

# Chronic Syndesmotic Instability Associated with a Complex Lesion of the Posterior Inferior Tibiofibular Ligament: Review, Case Report, and Surgical Report

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## Learning Point of the Article:

This article highlights the incidence, diagnostic challenges, and clinical significance of posterior inferior tibiofibular ligament avulsions in ankle fractures, emphasizing the importance of fibular avulsion of the posterior inferior tibiofibular ligament and its implications for treatment and future research.

## Abstract

**Introduction:** Syndesmotic injuries, particularly those involving the posterior inferior tibiofibular ligament (PITFL), are complex and often result in chronic pain and instability if not appropriately treated. The PITFL plays a crucial role in maintaining syndesmotic stability, especially in resisting rotational forces. This case report examines a PITFL injury involving two posterior fibular fragments, supporting the hypothesis that the superficial and deep components of the ligament function independently.

**Case Report:** A 41-year-old male presented after a bicycle accident with a complex ankle fracture involving a transverse medial malleolus fracture, a postero-medial tibial fragment, a fibular tip fracture, and two additional posterior fibular fragments. Despite initial fracture management, including closed reduction and open fixation, the patient developed chronic pain and instability due to malreduction. Computed tomography imaging revealed instability of the fibula within the fibular notch, indicating syndesmotic instability. The surgical procedure included fibular osteotomy, temporary fixation with K-wires, syndesmotic fixation with the TightRope® system, and PITFL repair using the InternalBrace™ ligament augmentation system. Intraoperative three-dimensional imaging confirmed successful reduction and stabilization.

**Conclusion:** Fibular avulsion of the PITFL is rare. Failure to diagnose the lesion may lead to malreduction of the fibula within the incisura. The combination of osteotomy, TightRope® syndesmosis fixation, and InternalBrace™ PITFL repair provides a reliable option for managing complex PITFL injuries.

**Keywords:** Syndesmotic instability, posterior inferior tibiofibular ligament fibular avulsion, tightrope® fixation, internalbrace™ repair, ankle fractures.

## Introduction

Syndesmotic injuries, particularly those involving the posterior inferior tibiofibular ligament (PITFL), are complex and often lead to chronic pain and instability if not treated correctly. According to biomechanical studies, the anterior tibiofibular

ligament contributes 35% to syndesmotic stability, the transverse ligament contributes 33%, and the interosseous ligament provides 22%, highlighting the importance of these structures in maintaining ankle stability [1-3].

Research indicates that PITFL contributes to syndesmotic

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## Author's Photo Gallery



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**Figure 1:** (a) Anteroposterior and lateral radiographs of the ankle after initial trauma. (b) Computed tomography scan of the ankle after initial trauma.

stability, particularly in resisting rotational forces. Martins et al. [4] described the PITFL as an important stabilizer of ankle syndesmosis. It is composed of two distinct parts: The superficial fibers and the deep fibers. Superficial fibers originate from the posterior edge of the lateral malleolus and extend proximally and medially toward the posterior tibial tubercle. Their average length ranges from 17.3 mm to 22.3 mm. Deep fibers (transverse ligament), denser and more horizontally oriented fibers, attach to the fibular malleolar fossa and the posterior ridge of the tibia. They have an average length of 25.3–26.2 mm.

This case report presents a PITFL injury involving two posterior fragments of the fibula, supporting the hypothesis that the superficial and deep components are distinct entities.

### Case Report

#### Clinical presentation

A 41-year-old male presented after a bicycle accident with a complex ankle fracture involving multiple components: (Fig. 1a and b)

· A transverse medial malleolus fracture



**Figure 2:** Anteroposterior and lateral radiographs of the ankle after osteosynthesis.

- A postero-medial tibial fragment
- A fibular tip fracture, and
- Two additional posterior fibular fragments.

An initial closed reduction was performed, followed by external fixation. After 14 days, an open reduction and internal fixation with screws and an anti-glide plate were carried out (Fig. 2).

Despite healing of the fractures, the patient experienced persistent pain and discomfort for 1 year. A comparative computed tomography (CT) scan revealed instability of the fibula within the fibular notch, associated with anterior translation. This finding led to the diagnosis of syndesmotic malreduction (Fig. 3).

#### Surgical procedure

Under general anesthesia, we proceed to hardware removal and intraoperative testing which confirmed instability of the syndesmosis. The surgical approach included:

1. Fibular osteotomy: A posterior fibular fragment was recentered within the fibular notch
2. Temporary fixation: Two K-wires were placed to stabilize the fibula
3. Syndesmotic fixation: TightRope® system was used to stabilize the syndesmosis
4. PITFL repair: The InternalBrace™ ligament augmentation system was employed to reinforce the PITFL (Fig. 4).

Intraoperative 3D imaging confirmed successful reduction and stabilization.

#### Post-operative care

Following the procedure, the patient was placed in a cast with no weight-bearing for 8 weeks, promoting healing and preventing the recurrence of instability (Fig. 5).

