Case study

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Sequelae of severe ankle sprain injury

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Ankle sprain injury is common in both athletes and non-athletes, accounting for 14-21% of all sport-related injuries. The most common aetiology of ankle sprain is incorrect foot positioning at landing. 80% of ligamentous sprains are caused by excessive inversion or supination. Delayed reaction time or weakness of the peroneal muscles at the lateral aspect of the ankle may also be a contributing factor.

The most commonly injured ligament is the anterior talofibular ligament (ATFL) which has the lowest load tolerance of all of the lateral ankle ligaments (Fig 1). The calcaneofibular ligament (CFL) is the next most commonly injured (Fig 2), while the posterior talofibular ligament is less commonly injured.

Radiological assessment of the medial collateral (deltoid) ligament, distal tibiofibular ligaments and sinus tarsi are also important.

Management of ankle sprains is usually conservative, with a view to early mobilisation to avoid joint stiffness, muscle atrophy and loss of proprioception.

Many ankle sprains are either not imaged in the initial phase or are only assessed with plain x-ray to exclude a fracture. Occasionally patients suffer ongoing pain and instability, do not recover as expected, or have symptoms out of proportion to a simple sprain injury. MRI and fine slice CT imaging can play an important role in detection of additional injuries that may not have been detected at the time of the initial clinical assessment.

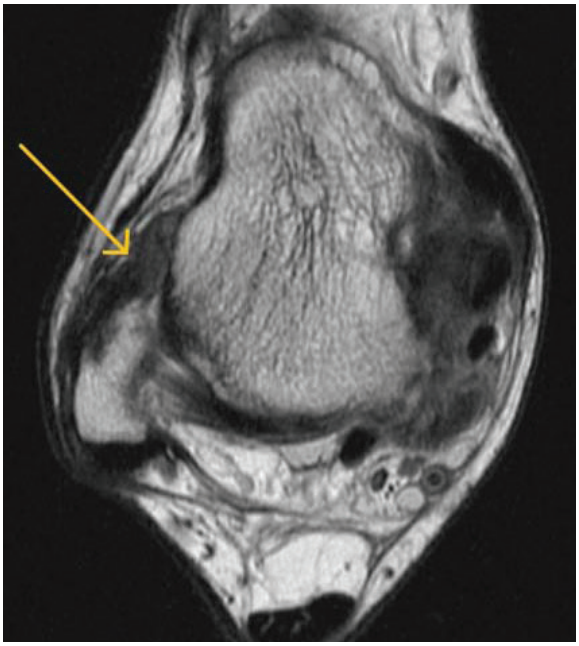

Figure 1:
ATFL sprain showing thickening and hyperintensity of the ATFL (axial PD MRI).

Figure 2:
CFL sprain (coronal PD MRI).

Some of the complications of ankle sprain injury are described below.

Undetected fractures

Some ankle and hindfoot fractures are not readily seen on ankle x-rays and may be better assessed with CT or MRI. These include fractures of the lateral talus process, cuboid, 5th metatarsal base and anterior process of calcaneus.

Anterior process calcaneal fractures can be particularly difficult to diagnose on x-ray and can be associated with lateral ankle sprain. Such fractures can also occur in association with bifurcate ligament injuries and tarsal coalition. Fine slice CT imaging provides superior spatial resolution for fracture detection (Fig 3 and 4). MRI can show the fracture lines best on T1 weighted images, and can also show extent of marrow oedema on fat suppressed T2 scans.

Lateral process of talus fractures, are an occult fracture that commonly occur with snowboarding. The underlying mechanism is dorsiflexion and inversion of the ankle. Early diagnosis is important to prevent subtalar joint pain and stiffness. The fracture which can be occult on x-ray, is well shown on MRI and CT (Fig 5 and 6).

Osteochondral injury

Osteochondral injuries in ankle sprain most commonly affect the talar dome.

Although there are various numerical grading systems regarding this type of injury, the most important factors for the radiologist to assess are the degree of chondral damage, chondral flaps, chondral loose bodies, bone bruising, subchondral compression, and partially or completely detached osteochondral fragments. On MRI these injuries are best appreciated on scans in the sagittal and coronal planes (Fig 7 and 8).
Untreated, these injuries can lead to joint stiffness, instability and secondary osteoarthritis. Treatment for mild injuries is conservative, while surgical treatment includes fragment excision, curettage, drilling and abrasion arthroplasty.

POMI lesion

The POMI (posteromedial impingement) lesion can occur after a severe ankle inversion with excessive plantar flexion. The deep posterior fibres of the medial deltoid ligament become crushed between the medial wall of the talus and the medial malleolus. There is initial posteromedial swelling and bruising which usually resolves without specific treatment. Occasionally however, thick disorganised fibrotic tissue persists and impinges between the medial wall of the talus and posterior margin of the medial malleolus.

On MRI, the changes are seen as a thickened or rounded area of low signal scar tissue, which can abut or encase the medial ankle tendons, which can lead to pain, restricted movement, or catching (Fig 9).

