

Chapter 17

The proximal tarsal region

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INTRODUCTION

Imaging of the proximal tarsus can be achieved in both standing and anaesthetized horses. The height of the horse and the amount of hind end musculature determines which magnet configuration will produce the best images of this region. A horse with short limbs and wide, well-muscled quarters may be more difficult to fit into the long, narrow bore of some high-field magnets under general anaesthesia. In the same way, the side of the lateral recumbency should be considered because it is generally easier to bring the proximal tarsus of the lower hind limb closer to the isocentre of the magnet compared with the upper one. Well developed hind limb musculature can prevent the limb from being placed far enough into the bore to allow the tarsus to be positioned at the isocentre of the magnet. The tarsus of a horse with this body type (or stature) is more easily positioned in a standing system. In contrast, for a narrow horse with long limbs, the height of the tarsus and width between the limbs may make it more difficult to image this region within a standing system. The degree of sway in the proximal aspect of the limbs in a standing, sedated horse is often substantially greater than in the distal aspect of the limbs. This degree of sway can produce significant motion artefact and can make it frustrating to acquire images of the proximal tarsus. Therefore, selection of sedation and patient handling is particularly important when acquiring images of the proximal tarsus using the standing system.

Soft tissue and osseous abnormalities of the proximal tarsus can be assessed using MRI, and it may be possible to identify lesions that have not been detected using other imaging modalities.

OSSEOUS PATHOLOGY

Fracture

Fractures of the talus, calcaneus and distal tibia can be identified on magnetic resonance images of the proximal tarsus. Fractures may be visualized as sharp, well-defined linear areas of increased or decreased signal intensity with loss of the normal bone contour. These findings can extend through the cortical, subchondral and cancellous bone. Displacement of the fracture can result in defects in the osseous margins. In acute fractures, increased signal

intensity on fat-suppressed images is evident in the bone surrounding the fracture. Displaced, complete fractures are generally evident on radiographs. In these cases, magnetic resonance imaging (MRI) may not be required to reach a diagnosis. However, a non-displaced fracture may be difficult to visualize on radiographs until there is osseous remodelling around the fracture line. MRI is useful for identification of non-displaced fractures when pain is localized to this region with marked radiopharmaceutical uptake and no radiographic evidence of a fracture (Figure 17.1).

