

CASE REPORT

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Adult Tillaux-Chaput tubercle fracture of the ankle with rupture of the peroneus tertius muscle: a case report

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Abstract

Background Tillaux-Chaput tubercle fractures occur in adolescents, which are often associated with the separation of the distal tibial growth plate. These types of fractures are rare in adults and even rarer when accompanied by a rupture of the peroneus tertius muscle. Given the limited number of reported cases, there is limited clinical awareness, resulting in missed diagnoses and delayed treatment, ultimately affecting ankle function.

Case presentation We report a case of an adult patient who experienced a right ankle injury resulting in swelling and pain after a traffic accident. Initial examination failed to identify the rupture of the peroneus tertius muscle, but the patient was observed to have restricted dorsiflexion and eversion of the foot. Surgical exploration through an anterolateral incision confirmed the rupture and the muscle was then repaired. The patient received four weeks of cast immobilization and then engaged in progressive rehabilitation exercises.

Discussion and conclusion This report shares the diagnostic and therapeutic experiences of an adult with a Tillaux-Chaput tubercle fracture associated with peroneus tertius muscle rupture to improve clinical recognition of such injuries, thus preventing misdiagnosis and treatment delays.

Keywords Ankle joint, Tillaux-Chaput tubercle fracture, Peroneus tertius muscle rupture, Diagnostic challenge, Case report

Background

Tillaux-Chaput tubercle fractures occur as avulsion fractures at the attachment site of the anterior inferior tibiofibular ligament on the tibia, commonly seen in adolescents during the closure of the distal tibial growth plate, often caused by forceful external rotation of the foot. These fractures are classified as Salter-Harris Type III fractures [1]. They are rare in adults, with even fewer

reports of cases accompanied by rupture of the peroneus tertius muscle.

The peroneus tertius muscle, part of the fibularis muscle group, is located on the anterolateral side of the distal fibula. It originates from the anterior surface of the distal third of the fibula, traversing the transverse crural ligament alongside the extensor digitorum longus tendon just above the ankle joint, and inserts into the dorsal base of the fifth metatarsal. The primary function of the peroneus tertius muscle is to dorsiflex the ankle joint and evert and externally rotate the foot, contributing to the stability and balance of the ankle joint [2]. Clinically, it is also utilized as a muscle flap for covering soft tissue defects and as a material for ligament reconstruction in

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the ankle joint [3, 4]. There is individual variation in the origin, insertion, and tendon structure of the peroneus tertius muscle [5, 6], and in rare cases, the muscle may be absent [7]. Despite its occasional absence in some individuals, studies indicate that its function is significant for midfoot and gait stability [8]. The occurrence of an ankle fracture combined with a peroneus tertius muscle rupture is uncommon. High-energy trauma, such as falls or traffic accidents, may result in simultaneous rupture of the peroneus tertius muscle and ankle fracture, although this can be easily overlooked. The current literature has few reports on such compound injuries, yet their clinical significance is noteworthy. Here, we present a case report of a Tillaux-Chaput tubercle fracture of the ankle combined with a rupture of the peroneus tertius muscle.

Case presentation

A 25-year-old male presented to our orthopedic outpatient department with swelling and pain in the right ankle joint following a traffic accident that occurred 2 h prior. The patient reported immediate swelling, pain, and limited mobility in the right ankle after the incident. He had no prior history of surgery on the right lower limb, ankle sprains, or joint diseases, and did not seek treatment at any other facility or receive any other treatment. On physical examination, the right ankle exhibited significant swelling and tenderness. Active dorsiflexion and eversion of the foot were markedly limited. Radiographic imaging, including X-ray and CT scan, revealed a Tillaux-Chaput tubercle fracture and a medial malleolus fracture of the right ankle. The preoperative diagnosis was a right ankle fracture (Tillaux-Chaput tubercle fracture with medial malleolar fracture) (See Fig. 1A) Given the severity of the injuries, surgical intervention was planned.

