

## Case Report

# Malunion of ankle fracture with displaced posterior tibialis tendon: a case report and review of the literature

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**Abstract:** Ankle fracture-dislocation with displaced posterior tibialis tendon is a very rare entity in clinical practice. This paper demonstrates an unusual finding of posterior tibialis tendon displacement to the anterior surface of the distal tibia through the syndesmosis. Open reduction and internal fixation was performed at the local hospital. While 9 months later, the patient still suffered from pain and swelling of the affected ankle and had difficulty walking. At the revision surgery, the displaced posterior tibialis tendon was identified and reduced. The patient was followed up 5 years later. X-rays were obtained and severe degeneration of the ankle joint was observed. Stiffness of the ankle joint was a major complaint. The American Orthopaedic Foot and Ankle Society-Ankle and Hindfoot (AOFAS-AH) score improved from 0 to 67 points and Visual Analogue Scale (VAS) pain scale score improved from 9 to 4 points. The patient was satisfied with the surgery. In review of the literature, we find a total of 8 similar case reports. The interposed posterior tibialis tendon was identified at the initial surgery in 5 cases, while the remaining 3 cases missed the diagnosis at the initial surgery. 5 patients were categorized as pronation-external rotation, while 2 patients were pronation-abduction accordance with the Lauge-Hansen classification. For irreducible ankle fracture-dislocation, displaced soft tissue (muscle, tendon, ligaments, neurovascular bundle) about the ankle joint should be highly suspected and explored. The clinical result for delayed diagnosis of posterior tibialis tendon incarceration can be catastrophic.

**Keywords:** Ankle fracture, Irreducible ankle fracture, posterior tibialis tendon incarceration

## Introduction

Ankle fracture-dislocation is a common entity. Usually, these injuries can be reduced using closed methods without any difficulty at the emergency department. However, in some rare cases with soft tissue entrapment, like the posterior tibialis tendon, the ankle can be irreducible [1]. In review of the literature, posterior tibialis tendon dislocation in the syndesmosis after irreducible ankle fracture is rare. To our knowledge, 8 cases have been reported in literature. In 1936, Böhler [2] first reported this injury. Followed by Parrish in 1959 [3], Panovich in 1976 [4], Walker in 1981 [5], Heini in 1994 [6], John in 1996 [7], Adla in 2004 [8], Ermis in 2010 [9], Lacasse in 2015 [10], all of them reported a similar injury after ankle fracture (Table 1). Of the 8 reported cases, the dislocated posterior tibialis tendon was identified and reduced at the initial surgery in 5 cases,

where they achieved good clinical results at the time of last follow up. While the remaining 3 cases all missed the diagnosis and left it untreated at the initial surgery. The displaced posterior tibialis tendon was finally identified during the revision surgery as the patients suffered continued pain, swelling, and reduced range of motion of the ankle joint. One of them eventually received ankle fusion due to severe post-traumatic ankle osteoarthritis. The aim of this study is to report the unusual case and recall the awareness of posterior tibialis tendon interposition in irreducible ankle fracture-dislocations, especially in fractures categorized as pronation-external rotation or pronation-everision in accordance with the Lauge-Hansen classification.

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A 44-year-old female was admitted to the local hospital after an accident involving bricks from

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**Table 1.** Review of the reported cases in literature

No.	Time & Author	Gender	Age	Cause of injury	Fracture Classification	Injury before diagnose	Other tendon or neurovascular involvement	Surgery	Results
1	1959 Thomas F. Parrish	Male	42	Jump from 4 feet high	Pronation-External rotation Or Type C	7 days	No	Reduction of the PTT and deltoid ligament sutured	Ankle stable, but still has some discomfort
2	1976 Arsen M. Pankovich	Female	27	Car accident	Pronation-Eversion Or Type B	4 hours	FDL+FHL+Neurovascular Bundle; Posterior tibialis artery and vein transected	ORIF Posterior tibialis artery and vein ligated	Full range of motion Mild to moderate ankle pain
3	1981 Richard H. Walker	Male	19	Struck from behind by a thrown tire	Pronation-Eversion Or Type C	4 days	No	ORIF	Not available
4	1994 Paul F. Heini	Female	24	Sail plane crash from a height of 5 m	Transverse fracture of distal tibia and fibular shaft Complete disintegration of distal tibia	8 months	No	PPT dislocation overlooked at initial surgery; PPT Z-shape tenotomy and reconstruction at revision surgery	Pain free Resume former sports activities
5	1996 Anderson John G.	Male	30	2000-pound stack fell onto the lateral aspect of the ankle joint	Pronation-External rotation Or Type C	1 year	No	PTT and FHL release Ankle fusion	Pain free Return to original job Resume full activities
6	2004 Deepthi N. Adla	Male	23	Fell off a motorbike	Pronation-External rotation Or Type C	Immediately	FDL+FHL	ORIF	Full range of motion Resume full activities
7	2010 Mehmet N. Ermis	Female	18	Traffic accident	Pronation-External rotation Or Type C	7 days	No	ORIF	Full range of motion
8	2015 Jean-Simon Lacasse	Male	17	Motor vehicle accident	Pronation-External rotation Or Type C	4 months	NO	ORIF	Minimal ankle pain Resume full activities

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**Figure 1.** X-rays were obtained at the Emergency Department. The fracture was categorized as a pronation-eversion stage 3 in accordance with the Lauge-Hansen classification or Type C1 according to Danis-Weber classification. The fracture was characterized with displaced medial malleolus fracture, separation of the distal tibiofibular syndesmosis, transverse fibular fracture and dislocation of the ankle joint.



**Figure 2.** Radiographs immediately after the primary surgery revealed widening of the medial ankle gutter, lateral shifting of the talus, and unreduced syndesmosis.

a collapsed wall that fell onto her left ankle. The radiographs revealed an ankle fracture-dislocation. We further categorized the injury as pronation-abduction in accordance with the Lauge-Hansen classification [11] or Danis-Weber type C1 [12] (**Figure 1**). Attempts were made in the emergency room to reduce the ankle joint by manipulation, but these failed. Calcaneus traction was applied in order to restore the normal hindfoot alignment and to protect the soft tissue. Compression, elevation, and ice were utilized in an effort to eliminate swelling around the ankle joint. Surgery was performed under spinal anesthesia on the sixth day following the



**Figure 3.** Weight-bearing X-rays of the ankle joint 9 months after initial surgery. Radiographs demonstrated moderate ankle degeneration, lateral shifting of the talus, significant widening of the medial ankle gutter, and distal tibiofibular syndesmosis. A. Weight-bearing anterior-posterior view; B. Weight-bearing lateral view.

original trauma. The medial malleolus fracture was reduced and stabilized with two cannulated screws, and the fibular fracture was stabilized with a plate and screws. A syndesmosis screw was placed through the plate (**Figure 2**). The post-operative X-rays demonstrated widening of the medial ankle gutter, lateral shifting of the talus, and unreduced syndesmosis. The syndesmosis screw was removed 3 months after the primary surgery, and full weight-bearing was initiated at that time. However, the patient continued to complain about pain, swelling, and restricted ankle range of motion.

This patient visited our outpatient department 9 months after the initial surgery, complaining of continued ankle pain, swelling, and walking difficulties. The AOFAS-AH score was 0 and the VAS pain score was 9 points. We also found the ankle was in equinus with a restricted range of motion of the ankle joint, especially in dorsiflexion. Weight-bearing radiographs were obtained for further evaluation, and the X-rays revealed moderate ankle degeneration, lateral shifting of the talus, significant widening of the medial ankle gutter, and distal tibiofibular syndesmosis on anteroposterior view, and anterior subdislocation of the ankle joint on lateral view. The patient was admitted to our hospital and revision surgery was recommended (**Figures 3, 4**).

The revision surgery was performed under general anesthesia, the lateral longitudinal incision was made for exposure of the fibular, the fibular

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**Figure 4.** The patient visited our outpatient department 9 months after initial surgery. The ankle was swollen, had equinus contracture, and claw toe deformities. A. Weight-bearing anterior-posterior view; B. Weight-bearing lateral view.



**Figure 5.** The dislocated posterior tibialis tendon was identified intra-operatively. The posterior tibialis tendon emerges about 5 cm above the ankle joint through the syndesmosis, ran downward and medially to the surface of distal tibia and talus, ended its original insertion on the navicular bone. A. The posterior tibialis tendon identified in the medial ankle gutter; B. The posterior tibialis tendon identified in the syndesmosis.

plate was removed, followed by the fibular osteotomy with an oscillating saw about 10 cm



