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Equinus foot deformity and malunion of the medial malleolus caused by tibialis posterior tendon interposition following irreducible fracture dislocation of the ankle: A case report and literature review[☆]

Toshifumi Hikichi^a, Hidenori Matsubara^{a,*}, Kanu Shimokawa^a, Koji Watanabe^b,
Hiroyuki Tsuchiya^a

^a Department of Orthopaedic Surgery, Kanazawa University Hospital 13-1 Takara-machi, Kanazawa, Ishikawa 920-8641, Japan

^b Watanabe orthopaedic hospital, 4-1-11 izuminode-machi, Kanazawa, Ishikawa, 921-8116, Japan

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ABSTRACT

We report a case of equinus foot deformity and malunion of the medial malleolus caused due to tibialis posterior tendon interposition following irreducible fracture-dislocation of the ankle. A 19-year-old female patient was referred to our hospital with the chief complaint of persistent ankle pain and restricted ankle dorsiflexion. Her medical history revealed a fracture-dislocation of the ankle in the left tibia at the age of 18 years. Open reduction and osteosynthesis were performed 3 days after injury. One year after the operation, ankle pain and restricted ankle dorsiflexion persisted. Computed tomography revealed malunion of the medial malleolus and an irregular groove in the interosseous space between the tibia and fibula. Magnetic resonance imaging revealed entrapment of the tibialis posterior tendon within the posterior talocrural joint and syndesmosis, preventing posterior translation of the talus back to its normal position and forcing the fibula to remain anteriorly displaced in the syndesmosis. We performed several procedures, including reduction of the tibialis posterior tendon interposition and dislocation of the talus, augmentation of the tibio-fibular ligament, and recession of the gastrocnemius. Finally, the patient achieved plantigrade stance and improvement in her Japanese Society for Surgery of the foot ankle/hindfoot scale from 42 to 82 points, after a 2-year follow-up. Anterior impingement caused the patient to experience severe osteoarthritis. Early reduction of the tibialis posterior tendon should have been achieved for this case. Age, fracture type, and severely restricted range of motion should raise suspicion of this adverse event.

Level of Clinical Evidence: 4.

Introduction

Tibialis posterior tendon interposition following irreducible fracture-dislocation of the ankle is rarely reported [1–9]; in most cases,

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* Corresponding author at: Department of Orthopaedic Surgery, Kanazawa University Hospital, 13-1 Takara-machi, Kanazawa, Ishikawa 920-8641, Japan.

E-mail addresses: toshifumi.h01@gmail.com (T. Hikichi), ortho331@staff.kanazawa-u.ac.jp (H. Matsubara).

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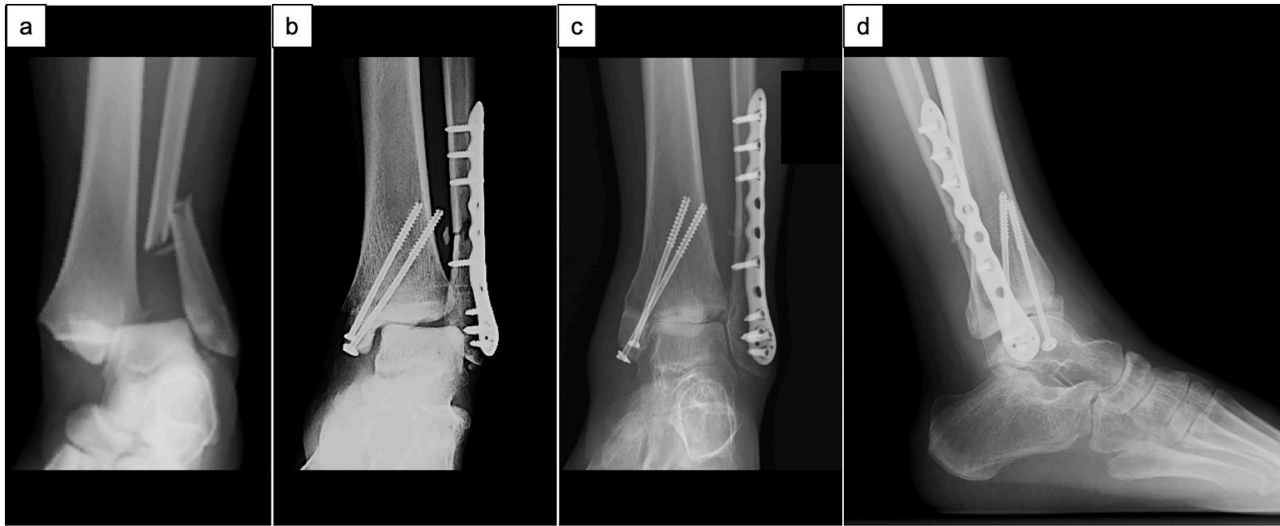


Fig. 1. X-ray of the dislocation fracture (a), and after osteosynthesis and removal of the positioning screw (b). The first operation was performed 12 months after injury (c, d).