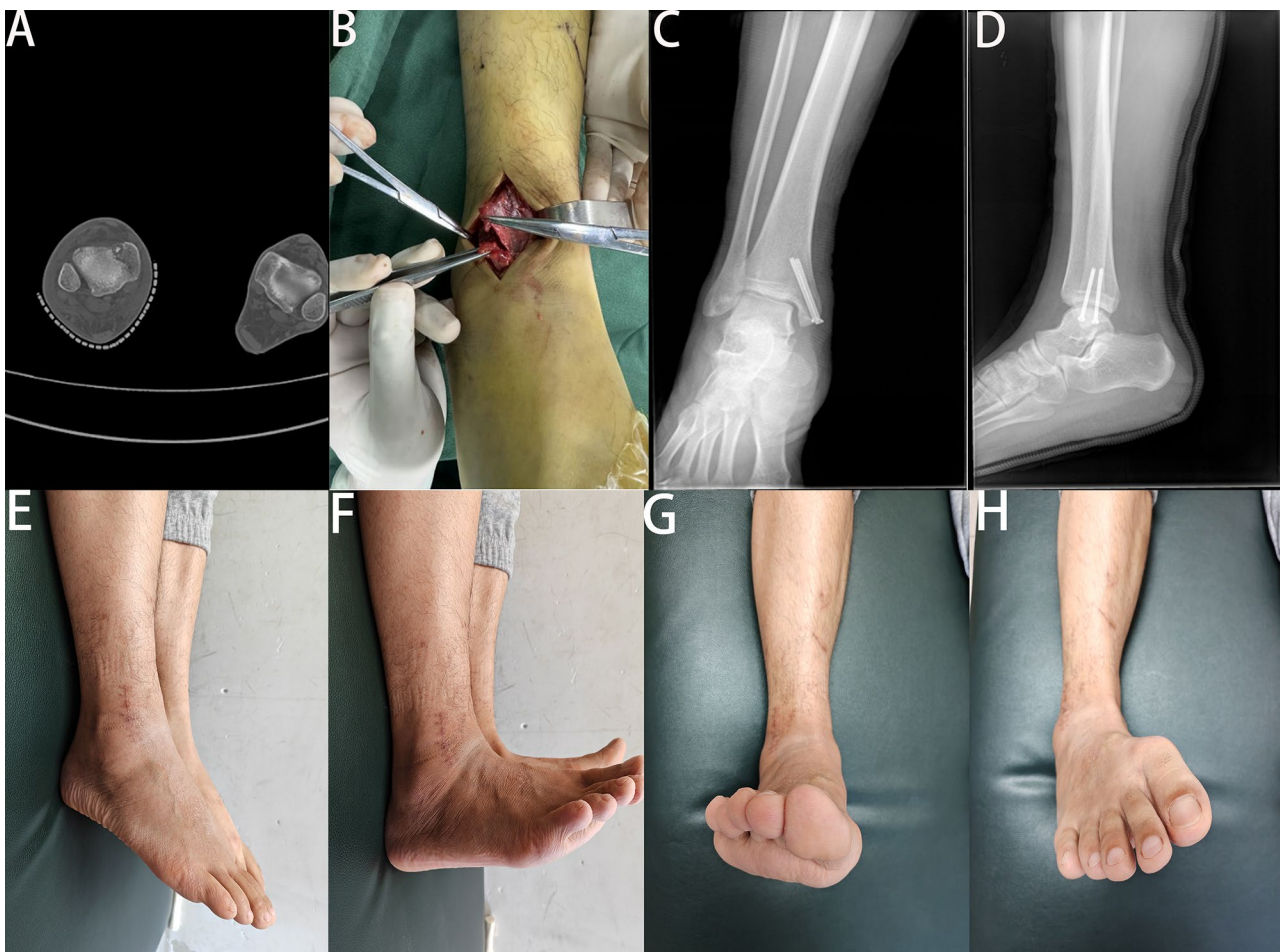


Fig. 1 **A** Preoperative CT scan demonstrating a medial malleolar fracture and Tillaux fracture of the right ankle joint. **B** Intraoperative findings revealing a rupture of the peroneus tertius muscle. **C** and **D** Postoperative follow-up X-ray images. **E** Postoperative photograph at 4 months showing ankle in plantarflexion. **F** Postoperative photograph at 4 months showing ankle in dorsiflexion. **G** Postoperative photograph at 4 months showing ankle in eversion. **H** Postoperative photograph at 4 months showing ankle in inversion

Under successful anesthesia, a medial malleolar fracture was exposed via a curved incision. The fracture fragment was reduced, and two cannulated screws were inserted under C-arm fluoroscopic guidance to achieve stable fixation. (See Fig. 1C-D)

A longitudinal incision approximately 5 cm long was made on the anterolateral aspect of the ankle joint, cutting through the skin and fascia. Exploration revealed an avulsion fracture at the anterolateral distal tibia (at the attachment of the anterior inferior tibiofibular ligament) along with a rupture of the peroneus tertius muscle (See Fig. 1B). A double-stranded anchor was precisely positioned 5 mm superior to the fracture line at the Tillaux-Chaput tubercle. The sutures were crossed and passed through the fibular attachment of the anterior inferior tibiofibular ligament, creating an “8”-shaped tension band configuration. The sutures were then tightened and securely knotted to provide optimal stabilization. The peroneus tertius muscle was repaired using the Kleinert technique, employing 2–0 non-absorbable sutures to ensure a robust end-to-end connection of the muscle ends. The incisions on the medial and anterolateral aspects of the ankle were irrigated and closed in layers. The ankle was immobilized in dorsiflexion and eversion with a plaster splint after dressing the wounds.

Following surgical intervention, the ankle joint was immobilized with a plaster cast for a period of four weeks, during which strict non-weight-bearing protocols were adhered to. Upon cast removal at the four-week mark, the patient initiated a regimen of passive and active range-of-motion exercises, with a focus on dorsiflexion, plantarflexion, inversion, and eversion movements. Weight-bearing was incrementally reintroduced at the six-week postoperative milestone, guided by the patient's clinical progress and pain tolerance.