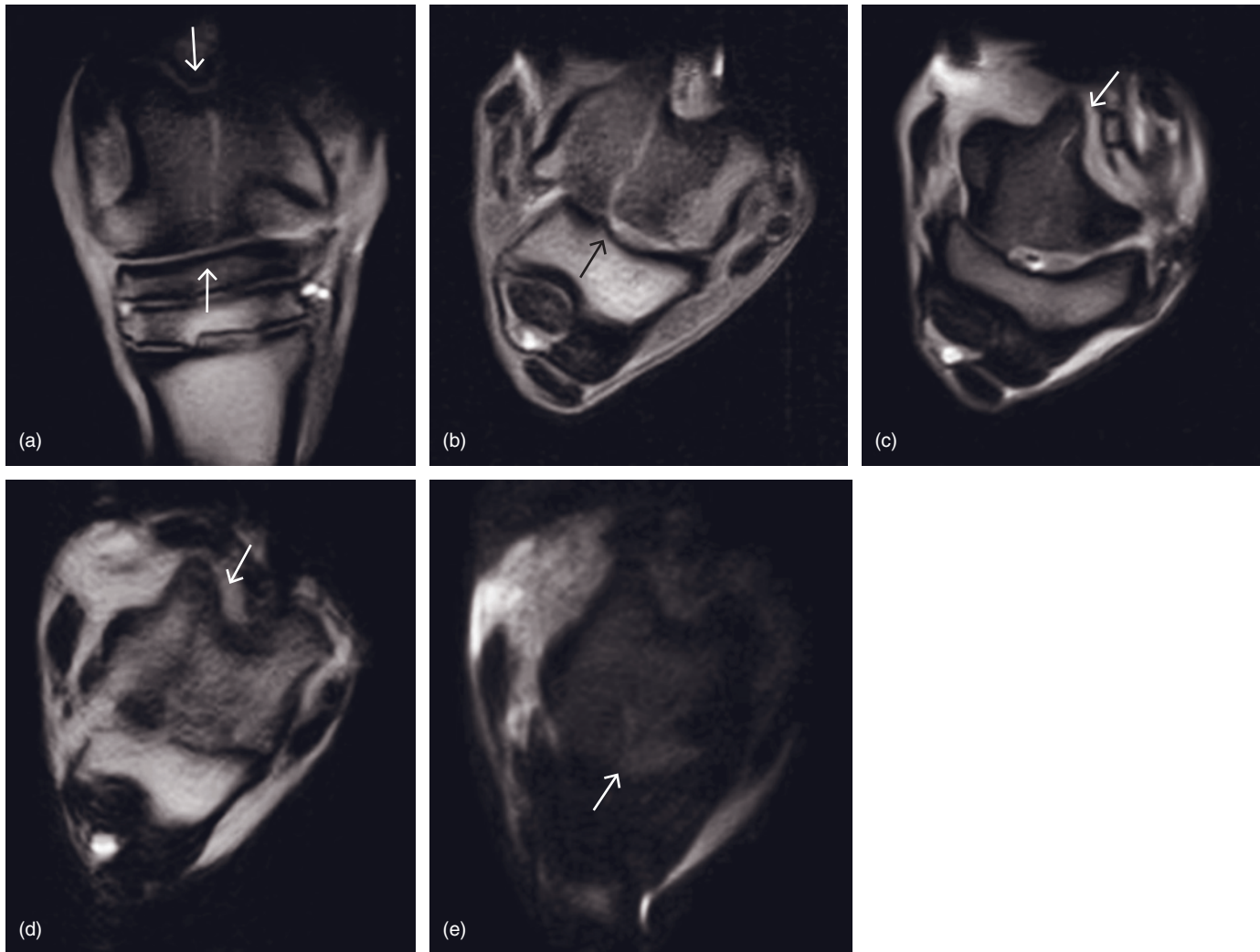


Figure 17.1 Talus fracture. (a) Dorsal and (b) transverse T1-weighted and (c) transverse T2* gradient-echo, (d) T2 FSE and (e) STIR images of the left tarsus of a 12-year-old Arabian endurance horse that had pulled up non-weight bearing lame after an endurance ride, 3 weeks previously. Radiographs were equivocal on initial evaluation but there was greatly increased radiopharmaceutical uptake in the talus. MR images were obtained standing using a 0.27T MR imaging system, demonstrating a minimally displaced complete sagittal fracture of the talus (arrows). The fracture line itself is seen as high signal intensity on T1-weighted images, bounded by low signal intensity representing bone oedema/damage. On T2* gradient-echo images the fracture line is seen as high signal intensity surrounded by moderately high signal intensity within the adjacent bone with a boundary of low signal intensity due to a fat-water cancellation artefact. On T2 FSE images, it is more difficult to see the fracture line, which is represented by lower signal intensity than the surrounding bone, but the absence of low signal intensity in the surrounding bone confirms that the low signal intensity boundary seen on T2* gradient-echo images represents an artefact and not sclerosis. On STIR images, there is generalized increase in signal intensity within the talus clearly defining bone oedema/pathology but it is relatively difficult to define a fracture line.

Fractures occurring in regions with/of extensive sclerosis are easily identified on many different sequences. Acute non-displaced fractures surrounded by fluid in the absence of sclerosis are most easily identified on T1-weighted images as a linear hyperintense line bordered by low signal intensity fluid. A fracture line can be obscured by surrounding high signal intensity on fat-suppressed images, although high signal highlights the presence of bone damage. In general, careful evaluation of the cortical and compact bone on all sequences will reveal the presence of a fracture.

Following identification of a fracture, it is important to evaluate all the associated soft tissue structures and not be misled into considering solely osseous injury. Assessment of the adjacent soft tissue structures including tendon, ligament and joint capsule attachments is necessary to determine the complete extent of the injury.