Syndesmotic injury

Injury to the distal tibiofibular syndesmosis can result in significant anterolateral pain and instability. The syndesmosis is normally stabilised by anterior and posterior inferior tibiofibular ligaments (AITF and PITF), the transverse tibiofibular ligament and the interosseous membrane. Injury to these structures can result in instability and diastasis of the joint. X-rays may show diastasis on unstressed or stressed (weight bearing) views. The normal syndesmotic clear space on mortise view is less than 6mm. MRI can show soft tissue oedema, disruption of the ligaments, and interosseous membrane hyperintensity, best appreciated on axial fat suppressed T2 images (Fig 10 and 11). Severe injuries may require internal fixation across the distal tibiofibular joint.

Figure 3:
Anterior process calcaneum fracture (sagittal CT image).

Figure 4:
Anterior process calcaneal fracture. A talar head avulsion fracture was also seen (coronal CT image).

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Figure 5:
Lateral process of talus fracture (coronal PD MRI).

Figure 6:
Lateral process of talus fracture (coronal CT).

Sinus tarsi syndrome

The sinus tarsi is located between the inferior surface of the talus and the superior surface of the calcaneus, immediately anterior to the posterior subtalar joint. Clinically the sinus tarsi syndrome consists of pain and tenderness over the lateral opening of sinus tarsi. Pain is thought to be from low grade inflammation related to sprain of the ligaments within the sinus tarsi. Sinus tarsi syndrome is preceded by an ankle sprain injury in up to 70% of cases. Classical findings on MRI are oedema within the sinus tarsi and poorly defined sinus tarsi ligaments. Ganglion cyst formation can also occur within the sinus tarsi (Fig 12 and 13).

Peroneal tendon injury

The peroneal tendons pass posteriorly and inferiorly to the fibular malleolus and can be traumatised during inversion injury. This can result in a post-traumatic tenosynovitis, tendinopathy, a tendon split or less likely a complete tear. The Peroneal tendons can be well assessed with ultrasound and MRI (Fig 14).

Other

Other sequelae of severe ankle sprain injury include recurrent joint effusions, capsulitis, or chronic ligamentous instability.

Figure 7:
Isolated chondral defect talar dome (coronal PD MRI).

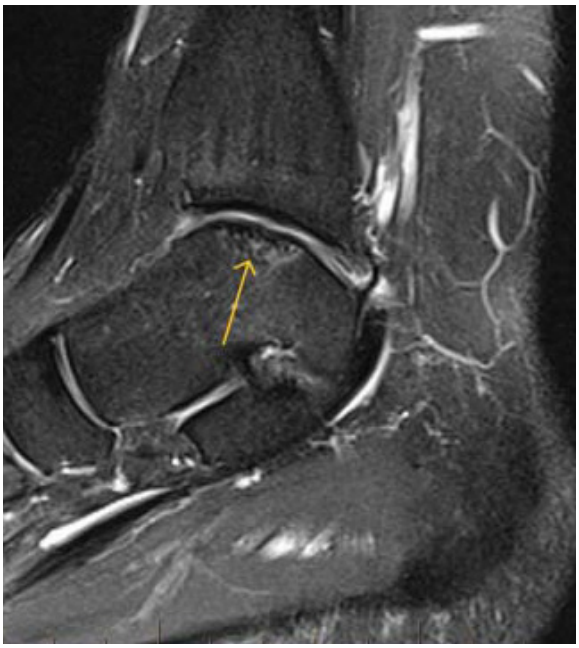

Figure 8:
Osteochondral lesion talar dome (sagittal T2 fat suppressed MRI).

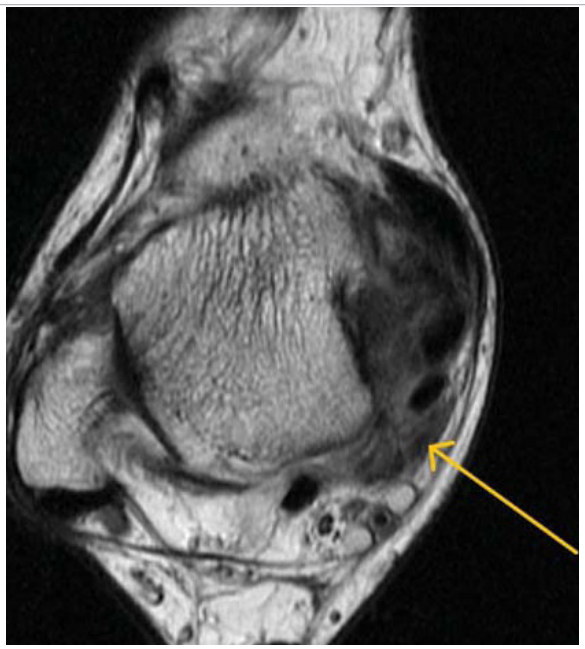

Figure 9:
POMI lesion. Soft tissue scarring partially encases the tibialis posterior and FDL tendons (axial PD MRI).

