

Case Resolution

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DIAGNOSIS: Osteochondral lesion of the talus.

DISCUSSION

An osteochondral defect is a lesion of the cartilage and the underlying subchondral bone of a joint. These lesions are mainly caused by traumatic events, commonly associated with ankle sprains and fractures. Secondary causes include degenerative joint disease, joint mal-alignment, metabolic abnormalities, and avascular necrosis. Most talar lesions involve both the superficial cartilage and the underlying bone. Purely chondral lesions are less common. Talar osteochondral defects occur more often on the medial side of the talar dome, where they are larger and deeper compared to their lateral counterpart.

The disabling complaints in a young active patient population and the limited intrinsic self-healing capacity result in talar osteochondral defects being a challenging medical condition.

Small defects show some spontaneous repair, where the defect is covered with a fibrous like tissue. This fibrocartilage has inferior mechanical qualities due to its simpler structure and the lower amount of glycosaminoglycan content. Larger defects may present repair tissue that can become unstable and fail to fill the defect, leading to chronic pain, inflammatory reaction, and potentially to osteoarthritis.

The diagnostic assessment starts with the patient's history and physical examination, establishing the impact of deep ankle pain due to an osteochondral lesion. Stability and ankle alignment are also studied. Anteroposterior, mortise and lateral conventional ankle radiographs are used to establish the presence of an osteochondral lesion. These imaging results also serve to identify both concomitant degenerative changes and ankle alignment.

However, conventional radiographs cannot identify approximately 50% of osteochondral lesions and often underestimate the defect size when compared to CT results. Additional imaging studies may provide a better visualization of the lesion dimensions and location. In clinical practice, MRI and CT imaging procure good to excellent sensitivity and specificity for detecting osteochondral defects. CT uses X-ray imaging to create three-dimensional images of the ankle. There are two types of CT modalities: the most widely known multislice CT and the cone-beam CT. Cone-beam CT has some advantages over multislice CT, including superior spatial resolution, lower radiation dose, and fewer metal streak artifacts, which should be considered in patients with previous surgical interventions or internal fixations. Traditionally, obtaining a cartilage CT image directly without additional intra-articular contrast is not possible. CT accurately shows the location of lesions on the talar dome (Figura 4). The anatomical grid proposed by Raikin is used to locate them. Central lesions are the most common followed by lateral lesions. CT is also used to establish the bony dimensions of a lesion, the integrity of the subchondral bone plate, and the presence of subchondral cysts.

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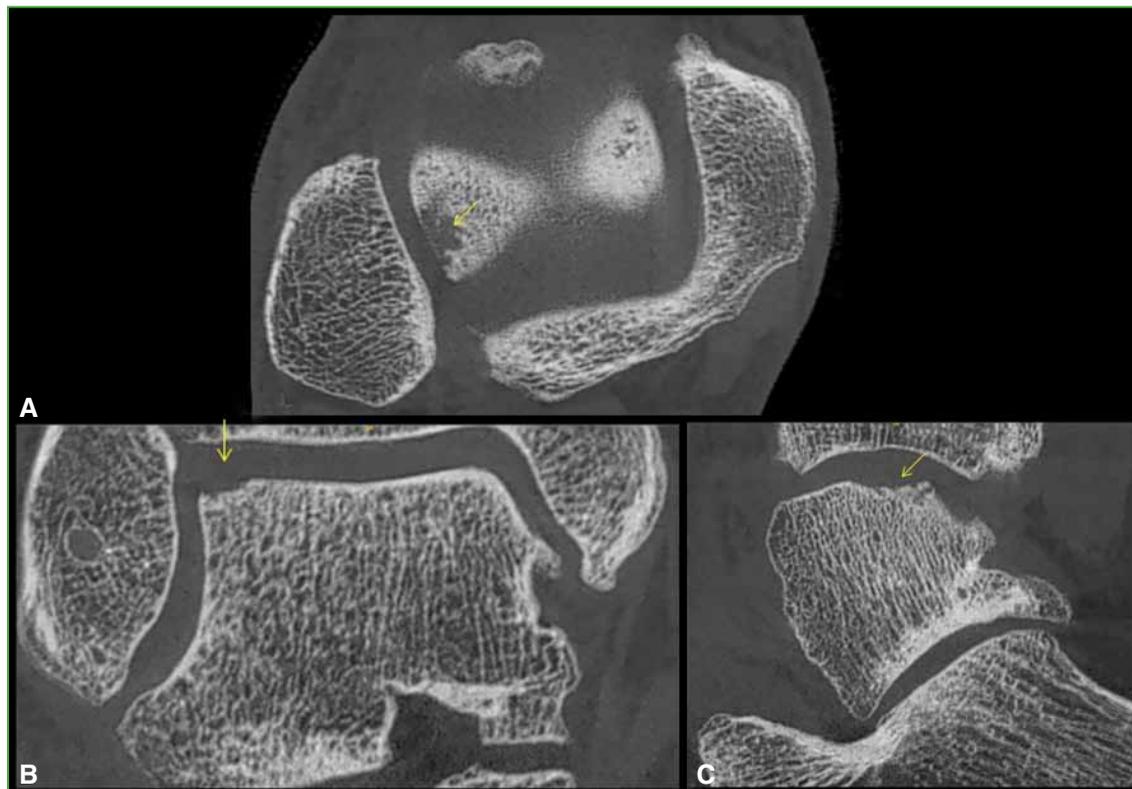


