ANATOMY

The TFCC is a fibrocartilage-ligament complex which stabilizes the distal radioulnar joint (DRUJ), transmits axial load between the carpus and the ulna, and stabilizes the ulnar aspect of the carpus. The TFCC is comprised of the disc proper (articular disc), meniscus homologue, ulnolunate ligament, ulnotriquetral ligament, proximal ligamentous component, volar and dorsal radioulnar ligaments, and the ulnar collateral ligament. Because these structures are located in small areas, high-resolution imaging is essential to diagnose TFCC injuries.

In coronal MR images, disc proper, triangular ligament, meniscus homologue, ulnotriquetral ligament are appreciated, and in axial plane images, volar and dorsal radioulnar ligaments are well recognized. The normal disc proper shows asymmetrical bowtie-like low signal intensity. The signal intensity of the ulnar attachment of the TFCC was higher than that of the disc proper on proton density-weighted images and T2*-weighted images. Most of the TFCC have two attachments to the ulna, inserting into the ulnar styloid tip (distal lamina) and the fovea (proximal lamina). The tissue between two triangular ligaments is called ligamentum subcruentum.

Three main arterial branches supply the TFCC: 1) the ulnar artery, 2) the palmar branch of the anterior interosseous artery, and 3) the dorsal branch of the anterior interosseous artery. The dorsal branch of the anterior interosseous artery runs on the dorsal side, while the palmar
branch and the ulnar artery run on the palmar side. These three arteries supply blood to the periphery of the TFCC in a radial fashion. Histologic sections demonstrate that the vessels penetrate the peripheral 15-20% of the disc while the central portion and radial attachment are avascular, and consist mainly of chondrocytes in a fibrocartilaginous matrix. Therefore, tears of the TFCC in its vascular zone can heal if repaired, while those in the central avascular zone cannot [1]. The vascularity and cellularity are more prominent in infants than in adults.

TFCC morphology is significantly associated with ulnar variance. The TFCC with zero ulnar variance is slightly tilted to a horizontal line at the level of the lunate fossa cartilage surface of the radius. The TFCC with minus variance runs more horizontally and is thicker and shorter than the TFCC with zero variance and plus variance. The TFCC with plus variance is thin, stretched distally, and arc-shaped between the ulnar head and proximal carpus. Therefore, there is an inverse relationship between ulnar variance and thickness of the TFCC. The ulnar plus variance leads to ulnocarpal impaction and yields greater biomechanical forces, particularly rotational forces, in the disc compartment of the joint [2]. TFCC thickness appears to be related to the size of the available space between the ulnar head and the carpal bones, and a thin TFCC would be more vulnerable to biomechanical forces.

**TFCC INJURY**

The imaging evaluation of the TFCC is still a challenge. Traditional imaging tools for investigation of wrist pain include plain radiographs, wrist arthrography, CT and MR imaging. Plain radiography is not useful in characterizing TFCC abnormalities. However, radiographic findings associated with abnormalities of the complex, such as positive ulnar variance, the presence of an ulnar styloid fracture associated with peripheral avulsion of the TFCC, and
avulsion fracture of the fovea of the ulna, that indicate injury at the site of attachment of the proximal lamina of the TFCC [3]. The neutral PA is the best view to measure ulnar variance. In addition, radiographs enable us to assess chondromalacia of the lunate or ulnar head, degenerative joint disease of the DRUJ, lunotriquetral or scapholunate instability, dorsiflexed intercalated segment instability (DISI), or volar flexed intercalated segment instability (VISI).

Although there is some disagreement regarding the optimal technique for compartmental injection (one injection, triple injection), the role of arthrography in the diagnosis of TFCC defects is well established. Its challenge is its lack of specificity with a high incidence of findings on the contralateral asymptomatic side [4]. MR imaging is, however, a useful imaging tool to diagnose TFCC injuries [5-10] with Potter et al. reporting sensitivity for high-resolution MR imaging of 100%, a specificity of 90%, and an accuracy of 97% with the use of arthroscopy as standard treatment [9]. Also, in a recent report [11], high-resolution MR images obtained using a microscopy surface coil allowed assessment of each TFCC component and showed high accuracy for diagnosing radial attachment injury, disc injury, and triangular ligament injury of the TFCC (100% sensitivity; 100% specificity). Given MR’s strengths, MR arthrography is probably the most accurate test for TFCC lesions and is useful for evaluating TFCC as well as other intrinsic wrist ligaments. To conduct this evaluation, clinicians see the high signal fluid contained by perforations of the TFCC on fat-suppressed T1-weighted MR arthrographic images. With a traumatic TFCC tear, fluid or contrast material is usually present in the DRUJ. Conventional MR imaging sometimes does not adequately reveal the peripheral attachment of the TFCC because the ulnar attachment is often obscured by an intermediate signal surrounding loose vascular connective tissue on proton density-weighted images and T2*-weighted images. MR arthrography with fat-suppressed T1-weighted images may provide better detection of ulnar-
sided peripheral TFCC tears than conventional MR imaging. The terms communicating (full-thickness) and noncommunicating (partial thickness) defects are used in the discussion of TFCC abnormalities. The presence of contrast material in the DRUJ after radiocarpal opacification or in the radiocarpal compartment after DRUJ injection diagnoses a communicating defect in the TFCC (articular disc). Noncommunicating, or partial defects involving the proximal and distal aspects of the TFCC can be demonstrated following injection of the DRUJ and radiocarpal joint, respectively [3]. Although some limitations exist for the use of this technique in the evaluation of the TFCC as discussed earlier, no cases of infection due to this procedure have been reported to date, and these potential risks seem to be negligible. [12] The TFCC with associated bony fracture is adequately analyzed using multidetector CT arthrography. The disc proper is clearly seen on a coronal image from its cartilaginous insertion on the radial sigmoid notch to its ulnar attachment [13].

REFERENCES


