

## Case Report

# The rare isolated adult Chaput-Tillaux fracture: two case reports and review of the literature

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**Received:** 20 September 2020

**Accepted:** 06 November 2020

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## ABSTRACT

The authors present two isolated Chaput-Tillaux fractures in an adult skeleton. A high level of suspicion is required to prevent diagnostic failure. Computerized tomography scan detects hidden fractures and enables a more detailed preoperative assessment of each case. Most of the cases reported in the literature are associated with other ankle lesions. This typical juvenile pattern is rare in the adults and ideal treatment is yet to be determined.

**Keywords:** Chaput-Tillaux fracture, Isolated, Adults

## INTRODUCTION

Isolated fractures of the Chaput tubercle are a very rare entity in adults.<sup>1-4</sup> In children, the historical pattern called Tillaux fracture is due to a forced external rotation of the foot, in an ankle in which the anterior inferior tibiofibular ligament (AITFL) is stronger than the epiphyseal plate.<sup>5</sup>

In adults, it is extremely unusual that the AITFL is strong enough to detach a fragment and, instead of a fracture, a ligament injury occurs - Tillaux lesion. Seldomly, the ligament fails to rupture and the anterolateral tibial plafond is avulsed-off-Chaput-Tillaux fracture (CTF).<sup>1,6,7,8</sup> In addition to the presented cases, complementary diagnostic exams, outcome data and a literature review was conducted. Informed consent was obtained from the patients involved in the study.

## CASE REPORTS

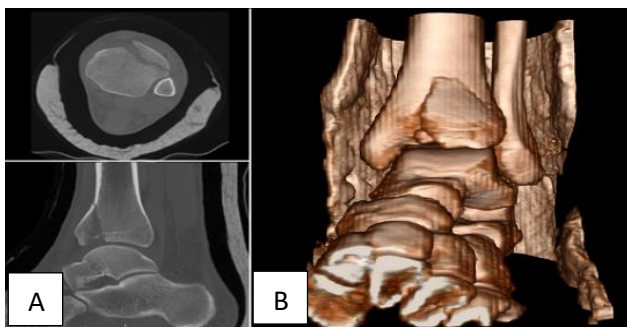
### Case 1

A 37-year-old male, with no relevant past medical history, presented with a suspected ankle twisting injury. Clinical examination revealed a tender and swollen left ankle, especially on the anterolateral region, without medial and proximal fibular complains. The patient was unable to bear weight on the affected limb. He was neurovascularly normal distally and no other associated injuries were identified. Anteroposterior and lateral radiographs revealed an intra-articular fracture of the antero-lateral part of distal tibia (Figure 1). There was no radiographic evidence of distal syndesmosis instability or proximal fibula lesion. Computed tomography (CT) excluded pilon fracture and confirmed a large displaced Chaput tubercle fracture (Figure 2), a pattern frequently observed in the adolescents.

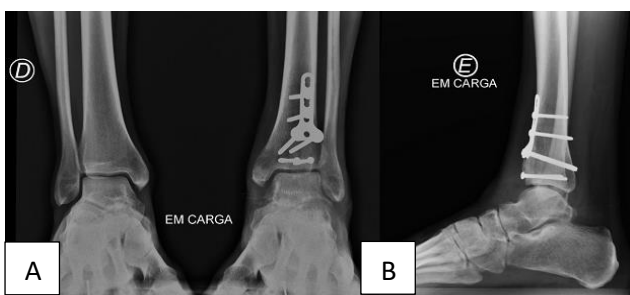
An uneventful open reduction and internal fixation with two cannulated screws and a neutralization T-shape plate was performed through an anterolateral Bohler-type approach. After a longitudinal incision on the deep fascia and subcutaneous dissection, the superficial peroneal nerve was protected and extensor tendons were swept medially. The direct visualization of the articular surface before stabilization allowed anatomical reduction.



**Figure 1: Preoperative anteroposterior (left) and lateral (right) radiographs of the left ankle (case 1).**



**Figure 2: Computerized tomography confirming a displaced chaput tubercle fracture of the left ankle (case 1).**



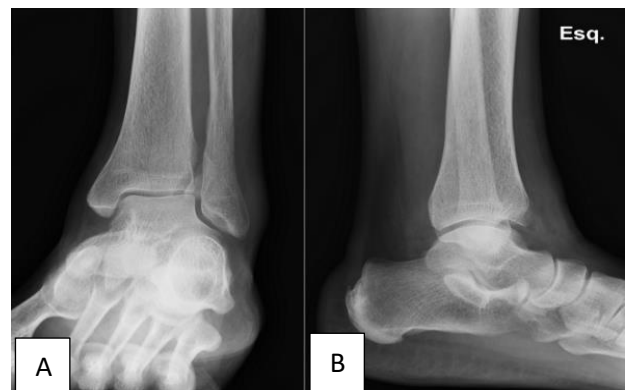
**Figure 3: Postoperative anteroposterior (left) and lateral (right) radiographs at one year demonstrating a healed fracture in a good anatomic position (case 1).**