Bone trauma/bruising/contusion

Where there has been trauma to the tarsal bones without macroscopic fracture, there may be osseous damage related to trabecular microfracture, bone oedema and increased blood flow. This condition is known as bone bruising or contusion and is demonstrated as high signal intensity on fat-suppressed images with a concurrent low signal intensity on T1-weighted and sometimes T2*-weighted images dependent on the sequence parameters and relative fluid/fat content (see fat-water cancellation artefact). High signal intensity can be identified on T2-weighted images at the site of injury, depending on sequence parameters. This may affect more than one bone or joint, and adjacent soft tissues and joints should be evaluated (Figures 17.2 and 17.3). Haemarthrosis may occur concurrently and can be identified as

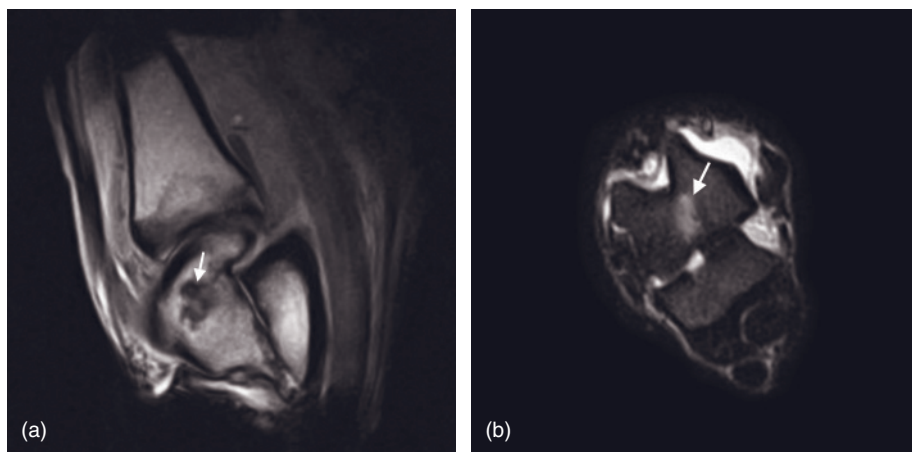


Figure 17.2 Focal talus pathology. (a) Sagittal T1-weighted and (b) transverse STIR low field images from a 3-year-old racehorse with acute lameness following competition. Low signal intensity can be identified in the talus on the T1-weighted image with corresponding increased signal intensity in the same area of the talus on the STIR image (white arrows). These findings represent fluid within the talus indicating oedema, contusion and/or osteonecrosis. There is also synovitis of the tibiotarsal joint characterized by increased fluid. This finding is best demonstrated on the STIR transverse image.

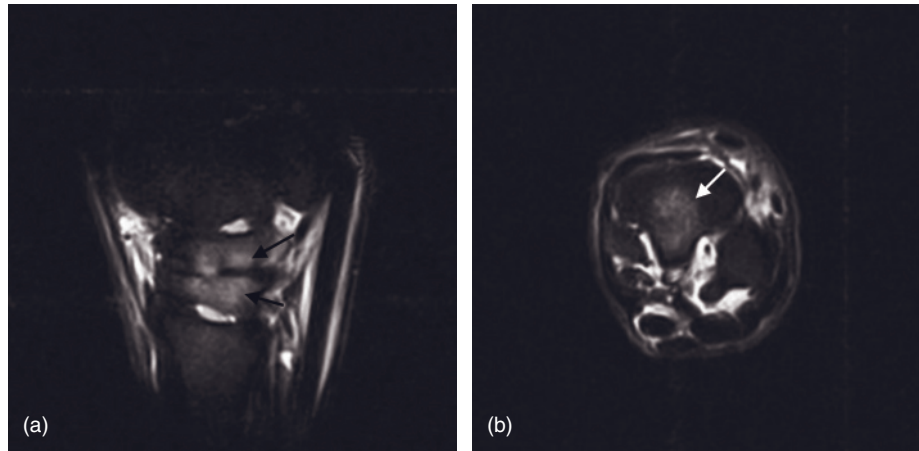


Figure 17.3 Tarsal bone trauma/contusion. (a) Sagittal and (b) transverse STIR images from a 9-year-old Warmblood jumper with an acute grade 3/5 lameness following competition. These images demonstrate increased signal intensity in the central and third tarsal bones (arrows). This pattern represents diffuse fluid accumulation and is consistent with trauma. In this case, the lameness gradually improved over a 6-month time period and the horse returned to full work after that time. Osteophytosis on the dorsal proximal aspect of the third metatarsus can be identified on the sagittal image.

