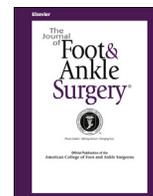


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## Isolated Adult Tillaux Fracture Associated With Volkmann Fracture—A Unique Combination of Injuries: Report of Two Cases and Review of the Literature



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### ABSTRACT

Avulsion fractures of the anterior inferior tibiofibular ligament from its tibial attachment, Tillaux fractures, are usually seen in adolescents during the interval of the distal tibial epiphyseal closure. However, this pattern of fracture is rare in adult patients, because the ligaments will usually fail before the bone fails. Avulsion fracture of the posterior inferior tibiofibular ligament from its tibial attachment, Volkmann fracture, is the posterolateral counterpart of a similar injury. In the present study, the cases of 2 adult patients with simultaneous Tillaux and Volkmann fractures are reported and the mechanism of injury, diagnosis, and treatment discussed. This fracture pattern is extremely rare and, to the best of our knowledge, has not been previously reported.

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The distal fibula is firmly attached at the fibular notch of the tibia by a strong ligamentous complex, the ankle syndesmosis, which is composed of the interosseous ligament, anterior inferior tibiofibular ligament (AITFL), and posterior inferior tibiofibular ligament (PITFL) (1). Traumatic anterior syndesmotomous disruptions can present as rupture of the AITFL, an avulsion fracture at its tibial attachment (Tillaux fracture), or an avulsion fracture at its fibular attachment (Le Fort–Wagstaff fracture). Similarly, PITFL disruption can occur as either rupture of the ligament per se or an avulsion fracture at its tibial attachment (Volkmann fracture) (2,3). Ankle syndesmotomous injuries are commonly seen in association with ankle fractures and/or fracture dislocations. However, isolated syndesmotomous injuries without medial or lateral malleolar fractures are rare (1).

Although avulsion fracture of the distal lateral tibia mediated by the AITFL, the Tillaux fracture, has been described in adults, it is a specific pattern of fracture usually seen in adolescents (4–6). Distal tibial epiphyseal closure has an asymmetric pattern of closure. Physeal closure starts from the center and then progresses toward the medial side. Finally, the lateral aspect of distal tibial fusion occurs. The medial closure occurs at approximately 13 to 14 years of age, with

lateral closure beginning at 14.5 to 16 years of age. The interval (~18 months) during which the distal tibial physis completes its closure and gains maturity is referred to as the “transition period” (7–9). Adolescent Tillaux fracture occurs during transition period when the medial and central physis has finished closure but the lateral physis is still open. Because the ligaments are stronger than the bone in adolescents, the bone will fail before the ligaments will fail. Adolescent Tillaux fracture is classified as a Salter–Harris type III epiphyseal fracture, because the distal lateral tibial growth plate is still open (6,9).

In contrast, adult Tillaux fractures are rare injuries, and few cases have been reported to date. We performed a detailed search of the published data using PubMed, Clinical Key/Elsevier, EBSCO Discovery Service, MD Consult, Science Direct, Scopus, EMBASE, Medscape, and Google Scholar electronic databases in the English language from 1960 to the present. The following terms were adopted for each database search: “Tillaux fracture,” “Chaput fracture,” “Tillaux–Chaput fracture,” and “adult.” Only 6 published case reports (8 patients) were identified in adults (>18 years old) (10–15). Of these patients, none had a Tillaux fracture associated with a Volkmann fracture (i.e., the simultaneous isolated avulsion fractures of both the AITFL and the PITFL). We present the cases of 2 adult patients with just such a combination of injuries and discuss its mechanism of injury, diagnosis, and treatment options. Both patients provided written informed consent for the publication of the present report and the accompanying images.

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## Case Report

### Patient 1

A 36-year-old male patient presented to our outpatient clinic 5 days after he had sustained an ankle sprain. He stated that he had attended the emergency department (ED) of another hospital immediately after the injury and that ankle radiographs were taken. A diagnosis of a simple ankle sprain was made, and the patient was discharged with instructions to rest and apply ice, compression, and elevation. Anti-inflammatory medications were also prescribed. Because the swelling did not subside and the pain continued, he presented to our outpatient clinic for further medical help. A detailed history of the injury revealed that the patient had sustained an inversion ankle sprain. He had an antalgic gait and difficult walking with the help of a crutch. On physical examination, swelling was present over the lateral aspect of the ankle. Passive ankle movements were normal but painful. Significant tenderness was present over the anterior aspect of the syndesmosis but not over the medial structures. A review of the initial ankle radiographs showed a suspicious fracture of the anterolateral tibia on the anteroposterior (AP) view (Fig. 1). Computed tomography (CT) was performed to identify a possible Tillaux fracture. The CT scan clearly showed avulsion fractures on both the anterolateral and posterolateral distal tibia (Tillaux and Volkmann fractures; Fig. 2). The anterior fragment was displaced >2 mm; thus, surgical fixation was decided. The patient underwent fixation of the Tillaux fracture with a single compression screw and a washer under fluoroscopic guidance (Fig. 3). The postoperative period was uneventful, and the patient was discharged at the first postoperative day. However, the patient was lost to follow-up and did not attend his scheduled postoperative follow-up examinations. At the final

follow-up visit, at 14 months after surgery, he presented to the outpatient clinic with anterior knee pain after he had hit his knee on the corner of a table, unrelated to the previous ankle fracture. The patient was free of pain, and his ankle movements were normal. The American Orthopaedic Foot and Ankle Society scale score was 100. The final ankle radiographs showed union of the fractures (Fig. 4).

### Patient 2

A 31-year-old male was brought to our ED after he had sprained his ankle. On arrival, he could not weight bear owing to intense pain, and his ankle was swollen. On physical examination, tenderness was present over the anterior aspect of the ankle over the syndesmosis. Neither the deltoid ligament nor the medial malleolus was tender on palpation. Passive movements of ankle were painful and slightly restricted. The findings from the neurovascular examination were normal. On direct radiographic examination of the ankle, a non-displaced posterior malleolar fracture was seen on the lateral view, and the findings from the AP view were normal (Fig. 5). To understand the extent of fracture, an additional CT examination was performed. The CT examination revealed a displaced Tillaux fracture associated with a posterior malleolar avulsion fracture (Fig. 6). With the patient under spinal anesthesia and tourniquet control, a small incision was made over the fracture fragment. The fragment was fixed with a compression screw and washer under fluoroscopic guidance. Because the posterior fragment was nondisplaced and constituted a small portion of the tibial plafond, no further fixation was intended (Fig. 7). The postoperative period was uneventful, and patient was discharged on the first postoperative day. After removal of the sutures on the 10th postoperative day, the plaster cast was removed, and the patient started ankle exercises without weightbearing. At the end of the first



**Fig. 1.** Anteroposterior (A) and lateral (B) ankle radiographs of the patient. Anteroposterior view shows a radiolucent zone consistent with a fracture at the distal lateral end of the tibia (arrows), but it was not clear because of superimposition of the fibula.

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