Full weight bearing on the operated limb was allowed at the 6<sup>th</sup> week and normal gait was achieved at the second month following surgery. Follow-up examination continued up until one year postoperatively with serial radiographs confirming the healing without complications (Figure 3). It was possible to recover ankle mobility without associated pain. The American orthopedic foot

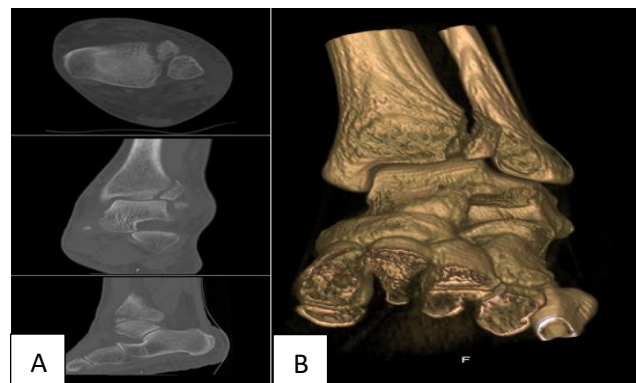
and ankle society (AOFAS) ankle-hindfoot scale score was 100.

### Case 2

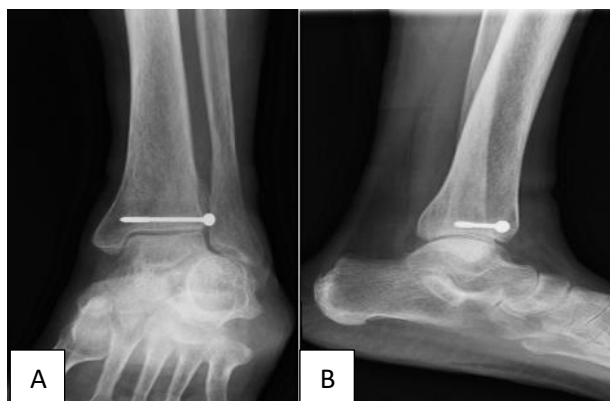
A 63-year-old woman, with dyslipidemia and hypothyroidism, was presented to the emergency service for a deformed left ankle and inability to bear weight after a fall from stairs. Passive ankle movements were normal, but pain was elicited on the anterolateral side. Neurovascular examination was normal but there was marked ankle swelling. Radiographs were suspicious of abnormality on the anterolateral aspect of the tibia (Figure 4) with an intact proximal fibula. A CT scan was conducted to clarify the fracture pattern prior to surgery (Figure 5). A unique anterolateral fragment was displaced 3.5 mm. As in CASE 1, an anterolateral Bohler-type approach was performed and the fragment was fixated with one 4.5 mm screw. The postoperative period was uneventful, and the patient was immobilized for 15 days with a cast. After cast removal, ankle exercises without weightbearing were initiated. The patient could support weight after 6 weeks and walk without overt pain 3 months following surgery. Postoperative radiographs confirmed complete fusion at 1 year of follow-up (Figure 6) with an AOFAS ankle-hindfoot scale score of 100.



**Figure 4: Initial anteroposterior (left) and lateral (right) radiographs of the left ankle (case 2).**



**Figure 5: Computerized tomography demonstrating a unique anterolateral fragment with 3.5 mm displacement (case 2).**



**Figure 6: Postoperative follow-up anteroposterior (left) and lateral (right) radiographs of consolidated fracture with fixation in situ (case 2).**

## DISCUSSION

Three authors played an important role in the history of this fracture: Cooper was the first describing it, Tillaux proved the avulsive nature in stress tests performed in cadavers and Chaput demonstrated it on plain radiographs.<sup>6,9,10</sup> In children, this injury is reported in up to 10% of the individuals and is a Salter-Harris type III epiphysiolysis.<sup>7</sup> In this population, the susceptibility of the anterolateral tibial aspect to a forced supination and external rotation is explained by the well-known asymmetric physiologic physodesis: it starts to close centrally, fusion then progresses medially with the anterolateral portion fusing last.<sup>6,9-13</sup> The vulnerable growth plate may not be fused until 14 years in girls and 18 years of age in boys.<sup>6-8,11,14,15</sup>

The adult Tillaux fracture, also recognized as CTF, has a relative incidence of 12% in transmalleolar fractures but the frequency as isolated bony avulsion remains unknown.<sup>16-17</sup> It is classified as AO/OTA43B. CTF is also well illustrated in a new classification of the AITFL avulsions based on Wagstaffe's system, proposed by Birnie et al.<sup>22</sup>

The diagnosis of this uncommon fracture is challenging. Along with the fracture of the posterior and medial malleolus, fractures of the anterior malleolus correspond to the three most occult fractures of the ankle on radiographs.<sup>23</sup> Despite having a sensitivity of only 50-72%,<sup>16</sup> this diagnostic exam plays a dominant role and should always include a mortise or internal oblique view to screen for fractures obstructed by the fibula.<sup>10,13,16,18,19</sup> The established literature recommends advanced imaging (i.e. CT scan) to evaluate all fracture planes, but also to detect other fractures, articular fragments and articular compatibility.<sup>1,6,8,20,21</sup> It should be noted that Liporace et al did not find inter- and intra-observer differences in primary treatment plans between radiographs and radiographs plus CT.<sup>24</sup>

Recently, Ito et al reported the first malunion case in a CTF, following conservative treatment, where a corrective osteotomy at the original fracture side was performed due to persistent pain five months post-injury.<sup>4</sup> Nevertheless, it was not an isolated CTF-a concomitant medial fracture was also detected by the time of sprain. Many case reports of CTF are associated with other malleolus and other avulsion fractures. In 2016, Köse et al reported the unique association between a CTF and a Volkmann fragment, never published until then.<sup>2</sup> The CTF presented by Shetty et al was associated with medial and lateral malleolus fractures.<sup>3</sup> Masur et al treated a Tillaux, Volkmann and Maisonneuve fractures triad.<sup>15</sup>

Treatment protocols for CTF described in the literature are highly variable as well as the techniques involved. The first reported cases are of a 50-years-old man treated conservatively by Protas et al and the first arthroscopically assisted reduction and fixation with screws performed by Miller.<sup>26</sup> In later published cases was possible to observe that the most common approach was the open reduction through an anterolateral incision and reduction with screws.<sup>5,6,11,20</sup> In a different approach, Oak et al reduced an anterior fragment with only two trans-syndesmotic screws, justifying this option by the instability in stress views.<sup>7</sup> Lee et al. reduced an interposed Chaput fragment and made an internal fixation with a T-shape plate along with stabilization of the syndesmosis with screws.<sup>13</sup> The retrospective study of Feng et al described an arthroscopic "all-inside" approach and fixation with Herbert screws (2 children and 17 adults) with excellent results and a rapid recovery.<sup>19</sup> The conservative treatment adopted by some authors, despite satisfactory outcomes, is no longer recommended.<sup>12,25</sup>

Appropriate surgical treatment is controversial and research is still ongoing. The size of the fragment should be considered in the preoperative assessment as well as the integrity of the AITFL. Since 35% of ankle fractures will not consolidate without further support, Birnie et al recommend surgical treatment in fragments larger than 5 mm<sup>22</sup>. Furthermore, Nelson et al disregard the use of tibiofibular screws when AITFL or avulsive AITFL lesion are repaired.<sup>17</sup> The established threshold of 2 mm displacement, above which all fractures should be fixated, is still questionable. Some authors advocate fixation of 1 mm displacements and others suggest greater functional benefit in an intra-articular gap greater than 2.5 mm.<sup>4,5,9-11,15,18,19,22</sup>

The potential complications are well recognized and range from pain to premature degenerative arthritis.<sup>4,14,19</sup> To the authors' knowledge, there are no previous studies reporting complications in adults with isolated CTF.

The two surgical options documented in this study proved to be effective in the approach of this pathology with good clinical and functional outcome one year after surgery. The optimal approach is, however, yet to be determined. Despite the promising results of arthroscopic treatment, it

is imperative to perform comparative and randomized studies. Since magnetic resonance image (MRI) was not performed is not possible to determine if it was a real isolated CTF or an association with deltoid ligament ruptures-present in up to 40% of all ankle fractures.<sup>27</sup> Likewise, MRI was not performed by other authors. Despite the stress tests performed before and after the surgical procedure, with the patients under general anesthesia, it is questionable whether the clinical signs and tests alone are a reliable indicator of ligament lesions.

## CONCLUSION

Judicious assessment of traditional radiographs followed by a CT scan is recommended in order to define the fracture pattern and achieve an accurate diagnosis. Misdiagnosing a fracture for a sprain may lead to a painful and dysfunctional ankle. Restoring congruency and encouraging of early motion are prerequisites for good-long-term functional outcomes.

## ACKNOWLEDGEMENTS

The authors would like to thank Dr. Catarina Amorim e Luís Frias Oliveira for their help in the preparation of the manuscript.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: Not required*

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**Cite this article as:** Pereira EC, Rosa JM, Diniz SE, Pereira F, Sapage R, Soares D, Costa L. The rare isolated adult chaput-tillaux fracture: two case reports and review of the literature. *Int J Res Orthop* 2021;7:134-8.