**Figure 6.** Radiographs immediately after operation. A. Anterior-posterior view; B. Lateral view.

above the ankle joint in an attempt to correct the malunion of the fibular. The scar tissue was dissected and released distally for the exploration of the ankle joint. The lateral talar dome was exposed by dorsiflexion of the ankle joint. The medial incision was made for further clearance of the medial ankle joint, 2 cannulated screws were exposed and removed. A tendon-like tissue was identified at the medial ankle gutter, the incision was extended for further exploration. The posterior tibialis tendon was identified as the tendon ran distally to its insertion on the navicular bone, as we traced proximally, the tendon disappeared at the level of the ankle joint. Then we turned to the lateral side, scar tissue was removed, and finally we find out that the posterior tibialis tendon emerged at approximately 5 cm above the ankle joint through the syndesmosis and ran distally anterior, medially to the surface of the distal tibia and talus (**Figure 5**). Attempts were made to reduce the posterior tibialis tendon to its anatomical position through the syndesmosis, but failed. The tendon was cut at the level of ankle joint and reconstructed from the medial side. An anatomical distal fibular plate was utilized to stabilize the fibular after anatomical reduction of the ankle joint. Two syndesmosis screws were placed through the plate, medial ankle instability was noticed after anatomic reduction of the ankle joint, then the deep layer of the deltoid ligament was reconstructed using suture anchors. In order to prevent anterior dislocation of the ankle joint, two 2.0 mm Kirchner wires were used to hold the ankle joint in place (**Figure 6**). The two Kirchner wires were removed 6 weeks after the operation and the two syndesmosis screws were removed 6 months after the operation. The patient still suffered mild to

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**Figure 7.** The patient was followed up 5 years later, X-rays were obtained at the time of last follow up. A. Anterior-posterior view; B. Lateral view.

moderate ankle pain during walking, but the pain was tolerable. The hardware was removed at 4.5 years after surgery, X-rays were obtained at the time of last follow-up (**Figure 7**) and demonstrated severe degeneration of the ankle joint. She complained about the stiffness of the ankle joint which would improve after walking for a few minutes. The AOFAS-AH score improved from 0 to 67 points and VAS pain scale score improved from 9 to 4 points at the time of last follow-up. The patient was satisfied with the surgery. Observation, medication, and functional rehabilitation were recommended. She was also informed that ankle fusion might be needed if the pain became worse and intolerable.

### Discussion

Ankle fracture with posterior tibialis tendon interposition in syndesmosis is rare. To our knowledge, only 8 cases have been reported in the literature. 6 cases had displaced posterior tibialis tendon alone, while 2 cases combined with flexor hallucis longus tendon and digitorum longus tendon entrapment, and one case was concomitant with neurovascular bundle entrapment. Of the 3 cases with a missed diagnosis of displaced posterior tibialis tendon, 1 patient who was diagnosed 1 year later eventually sustained ankle fusion due to posttraumatic ankle osteoarthritis [7].

According to the Lauge-Hansen classification [11], 5 patients were categorized as pronation-external rotation, while 2 patients were pronation-abduction, and the remaining 1 case had open fracture of the distal tibia and fibular.

Thus, for irreducible ankle fracture, especially due to an injury mechanism of pronation of the foot, accordance with Lauge-Hansen classification and posterior tibialis tendon entrapment should be taken into consideration, since open reduction and tendon exploration could be indicated.

The patients could have excellent clinical results if the displaced posterior tibialis tendon is identified and managed at the initial surgery. While the clinical results could be poor if the diagnosis at the initial surgery is missed. In our case, the diagnosis was not been made until 9 months after the injury, after which the patient had already been walking on an unreduced ankle joint for more than 6 months. She already had mild posttraumatic ankle osteoarthritis when she came back for continued ankle pain. Though revision surgery was performed to reduce the ankle joint, posttraumatic osteoarthritis did progress 5 years later. For severe cases, the patients would probably need an ankle fusion to relieve pain [7]. Therefore, it is essential for early diagnosis and management of irreducible ankle fracture with posterior tibialis tendon displacement.

Physical examination is critical for early diagnosis. If the patient complains of continued pain with restricted range of motion of the ankle joint after surgery, post-operative X-rays should be checked. For chronic cases, patients may demonstrate equinus contracture and restricted dorsiflexion of the ankle joint, varus deformity of the foot, the elevation of the first ray due to the incarceration of the posterior tibialis tendon in the syndesmosis. There also can be callus formation on the lateral border of the fore-foot [13]. Furthermore, flexor hallucis longus and flexor digitorum longus tendon can be incarcerated as the result of posterior tibialis tendon displacement, causing claw toe deformities and pain [6, 7].

MRI can be used for early diagnosis of posterior tibialis tendon interposition. The earlier the better since more cartilage of the ankle joint can be preserved. MRI is widely used for evaluation of chondral, osteochondral lesions and soft tissues for its high sensitivity [14]. However, the problem is that, for these patients, the use of plate and screws around the ankle can cause substantial MRI image artifacts [15].

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In conclusion, for irreducible ankle fracture-dislocation at the emergency department or during the surgery, if the X-rays reveal a pronation-external rotation or pronation abduction fracture accordance with Lauge-Hansen classification, the posterior tibialis tendon displacement should be highly suspected and explored. The clinical result for delayed diagnosis of posterior tibialis tendon incarceration can be catastrophic.

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### Disclosure of conflict of interest

None.

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