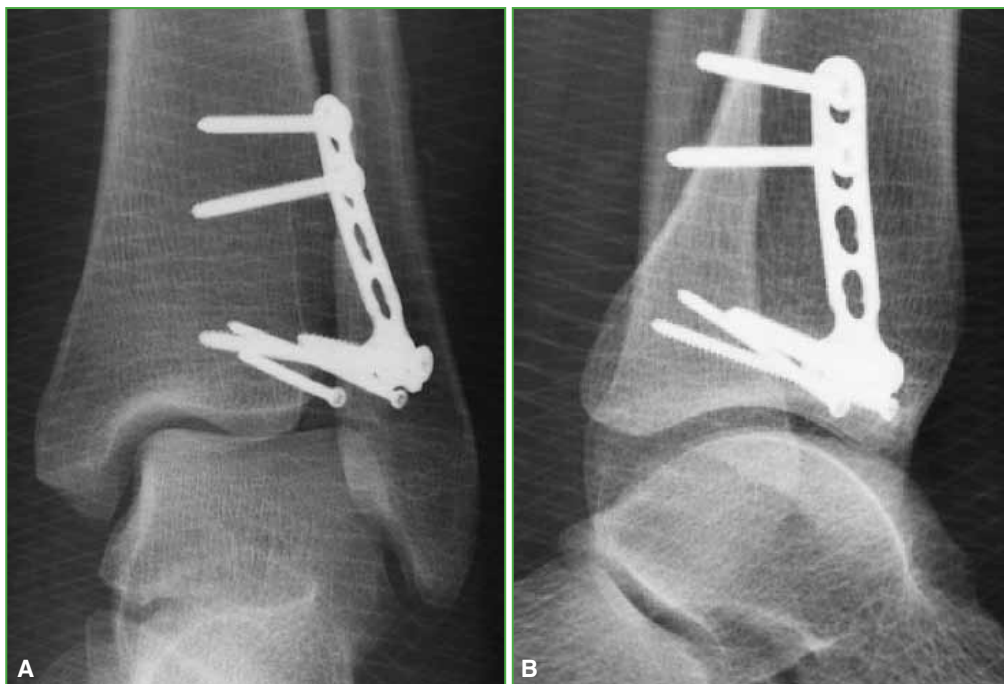
The reduction was controlled again and the adequate stability of the syndesmosis was verified. Primary closure was performed and a posterior ankle splint was placed to protect the wound. The postoperative joint reduction was monitored with a CT scan (Figure 4).



**Figure 4.** CT scan of the left ankle, axial (A), coronal (B), and sagittal (C) slices, showing the anatomical reduction of the Tillaux-Chaput fragment.

Postoperative management consisted of splint removal after a week, with a change to a non-weight-bearing Walker boot for six weeks. During this time, the patient began active and passive ankle range of motion exercises. In the sixth week, the Walker boot was removed and progressive partial weight-bearing was authorized and, in the eighth week, full weight-bearing was allowed.

Serial radiographic controls were performed 15 days, one month, three months, and one year after surgery (Figure 5).



**Figure 5.** A. Postoperative anteroposterior radiograph of the left ankle. No signs of secondary displacement or osteoarthritis are detected. B. Postoperative lateral radiograph of the left ankle. There are no signs of secondary displacement or osteoarthritis.

One year after surgery, the range of motion was comparable to the contralateral ankle and the AOFAS (*American Orthopedic Foot and Ankle Society*) score was 90/100, due to sporadic pain with sports activities.

## DISCUSSION

In 1872, Tillaux described the anterolateral fragment of the tibia upon discovering, in a cadaveric study, that the stress to which he subjected the AITFL caused a fracture of the tibial fragment; years later, he was supported by Chaput who observed him in clinical cases.<sup>4,12</sup> Tillaux fracture is diagnosed mainly in the adolescent population, this is because the anterolateral region of the distal tibia is the last zone of closure of the physis and the resistance of the physis is lower than that of the ligaments, which creates an avulsion of the fragment.<sup>1,2</sup> On the contrary, in adults, the incidence of this fracture is extremely rare, because bone resistance is greater than ligament resistance; therefore, ligament injuries prevail.<sup>7,8,13</sup> The mechanism of injury to the Tillaux-Chaput fragment, in isolated or complex fractures, is fundamentally supination and external rotation of the foot.<sup>4,6-9,12,13</sup> The lesion begins in the anterolateral region of the tibia, causing the avulsion or ligament injury, and spreads to the fibula and posterior and medial structures.<sup>3,13,14</sup> Almost all Tillaux-Chaput tubercle fractures are part of complex ankle fractures, with an approximate prevalence of 25%. An isolated Tillaux fracture occurs when the energy of the trauma is concentrated on this tubercle, without continuing its rotational direction.<sup>15</sup>