layering of different signal intensities in the joint. Red blood cells will settle in the dependent portion of the joint and will be covered by a serum layer. Bone bruising representing strain-related trabecular and cortical damage may occur adjacent to a ligament enthesis where there has been partial avulsion or excessive strain, so associated ligaments and periligamentar tissues should be assessed for damage. Ligament strain may result in secondary joint instability, so other articular ligaments, associated tendons and the articular surface should be assessed (Figures 17.4 and 17.5).

Where there is damage to an adjacent tendon, tendon sheath or bursa, then there may be concurrent bone bruising within the local bone if the damaged ligament or tendon is abrading the bone and causing secondary trauma. Bone bruising can result from biomechanical damage at the time of the original trauma or from altered biomechanics following an injury, resulting from tendon or ligament damage. Alternatively, bone contusion can be seen in association with adjacent inflammation (Figure 17.6).

When evaluating a bone contusion on MR images, a more severe focus of injury within the bone can be surrounded by diffuse changes resulting in increased signal intensity on fat-suppressed images. The entire region of increased signal intensity indicates osseous injury of various degrees. The severity of the injury generally correlates with the amount of signal increase on fat-suppressed images.

Osseous cyst-like lesions

Osseous cyst-like lesions (OCLLs) may be incidental or of clinical significance. They often have intermediate signal intensity surrounded by low
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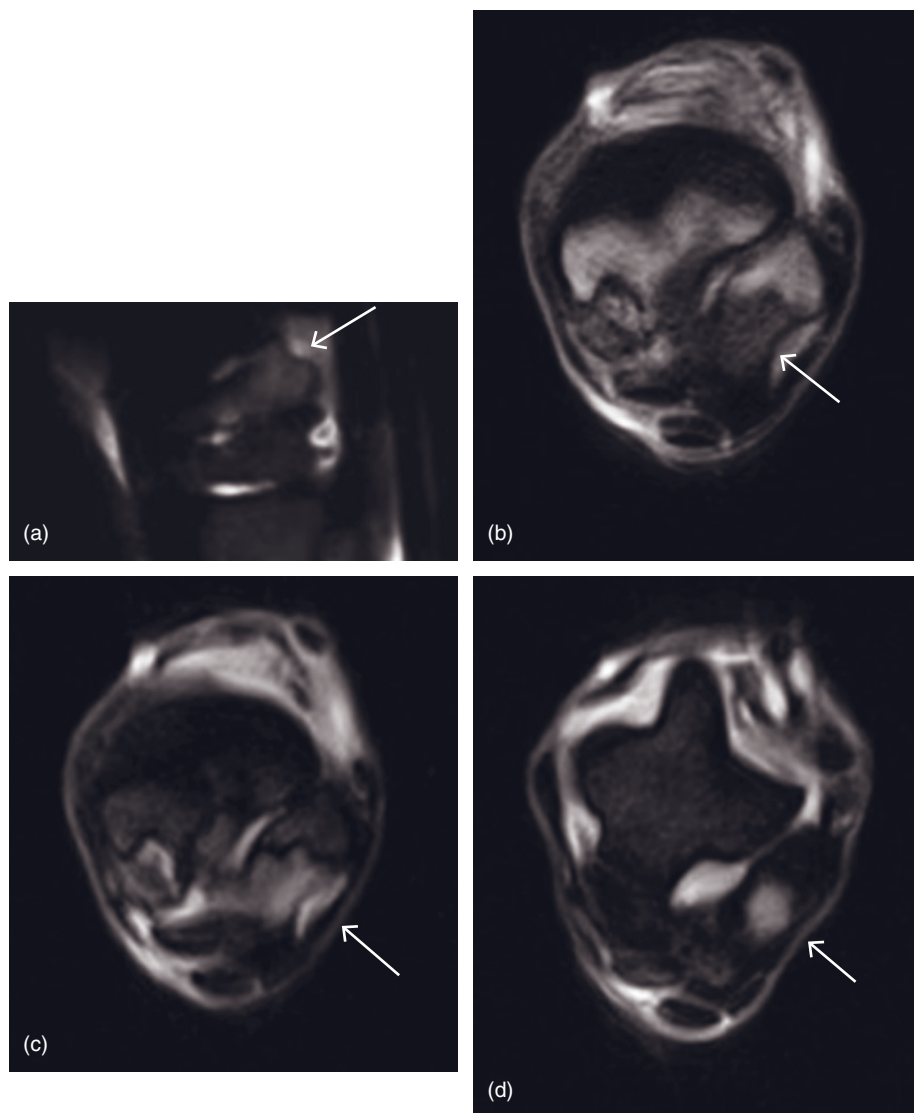


