Intrinsic Ligaments of the Wrist
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The intrinsic, or intercarpal, ligaments of the wrist connect the bones of the proximal and midcarpal rows. These include the trapeziocapitate, capitohamate, scapholunate and lunotriquetral ligaments. Of these, the scapholunate and lunotriquetral ligaments are by far the most important. MRI is the primary imaging modality for assessing the integrity of the intrinsic ligaments, either with or without intra-articular gadolinium arthrography. These techniques have largely replaced the use of conventional wrist arthrography.

Both the scapholunate and lunotriquetral ligaments are horseshoe shaped ligaments with dorsal, volar and membranous portions. The dorsal and volar portions consist of fibrocartilage with the membranous, central portions consisting of loose connective tissue. The strength of the ligaments comes from their fibrocartilaginous elements with very little contribution from the membranous portion of the ligaments.

Because of the orientation of the ligaments within the carpus it is extremely difficult to image the entire ligament on a single imaging acquisition or by using conventional imaging planes. In most cases the combination of at least two imaging planes, typically the coronal and axial planes, are required to visualize the ligaments in their entirety. Viewing the scapholunate or lunotriquetral ligaments in the coronal plane alone is particularly confounding as partial volume effects with the central membranous portions may suggest tears when they are not actually present. It is possible to image (separately) the scapholunate and lunotriquetral ligaments with oblique axial sections which are perpendicular to the coronal orientation of the ligaments in order to view the dorsal and volar components throughout the full extent of the ligament. The potential downside to that approach is the need for additional time and imaging over and above the conventional wrist exam.

In addition to choosing the correct imaging plane to image these ligaments, image contrast is an important consideration in tailoring exams to best see the normal fibrocartilage and to distinguish signal alterations related to the acquisition technique from true degeneration or tears. In our practice we rely heavily on intermediate weighted FSE T2 (TR=4000ms, TE 40-55ms) images with chemical fat suppression for this assessment. With that sequence the normal ligament should be black with intrasubstance degeneration appearing gray and tears having more of a bright fluid signal intensity. The use of gradient echo imaging, even when isotropic acquisitions are possible, is felt to be less desirable as this contrast in the ligaments is often altered to an intermediate gray tone, making it difficult to assess true pathology. 3D FSE, steady state free precession imaging and other techniques may have application in the future but currently basic FSE sequences will yield the best and most consistent results.

It goes without saying that the use of a dedicated receiver coil is required for optimum imaging of the intrinsic ligaments of the wrist. In our practice we primarily rely on a
single channel, transmit/receive (T/R) coil to obtain the best combination of uniformity and high SNR needed to achieve the optimum spatial resolution required. New coil developments, including multichannel T/R or even receive only coils, may allow even better imaging in the future but it is critical to maintain image uniformity over the small field of view – high SNR in and of itself is not enough for imaging small parts effectively. Ideally imaging would take place at a minimum field strength of 1.5T. If available, however, 3T is preferred with a trend toward improved diagnostic accuracy for the both the scapholunate and lunotriquetral ligaments at the higher field strength. Dedicated extremity magnets are now available at 1.5T and are also potentially good tools for wrist imaging.

Tears of the scapholunate ligament can be very difficult to assess. MR arthrography may help (especially if preceded by conventional arthrography as part of the instillation of contrast into the joint) but often close attention to certain signs may be nearly as effective. The association of a small ganglion is also a nice confirmation that a tear is indeed present, most commonly at the dorsal aspect of the ligament. Widening of the scapholunate interval in and of itself may not indicate a tear as the ligament may be redundant rather than disrupted. Fluid seen in a gap in the ligament or the presence of a ganglion cyst are the best secondary signs supporting the presence of a tear.

The lunotriquetral ligament is much more difficult to assess with relatively lower sensitivity and specificity for tears than any other ligamentous structure in the wrist. MR arthrography may also be helpful but generally it is less helpful than for the scapholunate ligament. A widening in the interval is sometimes helpful as would be the identification of a free edge or fluid tracking along the free, torn edge but often the best sign is any disruption of Gilula’s arc at the lunotriquetral interval. This can certainly be appreciated on x-ray but it also a sensitive sign of a tear on MRI. Ganglion cysts arising from the lunotriquetral ligament are much more rare than those coming from the scapholunate or triangular fibrocartilage complex, so that this is generally not a useful sign for lunotriquetral tears. Lunotriquetral ligament tears may also be seen in ulnar impaction syndrome in association with chondromalacia of the proximal lunate and radial sided tears of the triangular fibrocartilage complex, but do not occur 100% of the time in this entity. The presence of imaging signs of ulnar impaction should promote close inspection of the lunotriquetral ligament but is not diagnostic of a tear on its own.

In summary, MR imaging of the intrinsic ligaments of the wrist is challenging but close attention to technique, secondary signs such as the presence of ganglion cysts and disruption of alignment can assist in improving diagnostic accuracy for these tiny structures. The use of 3T can also improve accuracy, particularly for the lunotriquetral ligament.

References:
