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Tillaux and Volkmann Fractures in an Elderly Woman with an Unusual Ankle Injury Pattern - A Case Report

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Abstract **Case Report**

Tillaux and Volkmann fractures are avulsion injuries at the insertion sites of the anterior and posterior inferior tibiofibular ligaments, respectively. Each fracture is rare in isolation in skeletally mature adults; their simultaneous occurrence is exceedingly uncommon and strongly suggests syndesmotic disruption. We report an elderly patient who sustained both lesions in association with a spiral fracture of the distal fibula. Standard ankle radiographs were insufficient, whereas CT imaging clearly demonstrated the avulsion fragments and guided treatment planning. Early recognition and fixation restored ankle stability and may help prevent post-traumatic arthritis.

Keywords: Tillaux fracture, Volkmann fracture, Syndesmotic injury, Ankle fracture.

INTRODUCTION

Ankle injuries are among the most frequent reasons for emergency-department visits. Although standard radiographs diagnose the majority of fractures, occult or complex patterns may be missed without meticulous clinical–radiological correlation [1,2]. Tillaux and Volkmann avulsion fractures are especially easy to overlook on plain films; they result from a rotational mechanism, are rare in skeletally mature adults, and almost never occur together [1,2]. We present a 67-year-old woman with a combined Tillaux, Volkmann and distal-fibula shaft fracture—an exceptionally unusual constellation—highlighting the pivotal role of CT in diagnosis and management.

CASE PRESENTATION

A 67-year-old woman with no relevant medical history sustained a fall from approximately two metres, landing with her left foot fixed and the leg twisting outward, resulting in immediate pain in the lower leg and ankle. On examination, she was haemodynamically stable with swelling and marked tenderness of the distal leg and ankle, restricted active motion, intact skin, normal neurovascular status, and no signs of compartment syndrome. Initial radiographs demonstrated a spiral fracture of the distal fibular shaft, for which a posterior plaster splint was applied in the emergency department before referral to orthopedic surgery. Due to the high-energy mechanism and persistent ankle pain, a CT scan was performed and revealed a Tillaux fracture and a Volkmann fragment, confirming concomitant anterior and posterior syndesmotic avulsion fractures in addition to the fibular fracture [Figures 1, 2]. The diagnosis was therefore a rotational ankle injury with syndesmotic involvement, and surgical fixation of the Tillaux-Chaput and Volkmann fragments was considered necessary to restore ankle stability, alongside immobilization and non-weight-bearing instructions. The patient was scheduled for routine clinical and radiographic follow-up to monitor fracture healing and stability, with final treatment decisions guided by orthopedic evaluation; no additional follow-up data were available at the time of reporting.

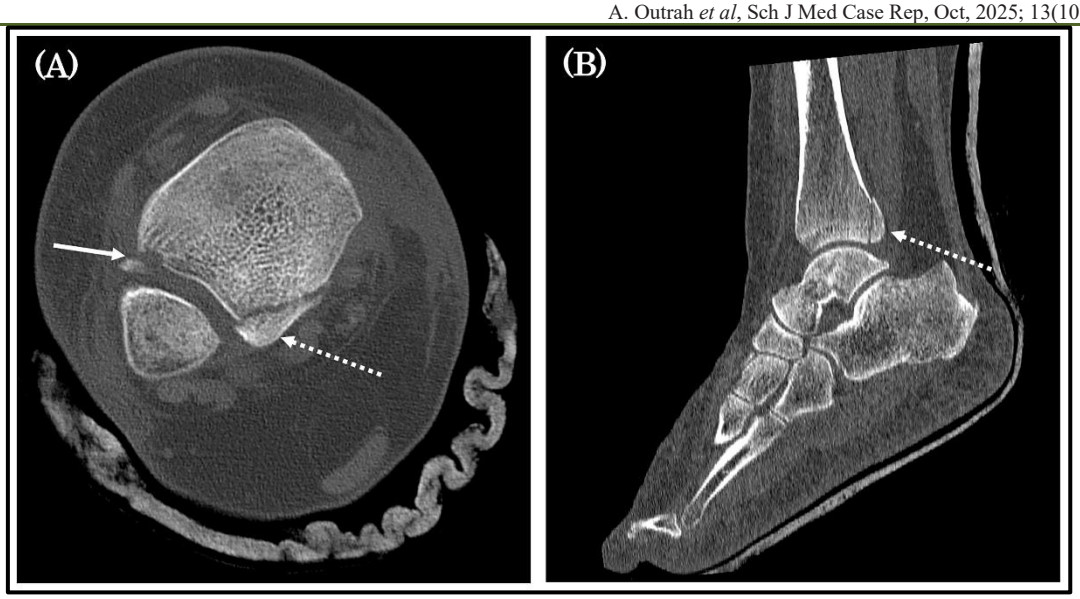

Figure 1: Axial (A) and coronal (B) CT images of the ankle demonstrating fractures of the posterior (dotted arrows) and anterior (solid arrow) malleoli

Figure 2: 3D reconstructed CT image of the ankle showing fractures of the posterior (dotted arrows) and anterior (solid arrow) malleoli

DISCUSSION

From an anatomical standpoint, the distal tibiofibular joint is a syndesmosis composed of the distal extremities of the tibia and fibula, held together by four key ligaments: the anterior inferior tibiofibular ligament (AITFL), the posterior inferior tibiofibular ligament (PITFL), the interosseous ligament, and the transverse ligament [1,3]. The posterior distal margin of the tibia, known as Volkmann's tubercle - or the "third malleolus" - serves as the point of origin for the PITFL. Similarly, the distal anterolateral tubercle of the tibia, referred to as the Tillaux-Chaput tubercle or "fourth malleolus", is the origin of the AITFL [1,3]. These ligaments insert, respectively, on the posterior and anterior distal margins of the fibula **[Figure 3]**.

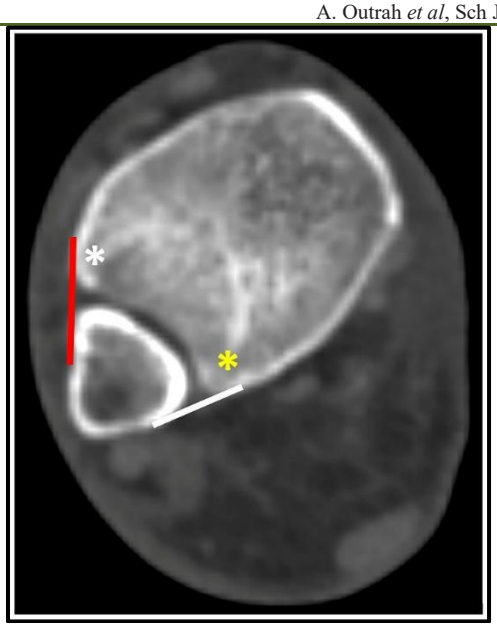

Figure 3: Normal ankle CT scan illustrating presumed normal anatomy: anterior inferior tibiofibular ligament (red line), posterior inferior tibiofibular ligament (white line), Volkmann tubercle (yellow asterisk), and Tillaux-Chaput tubercle (white asterisk)

From a pathological standpoint, Tillaux-Chaput fractures primarily occur in skeletally immature individuals, particularly adolescents [1]. This is due to the relative strength of the anterior inferior tibiofibular ligament (AITFL) compared to the underlying epiphyseal bone, which has not yet fully ossified [4]. As a result, external rotational forces tend to cause an avulsion fracture of the anterolateral distal tibial epiphysis, classically recognized as a Salter–Harris type III fracture [1]. These injuries are typically seen in late adolescence during physeal closure [3].

In contrast, Volkmann fractures—which involve avulsion of the posterior inferior tibiofibular ligament (PITFL)—are usually seen in the context of complex ankle injuries, particularly trimalleolar fractures or Maisonneuve-type injuries [5]. Isolated Volkmann fractures are rare. Both Tillaux and Volkmann fractures are closely associated with syndesmotic injuries and play a key role in ankle joint stability [6].

In terms of imaging, plain radiographs with orthogonal anteroposterior and lateral views remain the first-line diagnostic tool for evaluating ankle trauma. They are widely available and effective for identifying most fractures [1]. However, their sensitivity is limited in detecting subtle or complex fractures such as syndesmotic avulsion injuries [6]. In these cases, computed tomography (CT) is essential. CT provides superior spatial resolution, allowing for accurate characterization of fracture morphology, fragment displacement, involvement of the fibular incisura or articular surface, and alignment of the syndesmosis—information that is critical for guiding appropriate surgical management [1].

To address the need for a treatment-oriented classification system, Bartoníček and Rammelt developed a CT-based classification for both anterior and posterior malleolar fractures [4]. This system integrates anatomical location, fracture morphology, and treatment implications, making it the most widely adopted framework in current orthopedic practice. For anterior malleolar fractures, the classification includes type 1 (Extra-articular avulsion of the anterior tubercle), type 2 (Fractures extending into the fibular incisura and anterolateral tibial plafond and type 3 (Impaction fractures of the anterolateral plafond) [2,7]. For posterior malleolar fractures, involving the Volkmann fragment, the classification consists of type 1 (Small extraincisural fragments with the fibular notch intact), type 2 (Posterolateral fragments involving the fibular notch), type 3 (Posteromedial two-part fragments extending toward the medial malleolus, type 4 (Large posterolateral triangular fragments involving more than one-third of the articular surface and type 5 (Irregular, comminuted, or osteoporotic fragments that do not fit other categories) [4].

Treatment of Tillaux-Chaput and Volkmann fractures depends primarily on fragment size, displacement, and involvement of the articular surface or syndesmosis [1]. Small, non-displaced avulsion fragments may be managed conservatively with immobilization [6]. However, displaced fractures—particularly those compromising syndesmotic stability or involving the incisura or tibial plafond—typically require surgical fixation [1,6]. Options include transosseous sutures for small avulsions, cannulated screws for larger fragments, and buttress plating for impacted or comminuted fractures [6]. Accurate anatomical reduction is essential to restore ankle

stability, prevent chronic instability, and minimize the risk of post-traumatic osteoarthritis [6].

CONCLUSION

This case illustrates an uncommon combination of Tillaux and Volkmann fractures in an adult patient, reflecting underlying syndesmotic injury. It highlights the critical role of CT imaging in detecting subtle avulsion fractures and guiding appropriate management. Clinicians should consider these fracture patterns in patients with complex ankle trauma, even when initial radiographs appear unremarkable.

Conflict of Interest: The authors declare no conflicts of interest.

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