Figure 17.4 Bone bruising/trauma of calcaneus, central and fourth tarsal bones. (a) Sagittal STIR, (b) transverse T1-weighted and (c) T2* gradient-echo at the level of the central tarsal bone, and (d) at the level of the calcaneus images of the left tarsus of a 5-year-old flat racehorse with moderate to severe lameness following racing, 10 days prior to MRI. The lameness was localized to the tarsal region, radiographs were equivocal but there was generalized increase in radiopharmaceutical uptake, particularly towards the lateral aspect, so images were obtained standing using a 0.27 T MR imaging system. There is evidence of bone bruising in the plantar part of the central tarsal bone and its articulation with the fourth tarsal bone, and in the fourth tarsal bone and calcaneus (arrows). Bone bruising is seen as high signal intensity on STIR images and low signal intensity on T1-weighted images. On the T2* gradient-echo images, the fat-water cancellation artefact results in high signal intensity where there is very high water content, with a hypointense rim where there is equal fat and water content. The lack of a low signal intensity margin on T1-weighted images confirms that the signal intensity pattern on the T2* gradient-echo scan represents an artefact and not bone sclerosis.

signal intensity sclerosis. Well-circumscribed cysts without alterations in signal intensity in the surrounding bone are more likely to be incidental (Figure 17.7) in contrast to cyst-like lesions with irregular or poorly circumscribed margins and alterations in signal intensity in the surrounding bone. There is insufficient information available at this time to determine whether apparently incidental OCLs can progress and become clinically significant. Reaction of the bone surrounding an OCL, as demonstrated by the presence of fluid or extensive sclerosis, represents more significant bone damage and may be suggestive of pain (Figure 17.8). Where there is a query about clinical significance in a horse with unilateral lameness, there is value to assessing the contralateral limb for the presence and nature of any OCLs.

