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How to Report: Ankle MRI

Gregory E. Antonio, MD(CUHK), MBBS(UNSW), BScMed(UNSW), FHKCR, DRANZCR, FHKAM(Radiology)[1]
James Francis Griffith, MD(CUHK), MBBS(UNSW), BScMed(UNSW), FHKCR, DRANZCR, FHKAM(Radiology)[2]

[1] Scanning Department, St. Teresa's Hospital, Hong Kong, China
[2] Department of Imaging and Interventional Radiology, Prince of Wales Hospital, Chinese University of Hong Kong, Hong Kong, China

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Address for correspondence Gregory E. Antonio, MD(CUHK), MBBS (UNSW), BScMed(UNSW), FHKCR, DRANZCR, FHKAM(Radiology), Scanning Department, St. Teresa's Hospital, Hong Kong, China (e-mail: antonio@sthscan.com).

Abstract

Reporting ankle magnetic resonance imaging involves the assessment of multiple joints, tendons, and ligaments in several planes and numerous sequences. This article describes an approach using four anatomical categories (subcutaneous fat, bones and joints, tendons, and ligaments) to simplify and improve reporting efficiency. The main pathologies are covered, emphasizing the specific features to comment on, as well as suggesting terminology and phrases to use when reporting.

Keywords
- ► magnetic resonance imaging
- ► ankle
- ► joint
- ► tendon
- ► ligament

This article introduces magnetic resonance imaging (MRI) reporting of the ankle for trainee radiologists and those not experienced with reporting of the main features used to describe ankle MRI. We emphasize the specific features on which to comment on, along with examples of terminology to use. Reporting of ankle MRI is not confined to the ankle joint. The radiologist should also note the included hindfoot and midfoot structures (joints, tendons, and ligaments). To simplify analysis and reporting, the ankle region can be divided into four basic anatomical areas. This also helps readers navigate a lengthy report.

Report Structure (Based on Anatomical Areas)

- ○ Subcutaneous fat
- ○ Bones and joints
- ○ Tendons
- ○ Ligaments

Pathologies Considered

- ○ Ankle joint cartilage pathology
- ○ Hindfoot-midfoot arthropathy
- ○ Ankle tenosynovitis/tendinopathy
- ○ Achilles tendinosis
- ○ Plantar fasciitis
- ○ Ankle ligament injury

Subcutaneous Fat

The strength of magnetic resonance imaging (MRI) in fluid detection is most useful in demonstrating edema in the soft tissues and bone. This sentinel sign helps identify areas of pathology. Hence it is often helpful to initially inspect the fluid-sensitive sequence images to indicate the likely site of pathology. In cases of infection (cellulitis/panniculitis), intravenous contrast may help assess more fully the degree of inflammation and delineate collections, although these features can usually be assessed quite adequately on noncontrasted images.

Sample Terminology

- ■ "There is severe patchy subcutaneous edema and possible subcutaneous hemorrhage around the ankle, extending to the dorsum of the foot and the distal part of the leg. This may be due to trauma or abnormal mechanics. Dependent edema or venous congestion, or an infective etiology, is less likely in this clinical context."

Pitfalls

- Incomplete suppression of fat signal on fat-suppressed sequences.
- Skin artifacts.

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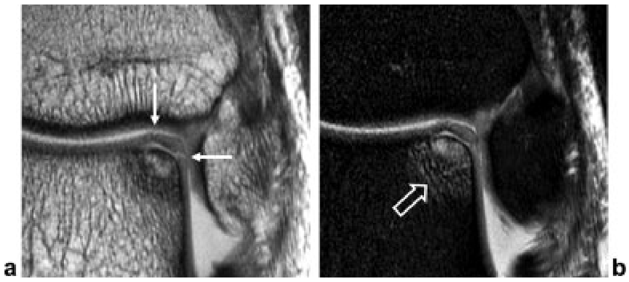

Fig. 1 (a) Proton-density-weighted coronal and (b) proton-density-weighted coronal fat-suppressed small field-of-view images of ankle. "A small ankle joint effusion is present. There is a medium-size (12 mm wide × 10 mm long) osteochondral lesion at the latero-central aspect of the talar dome. Mild subchondral bone marrow edema (open arrow) is present with mild cystic change. This is associated with mild (1 mm) collapse of the articular surface with osteochondral separation. There are two undisplaced fractures (arrows) of the overlying articular cartilage. Overall, the osseous component of this osteochondral lesion is stable; the cartilage component is moderately unstable."

Bones and Joints

Cartilage evaluation with MRI is one of the major strengths of this modality, unmatched by other forms of imaging.[1,2] Advances in MRI allow detailed evaluation of the relatively thin layer of cartilage on both sides of the ankle joint.[3] To optimize cartilage depiction, parameter requisites for cartilage and subchondral bone assessment should be met, such as sub-millimeter spatial resolution and using sequences with high contrast resolution for cartilage lesions[4] (►Fig. 1). The radiologist also needs to be familiar with the MRI appearances of hyaline cartilage compared to fibrocartilage as well as the different types of talar dome osteochondral lesions (►Fig. 2). These osteochondral lesions occur more commonly on the medio-central rather than the latero-central aspect of the talar dome. The MRI report should describe the size (area) and depth of cartilage defect as well as associated subchondral bone changes (►Fig. 1).

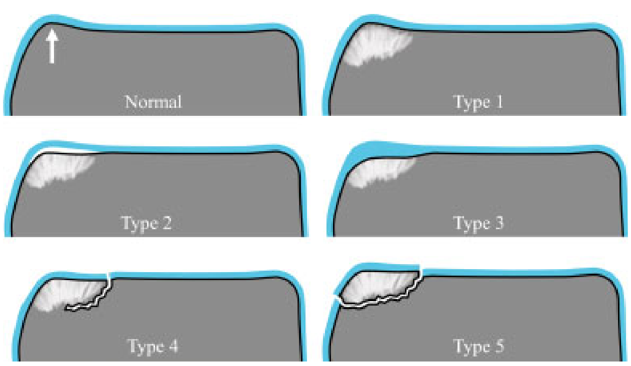

Fig. 2 Schematic showing types of talar dome osteochondral lesion from Griffith et al.[4] Normal appearances of talar dome. There is a slight bony protuberance normally at the medio-central aspect of the talar dome (arrow). Type 1: Subchondral bone marrow edema with or without subchondral cyst. Type 2: Subchondral bone collapse with osteochondral separation. Type 3: Reparative chondral hypertrophy with restoration of near-normal articular surface contour. Type 4: Partial osteochondral separation. Type 5: Complete osteochondral separation. Each type can be associated with an articular cartilage fracture which compromises chondral instability. Type 2 is unstable regarding the cartilaginous component. Types 4 and 5 are unstable regarding the cartilaginous and osseous components.

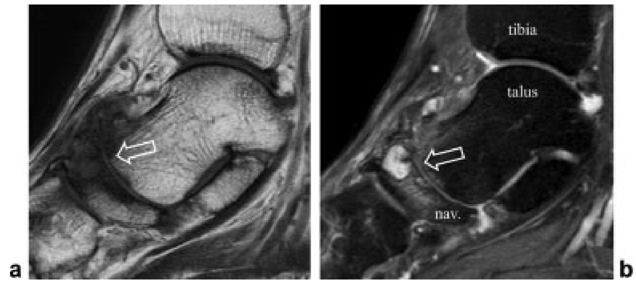

Fig. 3 (a) Proton-density-weighted and (b) T2-weighted fat-saturated sagittal image of the ankle. "There is a severe osteoarthritis of the talonavicular joint (arrows) with severe cartilage thinning, dorsal capsular thickening, moderate surrounding bone marrow edema, and a medium-size subchondral geode at the superior aspect of the navicular bone (nav.)."

These are other features to consider reporting:

- Cartilage signal change (loss of zonal gradation of hyaline cartilage, with areas of increased or decreased signal intensity)
- Cartilage surface irregularity (superficial fibrillation versus deep fissuring)
- Tidemark junction (osteochondral) separation or delamination (►Fig. 1)
- Focal cartilage defect versus generalized cartilage thinning (generalized cartilage thinning being a feature of osteoarthritis or a systemic arthropathy) (►Fig. 3)
- Cartilage fracture or reparative cartilage hypertrophy (►Fig. 1)
- Subchondral bone plate collapse (►Fig. 1)
- Subchondral marrow edema or cysts (►Fig. 1)
- Stability of chondral with or without osseous component of osteochondral injury (►Fig. 1)
- Chondral with or without osteochondral intra-articular body (►Fig. 4)

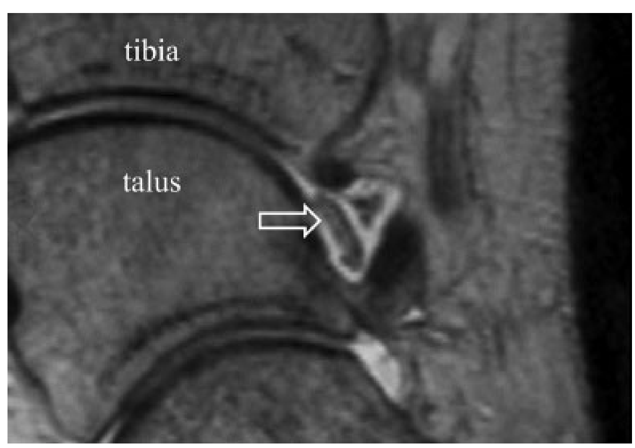

Fig. 4 Proton-density-weighted sagittal image posterior aspect of the ankle. "There is a medium-size (3 mm wide × 6 mm long) cartilaginous fragment (arrow) in the posterior recess of the ankle joint. The zonal hyaline cartilage MR pattern of this fragment is preserved, suggesting that it has, most likely, recently detached."

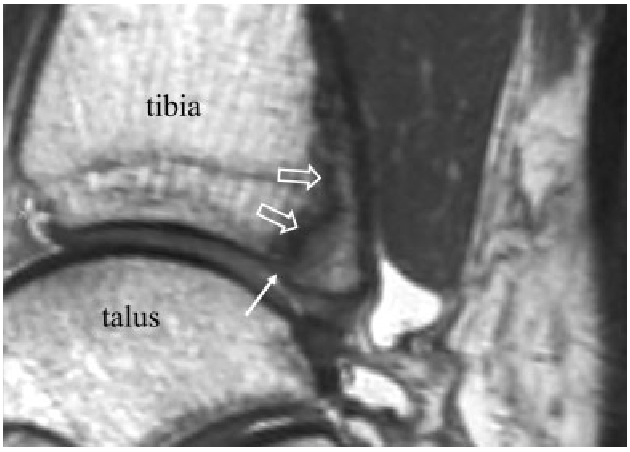

Fig. 5 Proton-density-weighted sagittal image of the ankle. "There is a mildly displaced vertical fracture of the posterior aspect of the distal tibia (open arrows). The fracture line extends to the distal tibial articular cartilage with a mild (~ 1 mm) step deformity (arrow) of the articular cartilage surface."

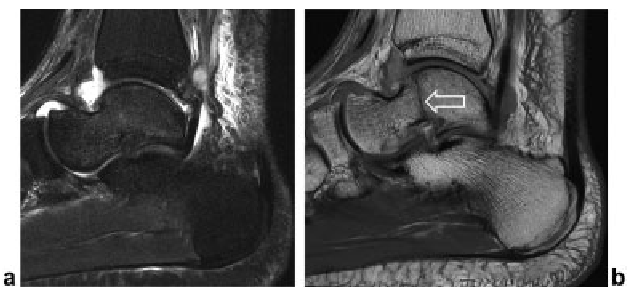

Fig. 6 (**a**) Sagittal T2-weighted fat-saturated and (**b**) proton-density-weighted images of the ankle. "There are small effusions of the ankle and tibiotalar joints. There is an undisplaced vertical fracture (arrow) at the junction between the talar dome and the talar neck. Mild surrounding bone marrow edema is present. No disruption of the talar dome articular contour is present."

Aside from cartilage pathology, these are other lesions to consider:

- Blood clots in the joint/hemarthrosis
- Tarsal coalition
- Pes planus and associated abnormalities[5]

Bone injury is common around the ankle. Most commonly, bone injury is manifest as bone marrow edema with or without a discrete fracture line. These fractures may be radiographically occult (►**Figs. 5** and **6**). Distinction between a traumatic fracture, stress fracture, insufficiency fracture, and pathologic fracture is made on clinical and imaging grounds.

Features to be reported include the intensity and location of bone marrow edema, the presence of a discrete fracture, and the pertinent features of this fracture. These features relevant to any fracture should be considered and/or reported:

1. Location
2. Alignment
3. Completeness
4. Displacement
5. Angulation or rotation
6. Comminution
7. Extension to cortex, physis, or joint and associated widening of physis or joint
8. Likely fracture type (traumatic, stress, insufficiency, pathologic)
9. Chronicity and healing

Sample Terminology

- "There is a small ankle joint effusion with a mild degree of synovitis."
- "There is a medium-size (5 mm wide × 10 mm long) osteochondral lesion on the medio-central aspect of the talar dome. There is mild flattening of the subchondral bone plate due to subchondral bone plate collapse. Mild osteochondral separation is present. No chondral fracture. There is moderate subchondral cyst formation and marrow edema."
- "There are small effusions with a mild degree of synovitis, involving the posterior and anterior subtalar joints, talonavicular joint, and calcaneocuboid joint. These changes may be related to abnormal mechanics or trauma."
- "There is bony ankylosis between the talus and calcaneus across the anterior subtalar joint, indicative of osseous tarsal coalition."

Pitfalls

- Os trigonum and accessory navicular bone can be mistaken for a fracture or an intra-articular body.
- Inability to recognize bone tissue (osseous body, fracture fragment, or accessory ossicle), particularly on T2-weighted fat-suppressed MR images. In some cases, radiographs are more sensitive in this regard.
- Low-resolution images failing to clearly show cartilage pathology.

Tendons

Similar to the wrist, many tendons traverse the ankle joint. All of these tendons possess a tendon sheath, except for the Achilles tendon, which has a paratenon. Similar to tendons elsewhere, four main types of tendon pathology should be sought and, if present, reported. The four types of tendon

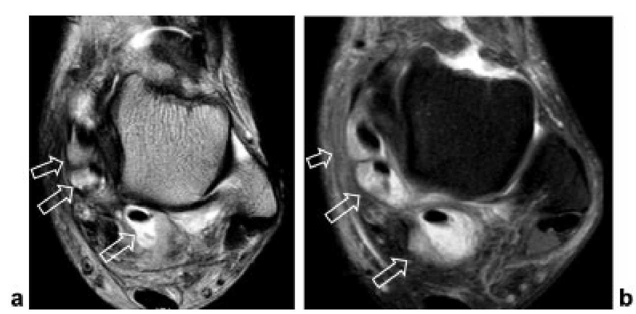

Fig. 7 (**a**) Proton-density-weighted and (**b**) T2-weighted fat-suppressed axial images of the ankle joint showing moderate tenosynovitis of the posterior tibialis, flexor digitorum, and flexor hallucis longus tendons (arrows). All of these tendon sheaths are moderately distended with moderate synovial proliferation. No tendinosis or tendon tear."

Fig. 8 T2-weighted fat-saturated sagittal image of the Achilles tendon insertion. "There is moderate to severe tendinosis of the distal 5 cm of the Achilles tendon with moderate tendon thickening. There is a partial-thickness avulsive-type tear of the Achilles tendon at the insertion (arrow). This tear involves the mid to deep fibers of the Achilles tendon and measures 2 mm anteroposterior × 4 mm mediolateral × 7 mm long. Mild supracalcaneal bursitis is present (arrowhead)."

pathology are the presence of tendinosis, tendon tear, peritendinitis, and tenosynovitis (or paratenonitis) (►**Fig. 7**).[6]

The Achilles tendon is the largest tendon in the body and is formed from tendinous contributions of the gastrocnemius and soleus tendons. The soleal and gastrocnemius components run parallel in the proximal part of the Achilles tendon, though rotate in the middle and distal part of the tendon as they pass to their insertion at the posterior margin of the calcaneum. The medial gastrocnemius fascicles are the deepest and insert more proximally into the middle calcaneal facet, whereas the lateral gastrocnemius and soleal components insert more distally into the inferior calcaneal facet. The superior calcaneal facet has no tendinous insertion with the retrocalcaneal bursa located between the facet and the Achilles tendon.

Achilles tendinopathy (tendinosis)[7,8] near the calcaneal insertion ("insertional tendinosis") tends to occur in older patients or those with a sedentary lifestyle (►**Fig. 8**), whereas tendinopathy in the proximal to midportion of the tendon (20–60 mm proximal to insertion, which is considered a watershed hypovascular zone) (►**Fig. 9**), tends to occur in

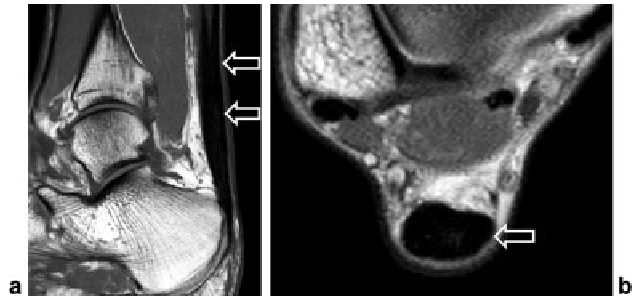

Fig. 9 (**a**) Sagittal and (**b**) axial proton-density-weighted images of the Achilles tendon. "There is moderate-severity tendinosis of the proximal to mid-third of the Achilles tendon (arrows). No tendon tear or peritendinitis is evident. The calcaneal insertion of the Achilles tendon is relatively normal."

younger patients and athletes (especially runners). The typical MRI features of tendinosis are an increase in tendon caliber, with loss of the normal anterior concavity, on axial images and increased tendon signal intensity on T1-weighted and T2-weighted fat-suppressed images (►**Figs. 8** and **9**).