Figure 4. Non-contrast cone-beam CT axial (A), coronal (B) and sagittal (C) sections revealing a bone irregularity on the medial region of the talar dome.

The width and length of osteochondral lesions were thought to be the key defining factors for defining management, but lesion depth and other dimensions have lately been considered to bear significant weight. Treatment may vary in the presence of 15mm diameter or 5mm deep lesions. Painful osteochondral lesions may inherently indicate bony involvement since the nerve endings are situated in the bone and not in the cartilage, making the subchondral bone an important structure for imaging studies. Finally, CT has been shown to be a useful preoperative planning tool because surgeons can assess the available bone stock and plan the approach with an anterior arthroscopy.

Ferkel and Sgaglione (1993) CT-based classification consists of 5 stages:

Stage I: Cystic lesion, intact roof

Stage IIA: Cystic lesion with communication to the talar dome surface

Stage IIB: Open articular surface lesion with overlying non-displaced fragment

Stage III: Open articular surface lesion with overlying non-displaced fragment, with radiolucency

Stage IV: Displaced fragment

MRI uses a magnetic field with electromagnetic waves to compile images without ionizing radiation. MRI is suited for detecting bone edema and provides detailed information on soft tissues, cartilage, and lesion stability. MRI is also able to image small disruptions in the cartilage, such as fissures. MRI commonly overestimates the lesion size due to edema. Improvements in imaging resolution, ankle coils, and additional sequences using T2- or PD-weighted fat suppression have helped in dealing with this problem. In addition, ankle morphological features are more difficult to image compared to other joints because ankle cartilage is very thin.

The follow-up of operative patients or those undergoing conservative therapy is routinely performed with the same modalities used for diagnostics (radiographs, MRI, and CT), preferably at the lowest frequency that may be clinically relevant. Radiographs provide too little information, while CTs are not suited for assessing the cartilage repair tissue and commonly increase the radiation burden, and MRI is an expensive study, limiting its frequency for some patients.

Intra-articular contrast material injection, both in MRI (arthro-MRI) (Figure 5) and in CT scanning (arthro-CT) (Figures 6-8), currently constitutes the most reliable study to assess the hyaline cartilage, as the contrast material distends the joint capsule and separates the contact surfaces, thus increasing sensitivity and specificity. Although unfortunately invasive, this method is well-tolerated and has a low complication rate.

Several adaptations to imaging studies have been to obtain indirect images of the cartilage quality. For MRI, techniques such as T2 mapping or delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) with intravenous injection were developed. While T2 mapping is related to water content and the reaction with collagen fibers in cartilage, dGEMRIC relies on glycosaminoglycan content present in cartilage. Both water and glycosaminoglycan concentrations decrease with cartilage degeneration. The advantage of T2 mapping over dGEMRIC is that it does not require intra-articular contrast injection.

To summarize, routine clinical imaging is currently limited to conventional X-ray, CT and MRI imaging. Although there are non-invasive methods to study osteochondral lesions (T2 mapping and dGEMRIC), the most reliable and specific methods are arthro-MRI and, mainly, arthro-CT with intra-articular contrast material injection. However, as previously mentioned, there are numerous suggestions for imaging and classification systems: Berndt and Harty (radiography), Ferkel (CT), Anderson (MRI), among others. We need to achieve a uniform use of the classification system and to improve non-invasive imaging that would allow for better reproducible morphologic, quantitative and qualitative data that may be compared over time to explore the effect of new treatment techniques on repair tissue. Therefore, the challenge for clinical imaging lies in defining a method, ideally a non-invasive one, with clinically relevant parameters.