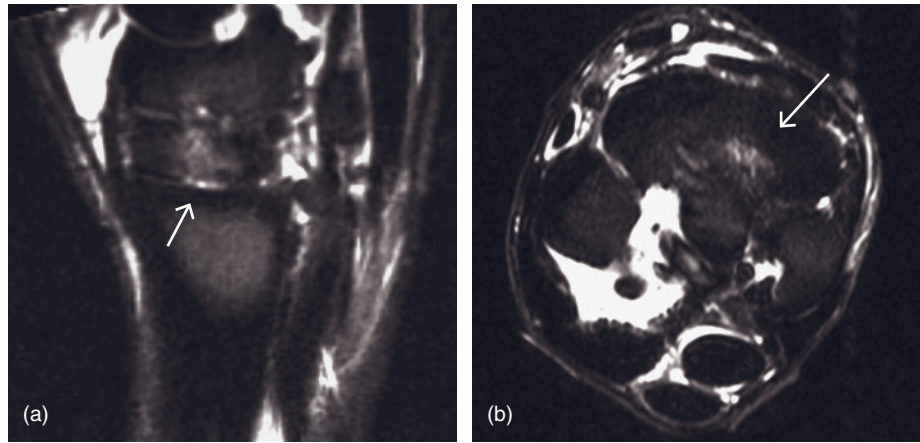


Figure 17.5 Tarsal bone oedema. (a) Sagittal and (b) transverse high-field STIR images of the tarsus from a 10-year-old Quarter Horse gelding who presented with a history of right hind limb lameness of 2 months duration that manifested as ‘hopping’ when he was cantered on the right lead. There is increased signal intensity in the third tarsal bone, consistent with tarsal bone bruising (arrows). This horse was 2/5 lame in the right hind limb and 3/5 after distal limb flexion, and the gait abnormality was abolished following anaesthesia of the deep branch of the lateral plantar nerve. Radiographs of the tarsus showed slight joint space narrowing and osteophyte formation at the margins of the distal intertarsal and tarsometatarsal joints. Following MRI, lameness was treated by injection of the tarsometatarsal joints with 6mg of triamcinolone each and the horse was confined to a stall with light hand walking only for 2 months. The horse resumed normal exercise 3 months after MRI. Images courtesy of Dr Michael Schramme, North Carolina State University.

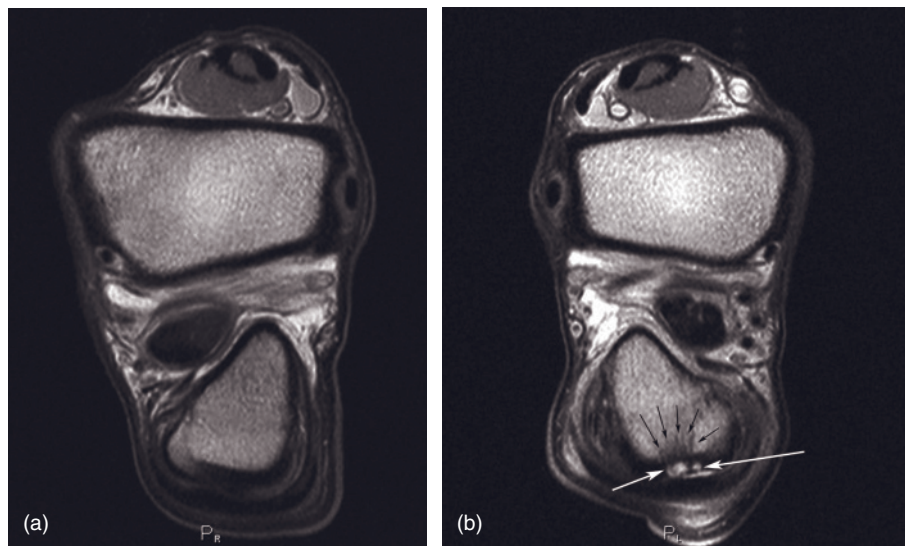


Figure 17.6 Calcaneal bursitis. High-field MR images of the tarsal region in a 6-year-old Selle Francais gelding with chronic problems in the right calcaneal bursa. There is calcaneal bursitis and osteitis of the tuber calcis. (a) Transverse proton density image of the normal left calcaneus. (b) Transverse proton density image of the right tarsus. There are focal regions of high signal intensity over the point of the calcaneus (white arrows) with sclerosis (black arrows). (c) Sagittal proton density image of the normal left tarsus in the region of the calcaneus. (d) Sagittal proton density image of the left normal tarsus in the region of the sustentaculum tali. (e) Sagittal proton density image of the right tarsus in the region of the calcaneus. There is effusion of the calcaneal bursae (gastrocnemius calcaneal bursa and intertendinous calcaneal bursa) (arrows). (f) Sagittal proton density image of the right hind in the region of the sustentaculum tali. There is increased signal in the calcaneus (arrow). (g) Sagittal T2 FSE image of the tarsus in the same plane as (e), demonstrating increased fluid within the calcaneal bursa. (h) Sagittal STIR image of the normal left tarsus. (i) Sagittal STIR image of the right tarsus showing increased signal in the calcaneus (arrow).