Distal Achilles tendinopathy may be associated with Haglund's syndrome which comprises, in addition to clinical symptoms (►**Fig. 10**),[6] the following characteristics:

- Haglund's deformity: hypertrophic bony protuberance at posterosuperior corner of calcaneum
- Achilles insertional tendinosis
- Retrocalcaneal or supracalcaneal bursitis

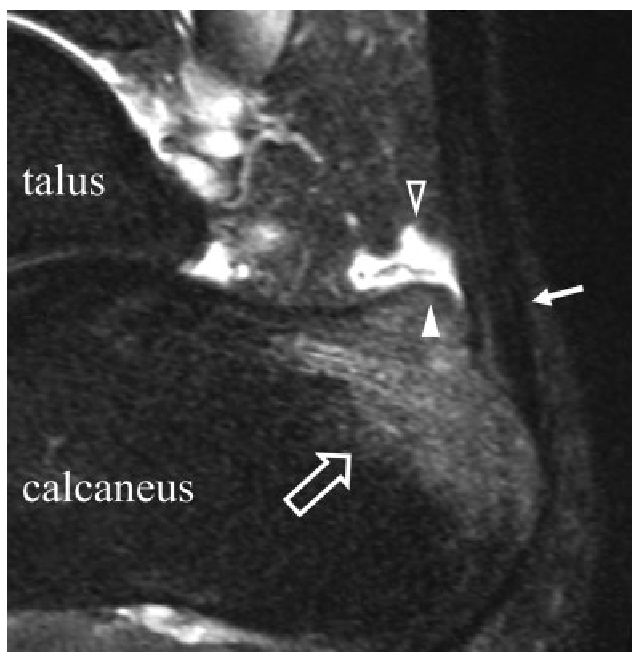

Fig. 10 T2-weighted fat-saturated sagittal image of the Achilles tendon insertion. "Mild insertional Achilles tendinosis is present (arrow). There is moderate bone marrow edema deep to the insertional area at the posterosuperior aspect of the calcaneum (open arrow). No tendon tear is present. Moderate-severity supracalcaneal bursitis is present (open arrowhead) and also a moderate Haglund's deformity with osseous enlargement of the posterosuperior corner of the calcaneum (arrowhead)."

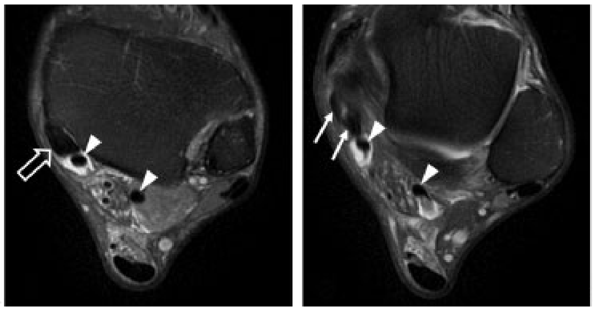

Fig. 11 (**a, b**) T2-weighted fat-suppressed axial images of the ankle. "There is moderate-severity posterior tibialis tendinosis (open arrow). This is associated with a single complete longitudinal split tear (arrows) of the posterior tibialis tendon, 12 mm long, at the inframalleolar portion tendon extending toward the insertion. There are small tendon sheath effusions of the flexor digitorum and flexor hallucis longus tendons (arrowheads)."

Achilles tendon tears usually occur in the proximal to midportions of the tendon. Describe, whenever possible, the degree of background tendinosis, whether a tear is a partial tear, complete tear (rupture), or longitudinal splitting. The location of the tear, the size of the gap between the torn tendon ends, and for partial tears, the proportion of torn tendon fibers (perhaps as a percentage of the total tendon caliber) should also be described (►**Fig. 8**). In some cases, a delamination pattern tear may be seen, where the tear is staggered along different depths (layers) of the tendon. In other cases, an avulsion fracture of the calcaneal insertion of the Achilles tendon may occur. All of this information is useful for treatment planning.

The remainder of the tendons around the ankle, particularly those passing behind the medial and lateral malleoli, have their own interesting features that may help the understanding of their pathology and enrich the radiology report. The posterior tibialis tendon, as the main tendinous support for the medial longitudinal arch,[9,10] is prone to tendinosis (►**Fig. 11**), especially in patients with a tendency toward pes planus. The other two main supports for the medial longitudinal arch are the spring ligament and the plantar aponeurosis. Tears of the posterior tibialis tendon include (1) longitudinal splitting (most common) (►**Fig. 11**), (2) tendon attenuation (partial transverse tearing, uncommon), and (3) complete (transverse) tear (uncommon) (►**Fig. 12**). Tibialis posterior tendinosis and longitudinal split tears typically occur in the relatively hypovascular zone, behind and just below the medial malleolus (i.e., the retro- and inframalleolar regions) (►**Fig. 11**). Complete tears usually occur at the insertion with retraction of the completely torn tendon proximally (►**Fig. 12**).

Posterior tibialis tendinosis and pes planus are often associated with an accessory navicular bone and/or cornuate (elongated) configuration of the medial pole of the navicular bone.

There are three types of accessory navicular bone.[11] Type I is a small accessory bone (os naviculare) embedded in the distal posterior tibialis Tendon. Type III is when the os naviculare is fused to the navicular tuberosity, giving rise to a cornuate-type navicular bone configuration. Both Types I and III accessory navicular bone are not directly symptomatic.

Type II comprises a large (>5 mm long) accessory navicular bone connected to the navicular tuberosity by a thin synchondrosis. The posterior tibialis tendon inserts, for the most part, into the accessory navicular bone (►**Fig. 13**). Type II accessory navicular bone may become symptomatic as medial foot pain, especially in young athletes, and known as "painful accessory navicular syndrome." This can be associated with bone marrow edema, pseudoarthrosis of the synchondrosis, overlying soft tissue edema, and tendinosis, tears, or tenosynovitis of the distal posterior tibialis tendon. Bone marrow edema may be confined to the immediate area around the synchondrosis, extend to the navicular tuberosity, or extend to the body of the navicular bone.[11] Bone marrow edema severity surrounding the synchondrosis does not seem to correlate with medial midfoot pain severity, although there is a positive correlation between adjacent soft tissue edema and pain severity. That said, bone marrow