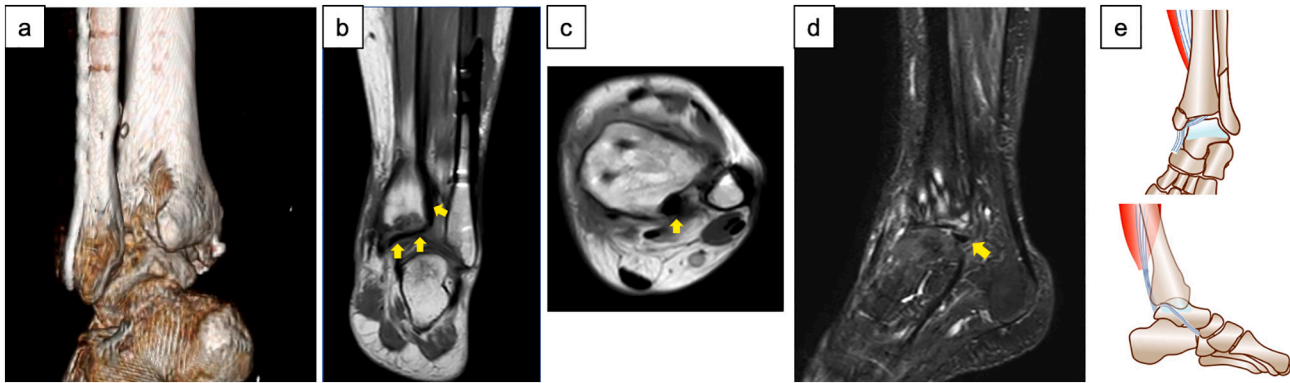


Fig. 2. Computed tomography scans of the non-anatomical groove between the tibia and fibula (a). Magnetic resonance imaging (MRI) revealed tibialis posterior interposition (yellow arrow) within the talocrural joint and intraosseous space between the tibia and fibula (b, c, d) and schema (e). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

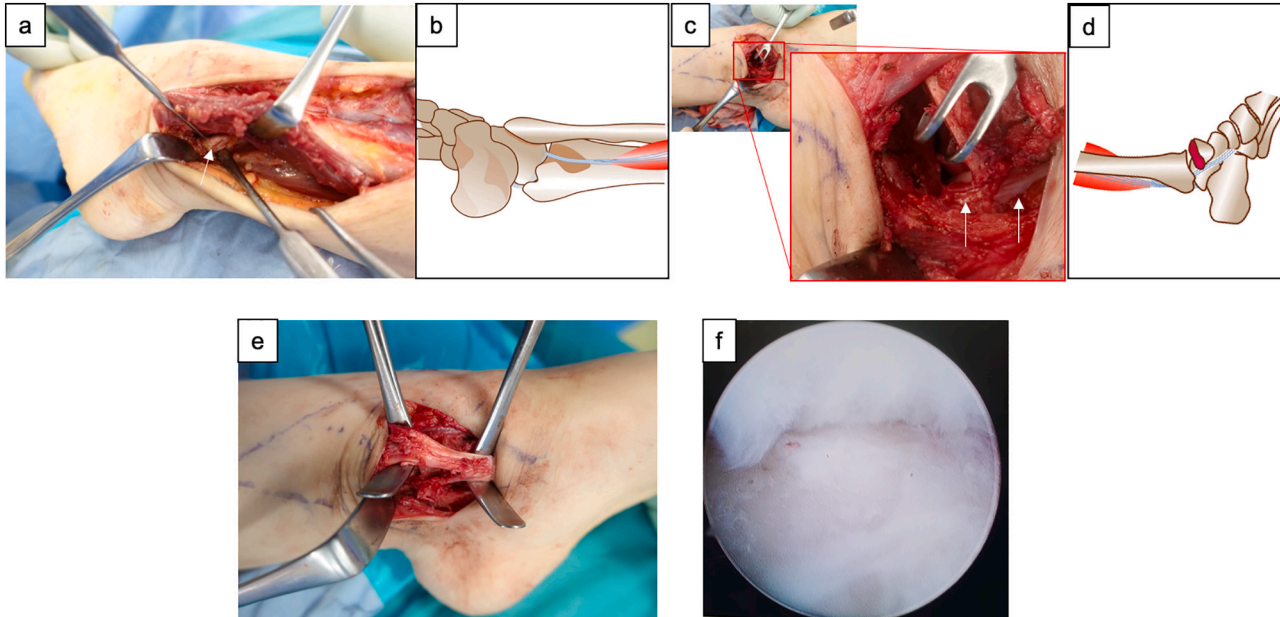


Fig. 3. Intraoperative findings. Intraoperative photo of the lateral incision and tibialis posterior tendon within the non-anatomical groove (a) and schema (b). Intraoperative photo of the medial incision and tibialis posterior tendon within the talocrural joint (c), and schema (d). Rupture of the tibialis posterior tendon (e). Subchondral bone of top the talus (f).

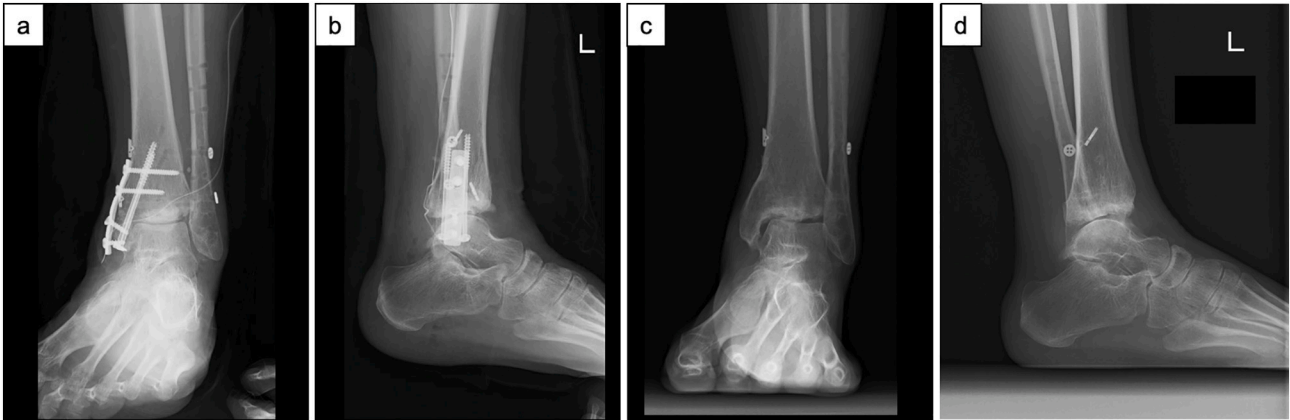


Fig. 4. Postoperative X-ray after the first salvage surgery (a, b) and at final follow-up (c, d).

the interposition reduced immediately in <6 months. However, no reduction of tibialis posterior tendon interposition even after a year has not been reported. Therefore, the natural course and operative management when the interposition is untreated, are unknown.

Herein, we report a case of equinus foot deformity and malunion of the medial malleolus from tibialis posterior tendon interposition following irreducible fracture-dislocation of the ankle. This is the first report of persistent tibialis posterior tendon interposition that lasted for a year and required operative management.

Case report

A 19-year-old female patient presented to our hospital with persistent ankle pain and restricted ankle dorsiflexion. Her medical history revealed fracture-dislocation of the left ankle at age 18 years (Fig. 1a). Open reduction and osteosynthesis were performed 3 days after injury, following which ankle pain and restricted ankle dorsiflexion persisted. The positioning screw was removed 6 weeks after the injury (Fig. 1b). However, restricted ankle dorsiflexion did not improve. One year post-operation, when the patient visited our hospital, pain, restricted ankle dorsiflexion, and gait disturbance remained in the left ankle. Ankle dorsiflexion was at -20° and was irreducible; forefoot eversion was 10° in the left ankle, compared with 60° in the right ankle. The Japanese Society for Surgery of the foot ankle/hindfoot (JSSF) scale score was 42 [4,5]. Radiography revealed regressive changes in the talocrural joint and anterior dislocation of the talus (Fig. 1c, d). Computed tomography (CT) revealed malunion of the medial malleolus and an irregular groove in the interosseous space between the tibia and fibula (Fig. 2a). Magnetic resonance imaging revealed entrapment of the tibialis posterior tendon within the talocrural joint and syndesmosis, preventing posterior translation of the talus back to its normal position and forcing the fibula to remain anteriorly displaced in the syndesmosis (Fig. 2b–d). Based on these findings, equinus foot deformity and malunion of medial malleolus caused by tibialis posterior tendon interposition were diagnosed (Fig. 2e).

We informed the patient of the risk of severe osteoarthritis and possible difficulty in regaining ankle congruity and explained that arthrodesis is the best option; however, the patient wished to preserve the ankle range of motion (ROM).

We decided to perform a challenging procedure that included reduction of the tibialis posterior tendon interposition and dislocation of the talus, and corrective osteotomy of the medial malleolus.

Operative course

Surgery was performed with the patient in the supine position, and a tourniquet was applied. Ankle arthroscopy was used to assess the articular cartilage and locate the tibialis posterior tendon. The talocrural joint was too tight to see the posterior joint space and the subchondral bone of anterior top the talus was exposed within visible range (Fig. 3f). A posterolateral incision exposed the tibialis posterior tendon within the intraosseous space between the tibia and fibula (Fig. 3a, b). However, reduction of the tibialis posterior tendon was not achieved with this incision. Therefore, a medial incision was also made to reduce the tibialis posterior tendon. The tibialis posterior tendon was not found in the medial groove and subsequently, corrective osteotomy of the medial malleolus was performed. The medial malleolus was rotated downward, and the tibialis posterior tendon was found to run on the talus within the talocrural joint and continue through the intraosseous space (Fig. 3c, d). The tibialis posterior tendon was not attached to the joint capsule posteriorly, but the capsule had healed and the tendon could not be repositioned posteriorly where it normally runs. Therefore, the posterior capsule was gently dissected, and the tibialis posterior tendon was then reduced to the medial side. The tibialis posterior tendon was partially ruptured (Fig. 3e). The medial malleolus was fixed with a thread screw, as congruity was enhanced because the medial malleolus deformity was ultimately repaired. The tight-rope technique was performed for tibio-fibular joint instability. Following these procedures, a plantigrade stance was achieved (Fig. 4a, b). Four weeks after the operation, the patient was allowed to bear weight on the leg, with a short leg brace. The patient was able to walk without pain for 3 months. However, the equinus foot deformity recurred with dorsiflexion of -10° . Six months post-operatively, we performed recession of the gastrocnemius and partial removal of hardware. She acquired a plantigrade stance again. Two days after the second surgery, the patient was allowed to bear full weight on the leg.

Final follow-up

The patient was treated at our hospital from June 2019 to December 2021. She could walk, but with slight pain. The dorsiflexion/plantar flexion ROM improved to $0/40^{\circ}$, and the JSSF ankle/hindfoot scale score was 82 points after the 2-year follow-up (Fig. 4c, d). She experienced slight pain at the medial joint space; however, the patient was satisfied with reduced pain and plantigrade stance.

Discussion

Several studies have reported tibialis posterior tendon interposition with dislocation fractures [2–9]. In the literature, the average age of patients is 21.5 years (range, 13–45 years). Five cases (71.4%) were Weber type-C fractures, and six cases were first attempts at failed reduction. Our patient had Weber type-C fracture. Teenagers with this fracture type may be at risk of the interposition of the tibialis posterior tendon.

There are two patterns of tibialis posterior tendon dislocation within tibio-fibular space interposition: the tendon runs anterior to the tibia [6,7] and within the talocrural joint [2–5,8,9]. Volume-rendering views of CT scans can reveal anterior tibialis posterior tendon dislocation [6,7]; however, the dislocation within talocrural joint are difficult to diagnose and have rarely been reported.

Our patient experienced severely restricted ankle dorsiflexion, and only two other studies have reported these symptoms. We also

reported restricted ROM of the forefoot valgus, caused by tension on the tibialis posterior tendon; therefore, this symptom may indicate the presence of this condition.

As per anatomical consideration, a tibialis posterior tendon, when dislocated within the intraosseous space and talocrural joint, displaces the talus anteriorly and superiorly, and consequently, tibial plafond impingement occurs.

Severe degenerative changes occurred in this case; therefore, we considered ankle arthrodesis (AA) as the most reliable treatment to reduce pain and prevent the recurrence of the equinus foot deformity. However, there were problems of restricted ankle motion or degenerative changes in the adjacent joints. Sangeorzan [10] reported that AA and total ankle arthroplasty (TAA) significantly improved patient-reported outcomes. However, TAA is associated with implant breakage, sinking, and infection. In our patient, we performed osteotomy and tendon reduction to improve congruity because the patient wished to preserve ankle ROM and remove hardware after the surgery. We considered corrective osteotomy for improving pain because it improves instability, contact area, and congruity of the ankle joint similar to distal tibial oblique osteotomy for the ankle joint.

After the treatment, slight pain persisted; degenerative arthritis was predicted. In such cases, AA or TAA may be indicated in the future.

In conclusion, equinus foot deformity and malunion of the medial malleolus caused by tibialis posterior tendon interposition can be salvaged by reduction of the tendon, corrective osteotomy, tight rope fixation, and recession of the gastrocnemius; early reduction of the tibialis posterior tendon should be achieved. Age, fracture type, and severe restricted ROM should lead to the detection of this condition.

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Declaration of competing interest

The authors declare no conflicts of interest associated with this manuscript.

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