Figure 17.6 *Cont'd*



Figure 17.7 Osseous cyst-like lesion (OCLL) in the third tarsal bone. High-field sagittal plane 3D T1 gradient-echo MR image of an OCLL within the third tarsal bone of a 6-year-old Thoroughbred National Hunt racehorse. The horse had no history of tarsal lameness, and the cyst-like lesion was found as an incidental finding. There is slight indentation of the articular surface within the centrodistal joint, but no evidence of osteoarthritic changes.

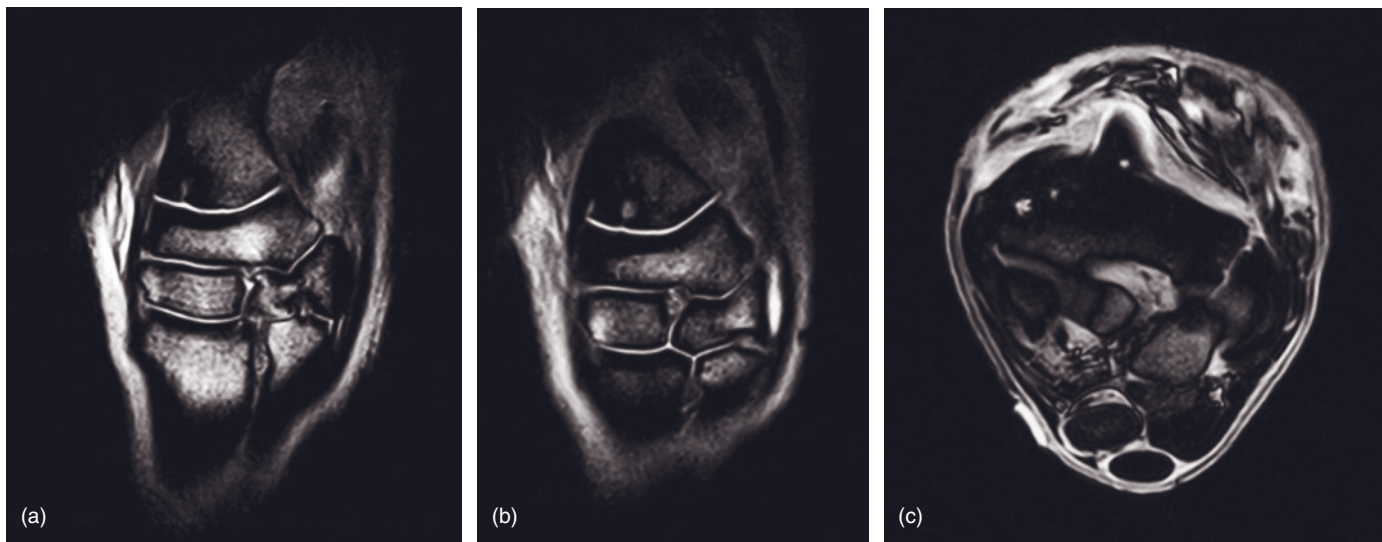


Figure 17.8 Osseous cyst-like lesions (OCLLs) in the talus. (a, b) Low-field sagittal and (c) transverse 3D T1 gradient-echo MR images of the left tarsus of a 4-year-old Warmblood mare with left hind lameness localized partially to the tarsus, a positive flexion test and a history of stumbling with this limb. There are multiple OCLLs in the talus, with evidence of communication with the articular surface. There is indentation of the articular surface and corresponding change in the opposing articular surface. There is irregular increase in trabecular bone density surrounding the cyst-like lesions. The horse had multiple osteochondrosis type lesions in other joints and was ultimately euthanized.

Osseous cyst-like lesions can be associated with subchondral bone trauma or lysis at the articular surface (Figure 17.9). Where an OCLL occurs adjacent to an articular surface, it is important to evaluate the articular surface for defects in the cartilage and subchondral bone, lack of joint congruency and any associated osteoarthritic changes (Figure 17.10). These [428]