The risk of not noticing this fracture is very high.<sup>4,7-9,12,13</sup> Therefore, its early diagnosis depends fundamentally on diagnostic suspicion, an exhaustive physical examination and a correct interpretation of the complementary studies. Clinically, it is easy to confuse it with a sprain of the lateral ankle ligament complex.<sup>6,8,13</sup> Considering our case and the reviewed literature, the most reported symptoms and signs are the inability to bear weight on the affected limb, slight edema and pain focused on the anterolateral region, and absence of pain in the medial and lateral malleolus.<sup>6,8,9,13,16</sup> Given clinical suspicion, radiographs should be requested that include the 20° internal oblique projection, since this projection avoids the superimposition of the medial cortex of the fibula with the vertical line of the fracture, therefore allowing better visualization of the anterolateral region of the tibia and, thus, preventing it from going unnoticed.<sup>1,4,17</sup> In addition, it is essential to request a computed tomography, which serves to confirm when there is a diagnostic doubt with the radiograph and allows establishing the characteristics of the fragment with more precision, such as size, joint gap, displacement and comminution.<sup>9,12,13</sup> These characteristics will define the treatment and, if surgery is chosen, help with planning.<sup>11,17</sup>

The Tillaux fracture challenges us with some aspects that can affect the future function and integrity of the joint. On the one hand, the tear of the anterior syndesmosis, even though the AITFL only contributes 35% of the total resistance; on the other hand, the disruption of the fibular notch, which can generate instability in the tibiotalar mortise and in the inferior tibiofibular relation, respectively.<sup>3,4,14</sup> This leads to the translation and valgus deviation of the talus, with an alteration in the distribution of weight load on the articular surface, which can cause early damage to the cartilage.<sup>3,10,14</sup> Another aspect to consider is joint congruence, where a gap >2 mm can accelerate articular cartilage degeneration.<sup>1,6,10</sup> Therefore, if this injury is not adequately treated, it can lead to post-traumatic osteoarthritis, with its subsequent functional consequences.<sup>10,14</sup>

The goal of surgery should be to achieve anatomic reduction and stable fixation. For this, multiple techniques have been published, such as the fixation of the Tillaux fragment with a 4 mm partially-threaded cannulated screw.<sup>4,13</sup>

Feng et al. published the largest case series of Tillaux fractures with 16 patients,<sup>6</sup> of whom were treated with one or two differentially-threaded cannulated screws using arthroscopic assistance. Arthroscopy, in these cases, has the advantage of lower morbidity, faster recovery, and the possibility of inspecting the tibiotalar and syndesmosis joint, in order to detect unsatisfactory reductions that were not perceived by fluoroscopy.<sup>6</sup> In fragments <5 mm, fixation is difficult due to the risk of fragmentation, but the AITFL can be reinserted with an anchor to restore ligament stability of the syndesmosis.<sup>15</sup> Cases of conservative treatment with immobilization using a posterior ankle splint for 6-8 weeks have been reported.<sup>8,9</sup> These cases presented a fragment with <2 mm displacement and stable syndesmosis. Our case is the only one published in which fixation was performed with a plate supplementing the compression of the cannulated screws. It was decided to add the plate with a support function to provide greater stability to the shearing forces and to be able to carry out early mobilization of the ankle without risk of secondary displacement. Therefore, we believe that the fixation to be sought allows sufficient stability to start early rehabilitation and, in turn, this is determined by the size and bone quality of the fragment.



As it is a unique case, we have the limitation of not being able to draw solid conclusions. However, we believe that the Tillaux fracture in adults is an entity that should be suspected in all ankle trauma with exquisite pain in the anterolateral region. In addition, anteroposterior, lateral, and oblique radiographic projections help to define the diagnosis, while computed tomography confirms it and establishes the treatment, as it allows determining the characteristics of the fragment and planning the surgical strategy.

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