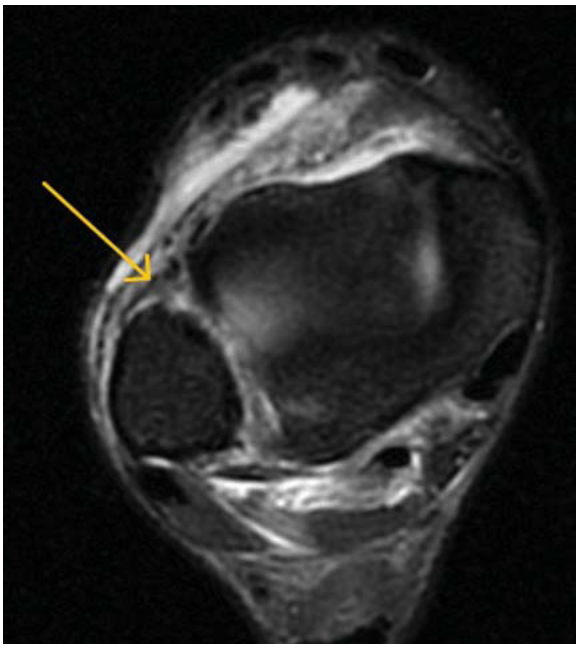

Figure 10:
Disruption of the anterior inferior tibiofibular ligament. (axial T2 fat suppressed MRI).

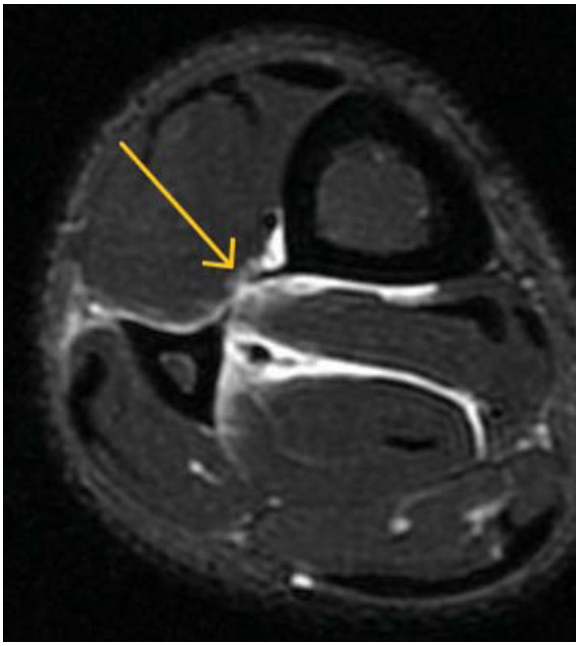

Figure 11:
Fluid and oedema and partial disruption of the interosseous membrane between the tibia and fibula (axial T2 fat suppressed MRI).

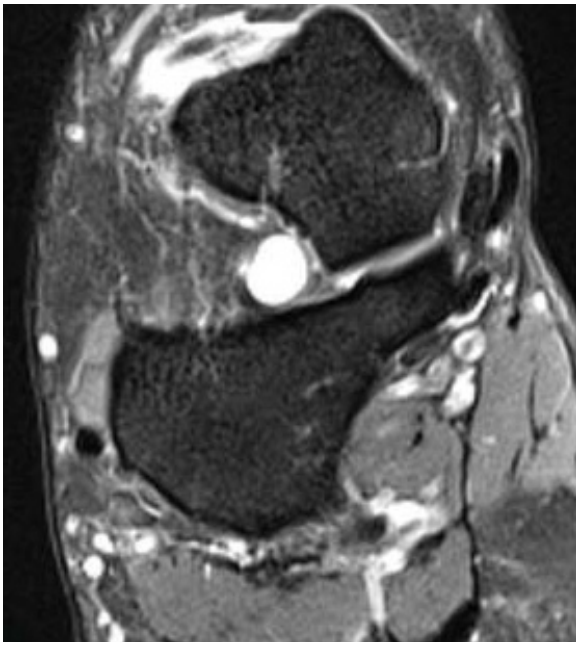

Figure 12:
Sinus tarsi ganglion (Coronal PD fat saturated MRI).

Figure 13:
CT guided injection of the sinus tarsi ganglion shown in Fig 12.

Figure 14:
Peroneus Brevis delamination tear (Coronal PD MRI).

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Dr Tim Dunshea studied medicine at Monash University and completed radiology training at St Vincent's Hospital. After that Tim completed a musculoskeletal imaging fellowship with I-MED Radiology Victoria House. He has extensive experience in cardiac imaging including coronary artery CTA (for which he has ANZCTCA Level 1 registration). Tim has worked with I-MED Radiology since 2006 and has been Clinic Director at I-MED Radiology Warringal since November 2009, and is also Clinic Director at I-MED Radiology Heidelberg. Tim is an experienced general radiologist with special interests in MRI, cardiac CT, and ultrasound.

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