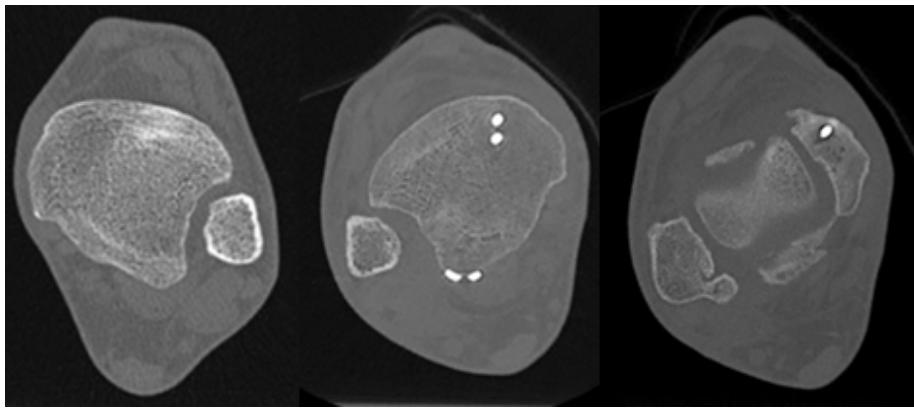


Figure 3: Comparative computed tomography scan axial views.

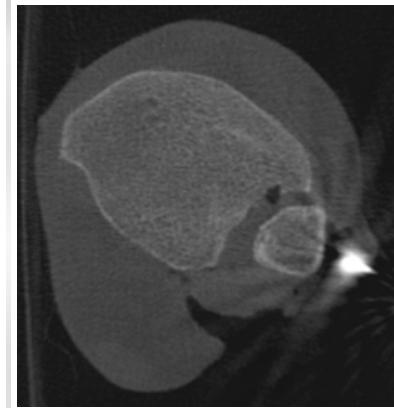


Figure 4: 3D intraoperative imaging.

## Followup

The patient was seen regularly in the outpatient clinic. At 6 months of follow up, he was asymptomatic with good ankle function. There was no sign of osteoarthritis on the radiograph.

## Discussion

This case supports the theory that the transverse tibiofibular ligament, the deep component of the PITFL, functions as an independent structure. It is usually not suspected to have a Volkmann fragment (avulsion fracture of PITFL in posterior tibia), and additionally, a bony avulsion of the PITFL at the fibula. The successful management of this complex injury required a high degree of clinical suspicion, a comprehensive understanding of ankle anatomy, and a meticulous multi-step surgical approach. The innovative surgical technique employed in this case demonstrates its effectiveness in providing a stable construct for PITFL reconstruction and repair.

Syndesmosis ankle injuries are less common than lateral ankle injuries but present significant challenges due to their complex evaluation and long recovery periods.

The current state of the literature on syndesmosis injuries has

extensively described anterior inferior tibiofibular ligament (AITFL) lesions, with Tillaux fragments for the anterior tibia and Wagstaffe fragments for the anterior fibula, as well as Volkmann fractures for the posterior tibia. However, posterior fibular avulsion remains undefined to date due to a lack of descriptions in the literature.

Yao et al. investigated avulsions of the AITFL/PITFL in ankle fractures. A total of 1770 ankle fractures in 1758 patients were analyzed in this study. The overall incidence of avulsions of the AITFL and PITFL was 26.3% (465/1770). They reported an incidence of 19.9% (353/1770) for Volkmann fractures and a low incidence of 0.5% (8/1770) for fibular avulsions of the PITFL [5].

The PITFL plays a crucial role in preventing posterior talar translation and enhancing joint stability. This is achieved by resisting internal rotational forces and anterior-posterior displacement of the fibula. This anatomical structure is often involved in syndesmotic injuries, especially in cases of external rotation and dorsiflexion trauma [6-9].

Injuries to the PITFL can result in chronic instability and require surgical intervention. In cases of syndesmotic injuries not visible on standard radiographs, stress CT or magnetic resonance imaging can reveal subtle instabilities, particularly involving the PITFL [3, 10].

## Conclusion

PITFL avulsion of the fibular is rare. Failure to diagnose the lesion may lead to malreduction of the fibula in the incisura. The described technique for treating complex PITFL injuries offers a reliable and stable option for revision surgeries. The combination of osteotomy, TightRope® syndesmosis fixation, and InternalBrace™ PITFL repair demonstrates effectiveness in restoring stability in cases of chronic syndesmotic instability.

This case highlights the complexity of managing syndesmotic

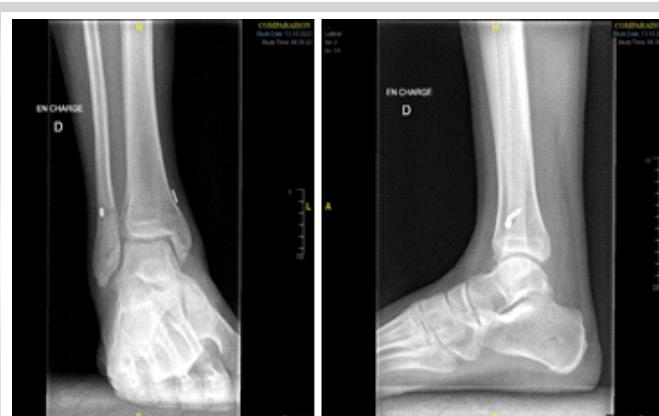


Figure 5: Anteroposterior and lateral radiographs of the ankle after syndesmosis correction: 6 weeks after surgery.

injuries and the importance of advanced surgical techniques in addressing such challenges effectively.

#### Clinical Message

Fibular avulsions of the PITFL are a rare manifestation of PITFL injuries that can result in significant syndesmotic malreduction and instability. Surgical intervention should be considered for the management of these lesions.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil    **Source of support:** None

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