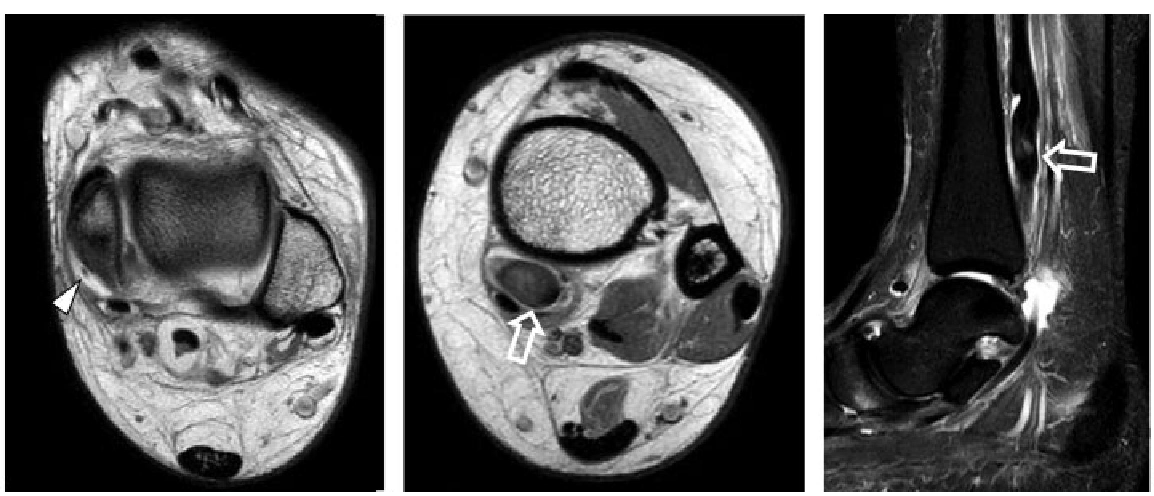

Fig. 12 (**a, b**) Proton-density-weighted axial and (**c**) T2-weighted fat-suppressed sagittal images of the ankle. "There is a complete tear of the posterior tibialis tendon. This tendon has avulsed from the insertional area and has retracted 10 cm proximal to the ankle joint (open arrows). The tendon sheath of the posterior tibialis tendon is empty at the retromalleolar region (arrowhead). The distal retracted end of the tendon is moderately swollen (open arrows). There is a small tendon sheath effusion of the flexor hallucis longus tendon."

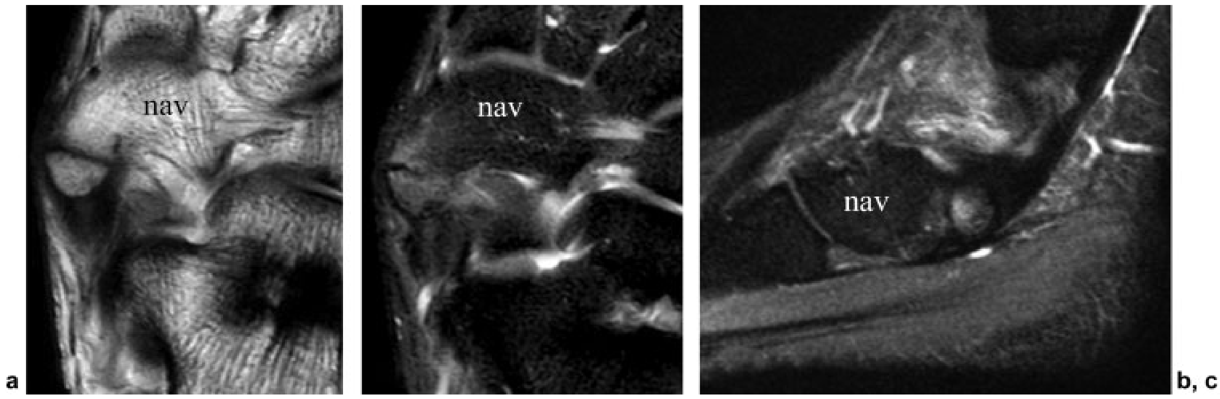

Fig. 13 (**a**) Proton-density-weighted axial, (**b**) T2-weighted fat-saturated axial, and (**c**) sagittal images of the medial side of the midfoot. "There is a medium-size (9 mm) accessory navicular (nav) bone with moderate-severity bone marrow edema of this accessary navicular bone and the adjacent medial tuberosity of the navicular. There is mild overlying soft tissue edema. No pseudoarthrosis is evident. Overall appearances, in this clinical context, would be compatible with painful accessory navicular syndrome. The posterior tibialis tendon is intact without tendinosis or tear."

oedema severity does not seem to correlate with medial midfoot pain severity though, there is a positive correlation between surrounding soft tissue oedema and pain severity.[11]

The flexor hallucis longus (FHL) tendon is considered the Achilles tendon of the foot. Dancers, especially ballerinas, stress the FHL in pointe work with entrapment between the talus and calcaneus. The FHL may develop tenosynovitis (including stenosing tenosynovitis), tendinosis, or tears. That said, tendon sheath fluid is common in the medial ankle tendons in normal subjects.

The peroneal tendons[12–15] also show the full spectrum of tendon pathology: tendinosis, tendon tears, tenosynovitis, and peritendinitis (►**Fig. 14**). Longitudinal splitting of the peroneus brevis tendon most commonly occurs behind and below the lateral malleolus (►**Fig. 14**). It is the most common ankle tendon to tear, often following an inversion injury, most likely due to the peroneus brevis tendon being compressed between the lateral malleolus and the peroneus longus tendon. Part of the split peroneus brevis tendon may sublux medially (►**Fig. 14**). Not so commonly, the peroneal retinaculum may tear with anterolateral subluxation of one or both peroneal tendons.

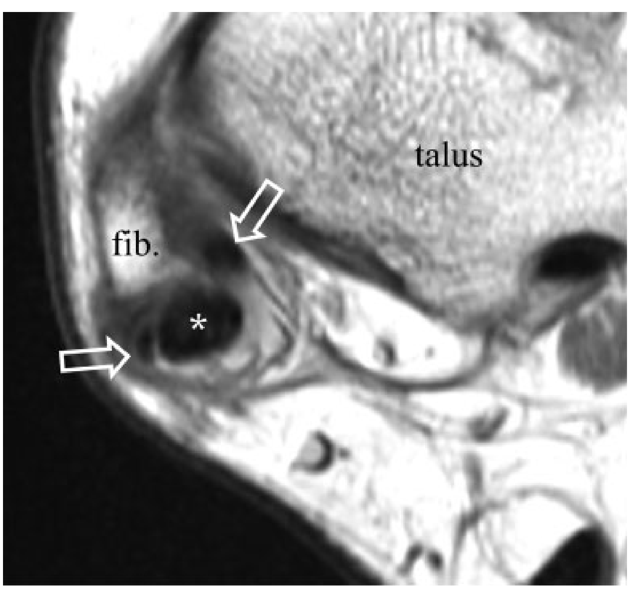

Fig. 14 Proton-density-weighted axial image posterolateral aspect of the ankle. "There is moderate tendinosis of the retromalleolar peroneus longus tendon (asterisk). There is a single complete longitudinal split tear of the retromalleolar peroneus brevis tendon (arrows). The medial component of this split peroneus brevis tendon has subluxed medially. Moderate peroneal peritendinitis is present." fib., fibula.

Sample Terminology

- "There is a complete tear of the Achilles tendon, 30 mm proximal to the calcaneal insertion. There is retraction of the torn ends of the fibers, resulting in a gap of 25 mm, which is filled by a mixture of blood and fluid. More proximally, there is patchy edema around the myotendinous junction of the soleus muscle indicative of an associated muscle strain."
- "There is stepwise laminar tearing of different layers of the Achilles tendon indicative of a delamination tear. This tearing spans from 30 mm to 85 mm proximal to the calcaneal insertion."

Pitfalls

- Magic angle artifact masquerading as tendon pathology.
- Accessory tendon masquerading as tendon tear[16–18] (►**Fig. 15**).
- Pseudotear mid- to distal Achilles tendon (due to rotation of soleal, medial, and lateral gastrocnemius components) (►**Fig. 16**).
- Physiologic tendon sheath effusions (FHL more than posterior tibialis and flexor digitorum longus more than peroneal tendons) masquerading as tenosynovitis. The presence of tenosynovial thickening or proliferation can help distinguish between a physiologic tendon sheath effusion and tenosynovitis (►**Figs. 11** and **12**).

Ligaments

The ligaments around the ankle joint can be grouped by location into the lateral, syndesmotic, and medial groups.[19]

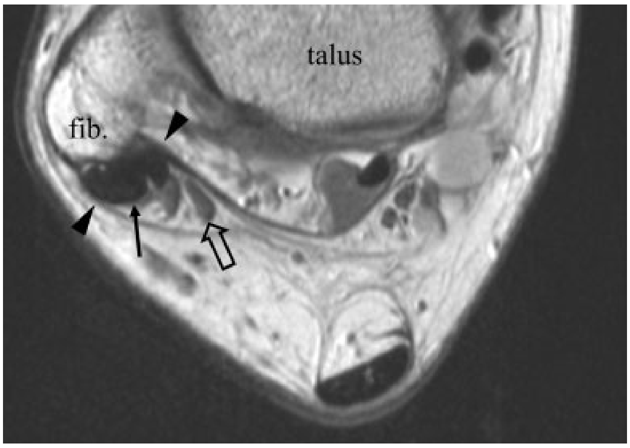

Fig. 15 Proton-density-weighted axial image of the posterolateral aspect of the ankle. "There is a peroneus quartus tendon (arrow). This is a normal anatomical variant. There is a split longitudinal tear of the peroneus brevis tendon (arrowheads). The peroneus longus tendon (arrow) is normal." fib., fibula.

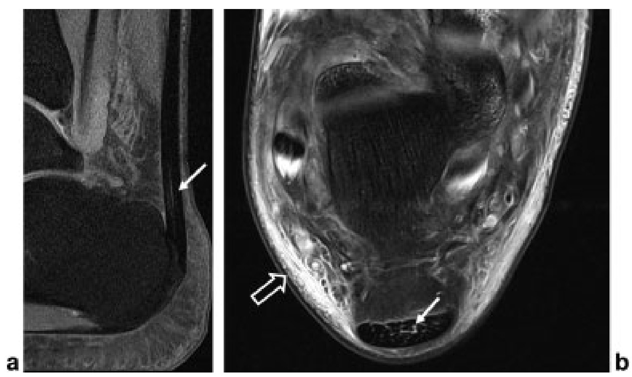

Fig. 16 (**a, b**) Proton-density-weighted sagittal and axial images of the ankle. "The thin linear high signal intensity within the distal third of the Achilles tendon is more likely to be a pseudotear (arrows) rather than a true Achilles tendon tear. No background tendinosis is evident. Otherwise, the Achilles tendon is unremarkable. There is moderate subcutaneous edema at the posterolateral aspect of the ankle (open arrow)."

Lateral Ligament Injury

The lateral group of ankle ligaments[20,21] consists of the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament (PTFL). It is the most commonly injured group among the three ankle ligament groups. The main mechanism of injury is an inversion force. The ATFL is the weakest, most prone to injury, and usually the first ligament to tear, followed by the CFL and then the PTFL. The ATFL is a capsular ligament extending almost horizontally from the fibular tip to the talar neck. As this area is highly vascularized, diffuse hemorrhage or hematoma adjacent to an acute ATFL tear is quite common (►**Fig. 17**). The CFL is extracapsular, extending almost vertically from the fibular tip, deep to the peroneal tendons, to the trochlear eminence on the lateral aspect of the calcaneal body. The PTFL extends intra-articularly almost horizontally from the lateral malleolar fossa to the posterior part of the talar bone, the lateral talar process, or the os trigonum, if present.

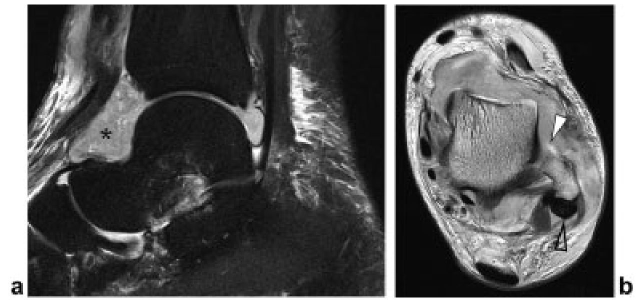

Fig. 17 (**a**) T2-weighted sagittal and (**b**) proton-density-weighted axial image of the ankle. "There is a severe ankle joint hemarthrosis (asterisk). There is a complete tear of the anterior talofibular ligament (arrowhead). There is a moderate peroneal tendon sheath effusion with mild peroneus longus tendinosis (open arrowhead). No tendon tear. The peroneus brevis tendon is normal."

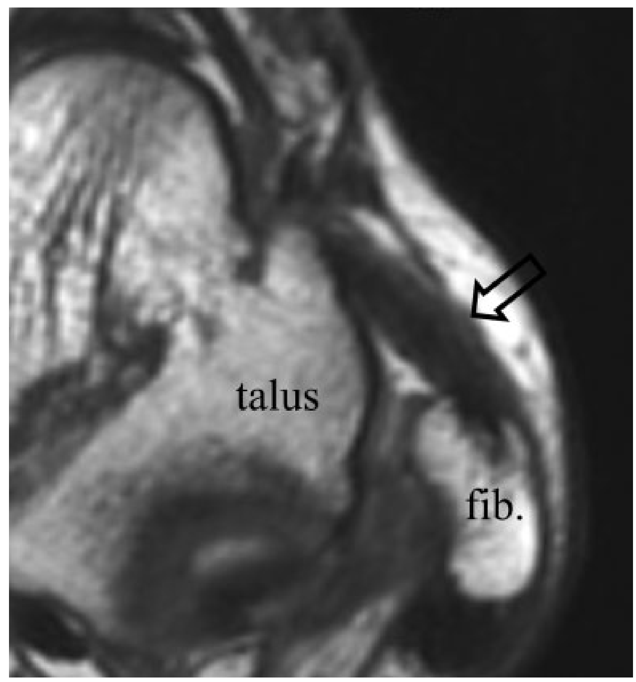

Fig. 18 Proton-density-weighted axial image lateral aspect of the ankle. "There is a healed tear of the anterior talofibular ligament with moderate reparative fibrotic-type ligament thickening (arrow). Overall ligament continuity is maintained." fib., fibula.

Isolated tears of the ATFL are common. Tears of the CFL nearly always occur in conjunction with ATFL tears. Tears of the PTFL only occur in conjunction with ATFL and CFL tears.

Like all ligament injuries, ankle ligament tears can be categorized into three types:

1. Sprain (ligament edema without visible discontinuity).
2. Tear (partial or complete ligament discontinuity).
3. Healing (ligament thickening with reparative fibrosis) (►**Fig. 18**). Alternatively, the torn ligament may not heal and undergo complete attrition with no ligament being visible (►**Fig. 19**) or there may be a variable degree of ligament attenuation present.

Fig. 19 Proton-density-weighted axial image of the ankle. “There is complete resorption of the anterior talofibular ligament consequent to a previous tear (arrow).”

Tearing of the ATFL and CFL may result in ankle joint instability. Aside from ligamentous changes, adjacent bony changes may also be visible, such as avulsed bony fragment (s), tug lesion, or dystrophic ossification (►Fig. 20). Ankle capsular injury may lead to periarticular ganglion formation.

Syndesmotic Ligament Injury

The syndesmotic group[22] consists of the anterior inferior tibiofibular ligament (AITFL), posterior inferior tibiofibular ligament, transverse tibiofibular ligament, and interosseous membrane. Injury to the syndesmotic ligaments is also known as a “high ankle sprain” and is a severe form of ankle injury. The anterior portion of this group is more susceptible to tear than the posterior portion. The main mechanism of injury is external rotation of the dorsiflexed ankle and, as such, syndesmotic ligament injury may be associated with fractures of the medial malleolus and deltoid ligament tear. Most syndesmotic injuries comprise partial or complete tears of the AITFL and are not associated with syndesmotic diastasis (►Fig. 20). Important features to report are the presence and type of ligament injury and the presence or absence of syndesmotic diastasis.

Medial Ligament Injury

The medial group consists of the superficial and deep components of the deltoid ligament.[23] The deep component is intra-articular, crosses one joint, and consists of a slightly more superficial anterior tibiotalar ligament and a slightly deeper, larger posterior tibiotalar ligament. The superficial component is extra-articular, crosses two joints, and comprises the tibiocalcaneal, tibionavicular component, and tibiospring components.

Injury occurs with excessive abduction, supination, external rotation, and eversion. Isolated deltoid ligament injury is uncommon. Usually, both the deep and superficial components are torn in conjunction with lateral collateral ligament or syndesmotic tears or malleolar fractures. Therefore, the presence, location, and degree of tear, as well as the presence of associated injuries, should be reported.

Sample Terminology

- “There is a complete tear of the anterior talofibular ligament and the adjacent anterolateral aspect of the ankle joint capsule. There is an associated medium-size subcutaneous hematoma overlying the torn ligament.”
- “There is moderate diffuse edema of the deep and superficial components of the deltoid ligament, indicative of a sprain. No discrete tear evident. Overall ligament continuity is maintained.”
- “There is a medium-size (4 mm × 5 mm) corticated bony fragment at the anteroinferior margin of the lateral malleolus. This bone fragment is attached to the anterior talofibular ligament (ATFL), indicative of a