At the four-month follow-up, the patient demonstrated normal functionality of the foot and ankle, as evidenced by a favorable AOFAS score. Mild ankle discomfort was reported only after prolonged periods of activity; however, the overall recovery was deemed satisfactory. (See Fig. 1E-H).

Discussion

The mechanism of Tillaux-Chaput tubercle fractures of the ankle accompanied by rupture of the peroneus tertius muscle is usually related to high-energy rotational forces. In adolescents, due to the asymmetrical closure of the growth plate and the relative fragility of the distal tibial cartilage, severe twisting of the ankle joint can lead to avulsion fractures at the anterolateral distal tibia caused by the traction of the anterior inferior tibiofibular ligament [9]. In adults, the anterior inferior tibiofibular ligament typically ruptures before a bony avulsion occurs [10], thus the incidence is lower. Current research on the

specific injury mechanisms of Tillaux-Chaput tubercle fractures in adults is quite scarce. This condition may be associated with the delayed closure of the epiphyseal plate [11], as well as localized stress concentration at the Chaput tubercle. The confluence of rotational forces and chronic stress, which can lead to the weakening of the local bone structure, may precipitate an avulsion fracture at the Chaput tubercle. This can occur despite the integrity of the anterior inferior tibiofibular ligament. The peroneus tertius muscle, located on the anterolateral side of the fibula, assists in dorsiflexion and eversion of the foot. During extreme twisting of the ankle joint, the peroneus tertius muscle may rupture due to strong traction and torsional stress. Although literature on ankle fractures combined with peroneus tertius muscle rupture is sparse, some relevant clinical studies exist. McGoldrick et al. [12] reported a case of a 12-year-old patient with complete rupture of the peroneus tertius tendon leading to lateral ankle pain; the pain resolved and normal activities resumed after surgical reconstruction. Derrick et al. [13] described a case of rupture near the insertion of the peroneus tertius tendon, accompanied by longitudinal tears of the peroneus longus and brevis tendons, causing lateral ankle pain. Iceman et al. [14] reported four cases of peroneus tertius syndrome, presenting with anterolateral ankle or hindfoot pain and a “locking” sensation during walking. All symptoms resolved after surgical resection of the peroneus tertius muscle. In these cases, patients with peroneus tertius muscle injuries exhibited lateral ankle pain, with MRI clearly showing muscle and tendon tears, facilitating accurate diagnosis and treatment decisions.

Diagnostic challenges arise as imaging techniques like X-rays primarily assess bony structures, lacking sensitivity for soft tissue injuries. CT scans offer improved visualization but still fall short in soft tissue resolution. MRI, the gold standard for soft tissue evaluation, is costly and time-consuming, limiting its use in emergencies. Clinically, peroneus tertius rupture might only present as limited foot eversion and dorsiflexion with anterolateral ankle pain. Severe trauma can obscure these symptoms, risking misdiagnosis. We recommend detailed physical examinations and MRI when suspecting such injuries, and intraoperative exploration when necessary.

Repairing the peroneus tertius muscle while fixing the ankle fracture is crucial. Although Witvrouw et al.'s [15] cohort study found that the absence of the peroneus tertius muscle does not reduce the strength of ankle eversion and dorsiflexion or increase the incidence of ankle ligament injuries, and Oyedun et al.'s [16] study also showed no significant difference in the range of motion of ankle dorsiflexion and eversion between patients with and without the peroneus tertius muscle. These findings are more applicable to individuals with congenital

absence rather than acute traumatic rupture. In cases of ankle fractures with associated soft tissue injury, the muscle's role in stabilizing the joint may be more critical, especially during the early stages of rehabilitation. Although definitive evidence on the impact of peroneus tertius muscle repair on long-term functional outcomes remains limited, some clinical perspectives have revealed a correlation between the muscles of the ankle and ankle joint stability [17]. Therefore, while not universally necessary, repairing the peroneus tertius muscle may be beneficial for the recovery of ankle function following trauma.

Conclusion

In summary, the incidence of Tillaux–Chaput tubercle fractures of the ankle combined with peroneus tertius muscle rupture is low in adults. Clinical awareness is relatively insufficient, leading to missed diagnoses, delayed treatment, and impaired ankle function. Through in-depth research and sharing of such cases, we can enhance understanding of these injuries, avoid missed diagnoses, and better guide clinicians in determining treatment plans to improve patient outcomes and quality of life.

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Author contributions

M.Z.S was instrumental in the collection and analysis of data, as well as the writing of the manuscript. P. D provided valuable assistance in data collection and analysis, ensuring thoroughness and accuracy. L.R.Q participated in data analysis. Z.M.N contributed by collecting patient data and assisting in the literature review process. corresponding author, T.Y.H was responsible for the overall study design, formulating the research ideas, and the critical review and revision of the manuscript, ensuring the study's integrity and coherence.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The patient's informed consent has been obtained, and our hospital's ethics committee has confirmed it.

Consent for publication

Written informed consent was obtained from the patient for the publication of their personal and clinical details along with any identifying images included in this study.

Competing interests

The authors declare no competing interests.

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