

# Medial-sided Ankle Pain Deltoid Ligament and Beyond

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## KEYWORDS

- Deltoid ligament • Ankle sprain • Spring ligament • Posterior tibial tendon • Flexor retinaculum
- Ankle impingement • Ankle instability

## KEY POINTS

- Abnormalities of the medial ligaments and posterior tibial tendon can occur because of acute injury or chronic instability or malalignment.
- Medial ankle injuries may occur because of pronation or supination–external rotation injuries.
- Deltoid ligament injuries have a significant impact on lateral ankle instability but can be overlooked in patients with lateral ligament injuries.
- Posterior tibial tendon dysfunction is usually associated with spring ligament or flexor retinaculum injury.
- Tarsal tunnel syndrome, accessory flexor muscles, and subtalar coalition should be considered as well as ligament and tendon tears in differential diagnosis of chronic medial ankle pain.

## INTRODUCTION

The medial soft tissue anatomy of the ankle is complex; the ligaments and posterior tibial tendon are closely interrelated both anatomically and functionally. The medial soft tissues may be acutely injured, or may undergo degeneration caused by hindfoot instability or malalignment. Abnormalities may be limited to the medial side of the foot, or occur in conjunction with lateral hindfoot abnormalities. Clinically, medial ankle abnormalities are often underestimated, or overshadowed by lateral injuries, and magnetic resonance (MR) imaging is useful in showing the full extent of injury and guiding surgical management.

A systematic analysis of medial soft tissue structures on MR imaging should begin with the deltoid ligament, followed by the flexor retinaculum, the spring ligament, and the posterior tibial tendon. The tarsal tunnel is examined next, and the intrinsic muscles of the foot. In addition, a search for tarsal coalition should be made because this diagnosis

is often overlooked, especially in subtle cases. The medial findings should be analyzed in conjunction with lateral abnormalities, which may have precipitated the medial findings, or may have resulted from them. Integrating the entire MR imaging picture usually enables radiologists to diagnose the type of injury and to guide treatment.

## IMAGING PROTOCOLS

Images obtained through the hindfoot should be aligned with the axis of the talus. The axial plane is the long axis of the talus, and the coronal plane is perpendicular to it. At least 1 T1-weighted sequence should be obtained to evaluate for bone marrow. Fluid-sensitive sequences should be acquired in all 3 planes. A second short echo time plane, either T1 or proton density, is recommended to improve identification of normal anatomy and variants. The field of view is generally 12 to 14 cm, and a dedicated ankle coil is preferred.

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## ANATOMY

The medial ankle ligaments are closely associated anatomically and functionally. A robust understanding of their interconnections is necessary to evaluate medial ankle pain.

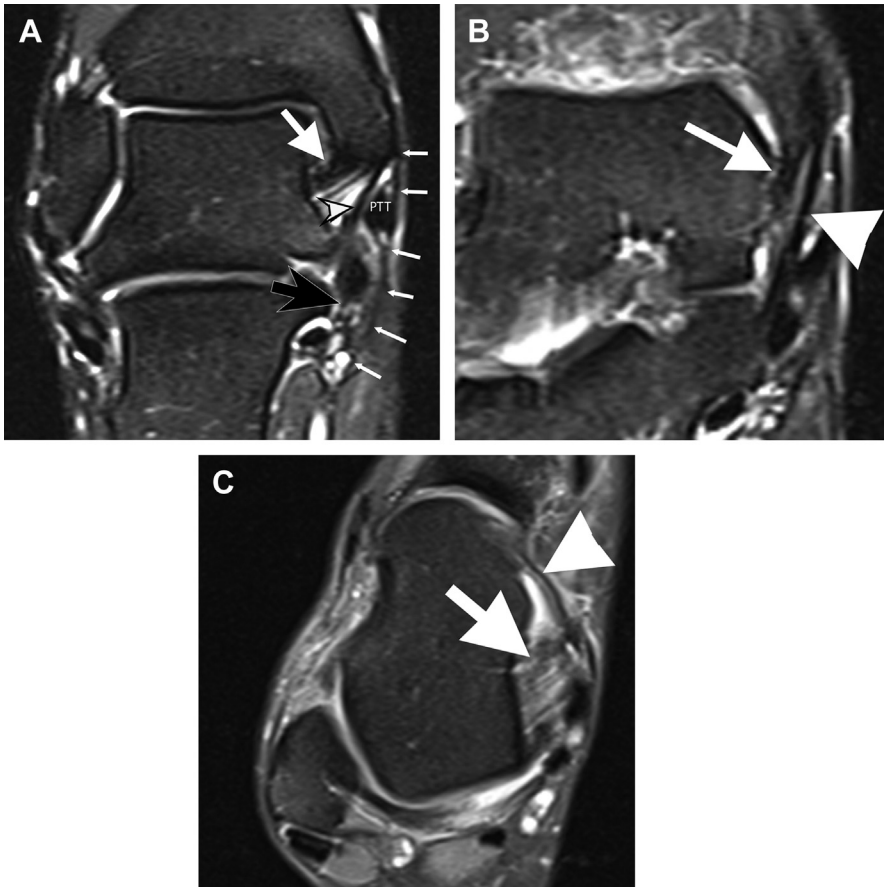
### Deltoid Ligament Anatomy Overview

The constituent parts of deltoid ligament anatomy have been debated by numerous anatomists,

perhaps because cadaveric studies tend to be performed in an elderly population that has a high likelihood of prior ankle injury. The appearance of the ligament on MR imaging is fairly constant (Figs. 1–3).<sup>1</sup>

### Deep Deltoid Ligament Anatomy

The deep deltoid ligament prevents lateral talar shift and external rotation of the talus. It has 2 bands. The posterior band of the deep ligament



**Fig. 1.** Normal appearance of the deltoid ligament. (A) Coronal fast spin echo T2 weighted fat-suppressed (FSE T2FS) image through the midportion of the ankle joint shows the posterior band of the deep deltoid ligament (*white arrow*) coursing obliquely from the medial malleolus to the fovea at the medial margin of the talar body. Note that the ligament insertion does not entirely fill the fovea. The posterior band of the deep deltoid ligament has a striated appearance. A small portion of the tibio-calcaneal band of the superficial deltoid (*white arrowhead*) is also visible. Superficial to this, and separated from it by the soft tissue contents of the tarsal tunnel, is the vertically oriented portion of the flexor retinaculum (*small arrows*). Black arrow points to tibial nerve. (B) Coronal FSE T2FS image anterior to prior image shows the small anterior band of the deep deltoid ligament (*arrow*) inserting on the talar neck. The tibio-calcaneal band of the deltoid ligament, its strongest band, is seen coursing from the superficial margin of the medial malleolus to the sustentaculum tali (*arrowhead*). (C) Axial proton density weighted fat-suppressed (PDFS) image MR image at level of talar body fovea shows a portion of the deep deltoid ligament posterior band (*arrow*). Although the tibial attachment is not included on this slice, the tautness of the ligament fibers indicates an intact ligament, which should be confirmed by correlation with other slices. The tibio-Navicular band of the superficial deltoid ligament (*arrowhead*) is also included. The tibio-Navicular band merges distally with the superomedial band of the spring ligament. PTT, posterior tibial tendon.

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