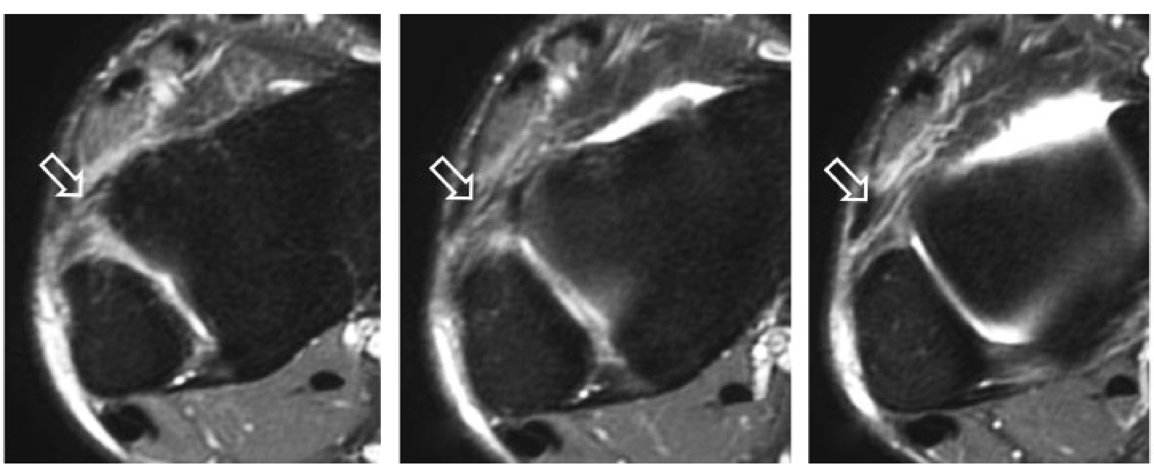

Fig. 20 (a–c) T2-weighted axial images of the ankle. “There is a moderate sprain of the anterior tibiofibular ligament (arrows). The ligament is moderately swollen and edematous, although overall ligament continuity is maintained. No discrete tear is evident. No syndesmotic diastasis.”

previous ATFL avulsion injury. There is marrow edema in this bony fragment and the anteroinferior margin of the lateral malleolus, suggesting continual abnormal mechanics."

Pitfalls

- Magic angle artifact.
- Partial volume artifact.

Both of these artifacts can be overcome by reviewing the two-dimensional fluid-sensitive images acquired in the standard three orthogonal planes or by acquiring a three-dimensional (3D) imaging data set (e.g., 3D proton-density data set).

- Bony avulsion in conjunction with ligament tears.

Conflict of Interest
None declared.

References

1 Schmid MR, Pfirrmann CW, Hodler J, Vienne P, Zanetti M. Cartilage lesions in the ankle joint: comparison of MR arthrography and CT arthrography. Skeletal Radiol 2003;32(05):259–265
2 Forney M, Subhas N, Donley B, Winalski CS. MR imaging of the articular cartilage of the knee and ankle. Magn Reson Imaging Clin N Am 2011;19(02):379–405
3 Barr C, Bauer JS, Malfair D, et al. MR imaging of the ankle at 3 Tesla and 1.5 Tesla: protocol optimization and application to cartilage, ligament and tendon pathology in cadaver specimens. Eur Radiol 2007;17(06):1518–1528
4 Griffith JF, Lau DT, Yeung DK, Wong MW. High-resolution MR imaging of talar osteochondral lesions with new classification. Skeletal Radiol 2012;41(04):387–399
5 Sanghvi D. MRI of lateral hindfoot impingement. Diagn Interv Radiol 2021;27(03):432–439
6 Palmer W, Bancroft L, Bonar F, et al. Glossary of terms for musculoskeletal radiology. Skeletal Radiol 2020;49(Suppl 1):1–33
7 Haims AH, Schweitzer ME, Patel RS, Hecht P, Wapner KL. MR imaging of the Achilles tendon: overlap of findings in symptomatic and asymptomatic individuals. Skeletal Radiol 2000;29(11):640–645
8 Schweitzer ME, Karasick D. MR imaging of disorders of the Achilles tendon. AJR Am J Roentgenol 2000;175(03):613–625
9 Khoury NJ, el-Khoury GY, Saltzman CL, Brandser EA. MR imaging of posterior tibial tendon dysfunction. AJR Am J Roentgenol 1996;167(03):675–682
10 Schweitzer ME, Karasick D. MR imaging of disorders of the posterior tibialis tendon. AJR Am J Roentgenol 2000;175(03):627–635
11 Kamel SI, Belair JA, Hegazi TM, et al. Painful type II os naviculare: introduction of a standardized, reproducible classification system. Skeletal Radiol 2020;49(12):1977–1985
12 Wang XT, Rosenberg ZS, Mechlin MB, Schweitzer ME. Normal variants and diseases of the peroneal tendons and superior peroneal retinaculum: MR imaging features. Radiographics 2005;25(03):587–602
13 Lee SJ, Jacobson JA, Kim SM, et al. Ultrasound and MRI of the peroneal tendons and associated pathology. Skeletal Radiol 2013;42(09):1191–1200
14 Schubert R. MRI of peroneal tendinopathies resulting from trauma or overuse. Br J Radiol 2013;86(1021):20110750
15 Kijowski R, De Smet A, Mukharjee R. Magnetic resonance imaging findings in patients with peroneal tendinopathy and peroneal tenosynovitis. Skeletal Radiol 2007;36(02):105–114
16 Saupe N, Mengiardi B, Pfirrmann CW, Vienne P, Seifert B, Zanetti M. Anatomic variants associated with peroneal tendon disorders: MR imaging findings in volunteers with asymptomatic ankles. Radiology 2007;242(02):509–517
17 Cheung YY, Rosenberg ZS, Ramsinghani R, Beltran J, Jahss MH. Peroneus quartus muscle: MR imaging features. Radiology 1997;202(03):745–750
18 Cheung Y, Rosenberg ZS. MR imaging of the accessory muscles around the ankle. Magn Reson Imaging Clin N Am 2001;9(03):465–473, x
19 Lee SH, Jacobson J, Trudell D, Resnick D. Ligaments of the ankle: normal anatomy with MR arthrography. J Comput Assist Tomogr 1998;22(05):807–813
20 Erickson SJ, Smith JW, Ruiz ME, et al. MR imaging of the lateral collateral ligament of the ankle. AJR Am J Roentgenol 1991;156(01):131–136
21 Kreitner KF, Ferber A, Grebe P, Runkel M, Berger S, Thelen M. Injuries of the lateral collateral ligaments of the ankle: assessment with MR imaging. Eur Radiol 1999;9(03):519–524
22 Brown KW, Morrison WB, Schweitzer ME, Parellada JA, Nothnagel H. MRI findings associated with distal tibiofibular syndesmosis injury. AJR Am J Roentgenol 2004;182(01):131–136
23 Mengiardi B, Pfirrmann CWA, Vienne P, Hodler J, Zanetti M. Medial collateral ligament complex of the ankle: MR appearance in asymptomatic subjects. Radiology 2007;242(03):817–824