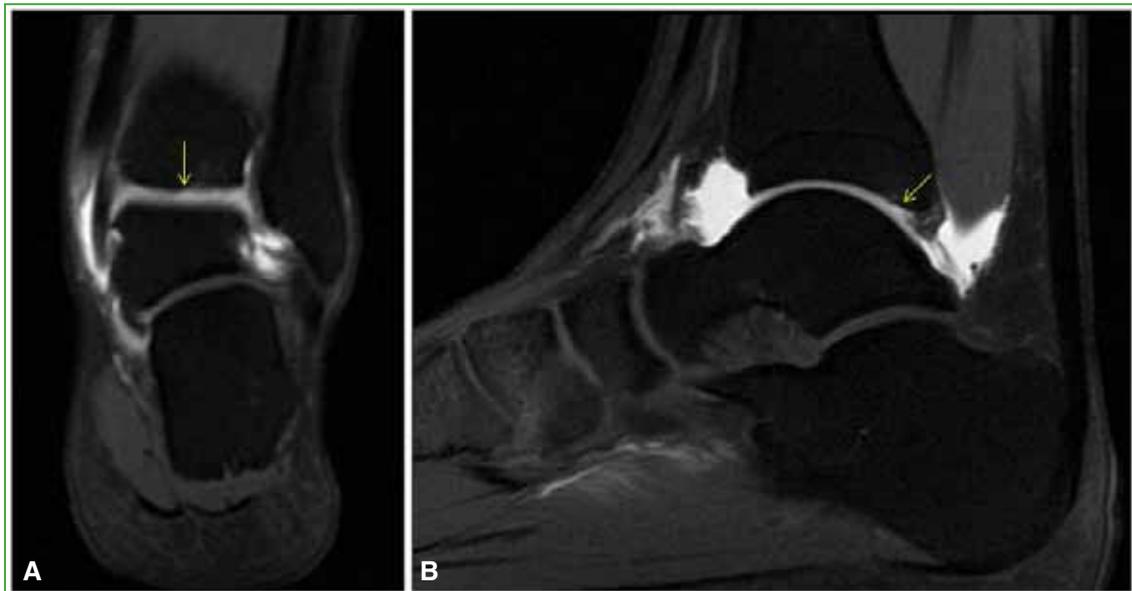


Figure 5. Ankle arthro-MRI coronal (A) and sagittal (B) sections. This type of imaging study includes intra-articular contrast injection to improve the technique sensitivity and specificity. Image shows a small hyaline cartilage defect on the posterior aspect of the posterior articular surface of the tibia that is filling with contrast material.



Figure 6. Cone-beam arthro-CT coronal (A) and sagittal (B) sections showing two fissure lines of the talar dome hyaline cartilage.

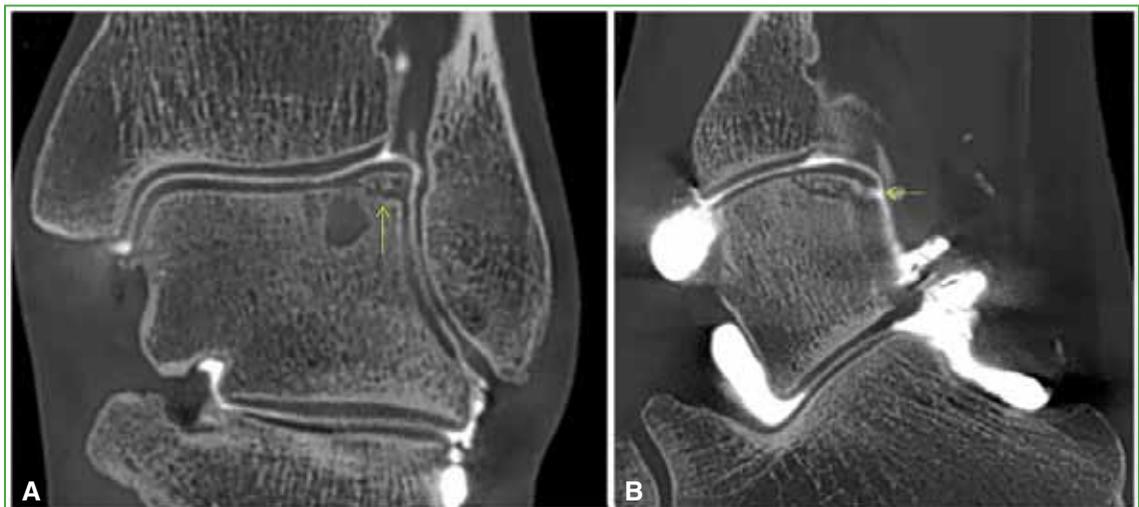


Figure 7. Cone-beam arthro-CT coronal (A) and sagittal (B) sections showing a fracture line of the hyaline cartilage on the posterior side of the osteochondral lesion.



Figure 8. Cone-beam arthro-CT coronal (A) and sagittal (B) sections showing a large bone defect and fragmentation, which are completely covered by hyaline cartilage.