

MR Imaging of Wrist Ligaments



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KEYWORDS

- MR imaging wrist • MRI wrist • Wrist ligaments • Scapholunate • Lunotriquetral
- Extrinsic ligaments • Intrinsic ligaments • Diagnostic performance • Carpal instability

KEY POINTS

- Ligamentous injury to the wrist is a common cause of chronic wrist pain and carpal instability.
- MR imaging, coupled with knowledge of normal anatomy, allows consistent visualization of all major intrinsic and extrinsic wrist ligaments.
- Ligament tears are diagnosed by the presence of abnormal signal hyperintensity on fluid-sensitive sequences, ligament discontinuity, or altered morphology.
- MR imaging has excellent specificity, good sensitivity, and substantial interobserver agreement for diagnosis of partial and complete scapholunate and lunotriquetral ligament tears. Sensitivity is enhanced with higher field strengths and use of magnetic resonance arthrography.
- Appropriate clinical management is guided by wrist MR imaging interpretation.

DISCUSSION OF THE PROBLEM

There is a high prevalence of ligamentous injury to the wrist in the setting of trauma, particularly in the presence of bone abnormalities.^{1–4} A recent study found that 60% of patients presenting for wrist MR imaging following trauma had intrinsic ligament injury and 75% had extrinsic ligament injury.⁴ Such traumatic ligament injuries have delayed functional consequences⁵ such as progressive carpal instability with secondary deterioration of the wrist joint and chronic wrist pain.^{6–8} However, a history of trauma is not always elicited, and this has led to the theory that, in some cases, degenerative changes in ligaments alone may cause pain in the stable wrist,^{9–11} and may extend over time, possibly via increased local motion, to complete tears and resultant instability.¹² Regardless of cause, appropriate clinical management is predicated on accurate and timely diagnosis.^{13,14}

MR imaging is a proven, established technology for the detection, evaluation, and follow-up of

disorders of the wrist, including ligamentous disorders.^{14–16} Wrist MR imaging frequently alters planned clinical management, including the decision to perform surgery.¹⁴ All of the major intrinsic and extrinsic wrist ligaments are easily identified^{17–25} on 1.5 T and 3 T MR imaging with a range of accuracies for tear detection depending on the particular ligament and disorder type.^{7,26–36} MR imaging is considered appropriate in the work-up of both radial-sided and ulnar-sided wrist pain with normal or nonspecific radiographs, according to the American College of Radiology Appropriateness Criteria.³⁷

ANATOMY

The ligaments of the wrist guide and constrain the complex motion of the carpus relative to the forearm and metacarpals, and facilitate transmission of force between carpal bones.^{38–40} They are commonly divided into intrinsic and extrinsic groups.⁴¹ Intrinsic ligaments arise and insert

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entirely within the carpus onto carpal bones, whereas extrinsic ligaments arise in the forearm, or extend onto metacarpals, and have additional attachments to retinacula and/or tendon sheaths.^{41,42} The appropriate nomenclature is to name the ligaments for the bones from which they originate and onto which they insert, proximal to distal, radial to ulnar.⁴³ This article describes some of the most important ligaments organized by anatomic location.

Interosseous Ligaments

Interosseous ligaments are intrinsic intercarpal ligaments that unite carpal bones either within a carpal row or between carpal rows. The most important and well-studied are those that separate the radiocarpal and midcarpal compartments, providing the flexible linkage of the proximal carpal row, the scapholunate ligament (SLL) and lunotriquetral ligament (LTT).^{42,44} In contradistinction, the 3 distal carpal row interosseous ligaments that unite the trapezium with the trapezoid, the trapezoid with the capitate, and the capitate with the hamate, allow normal communication between the midcarpal and common carpometacarpal compartments, as they do not extend from volar wrist joint capsule to dorsal capsule.⁴⁴

Scapholunate ligament

The SLL is a C-shaped³⁹ structure, approximately 18 mm in length, and 2 to 3 mm in thickness,¹² connecting the mutually articulating surfaces of the ulnar scaphoid and radial lunate (Fig. 1).⁴⁵ It has 3 histologically and functionally distinct segments.⁴⁵ Knowledge of segmental anatomy is crucial because the site and extent of the ligament disruption may be used to differentiate between a traumatic tear and a degenerative perforation, the latter of which sometimes represents asymptomatic senescent change.^{31,46}

Dorsal scapholunate ligament The dorsal segment of the SLL is a true histologic articular ligament, with normally taut transversely oriented collagen fascicles averaging 3 to 5 mm in proximal to distal length (Fig. 1).⁴⁵ It has a trapezoidal shape in the axial plane, with shorter volar fibers, and is intimately associated with the dorsal joint capsule. Distally it merges with the dorsal intercarpal ligament (DIL).⁴⁵

Volar scapholunate ligament The volar segment of the SLL is a much thinner ligament (no more than 1 mm thick), with slightly obliquely oriented collagen fibers from proximal-ulnar to distal-radial.⁴⁵ The lunate attachment is just dorsal to

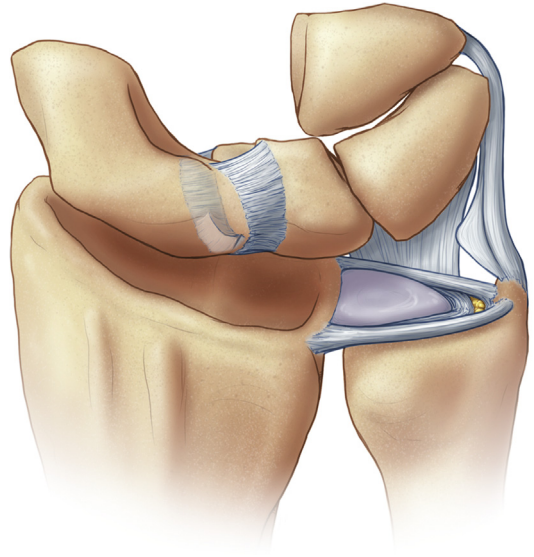


Fig. 1. Interosseous ligament. Note the 3 histologically and functionally distinct segments of the SLL, with meniscoid proximal fibrocartilaginous component, and transversely oriented collagenous dorsal and volar components. The LTL is analogous (not shown). Capsular ligaments have been removed. (From Mayo Foundation for Medical Education and Research, all rights reserved; with permission.)

the long radiolunate ligament (LRL) attachment and immediately proximal to the cartilage surface. It is not normally possible to directly visualize the volar SLL with an arthroscope, because thin laminae of collagen fibers extending from the radioscapolunate neurovascular bundle isolate it from the radiocarpal joint.⁴⁵

Proximal (membranous) scapholunate ligament Unlike the dorsal and volar segments of the SLL, the proximal or membranous segment is grossly anisotropic fibrocartilage rather than a true ligament.⁴⁵ It has a pliable consistency and its attachments blend with the articular cartilage of the scaphoid and lunate. Usually there is a meniscus-like extension that protrudes into the scapholunate joint space, with wedge-shaped or triangular cross-sectional geometry, usually nicely shown in the coronal plane with MR imaging (Fig. 1).^{12,45} This segment is the weakest part of the SLL, prone to degenerative perforations, and the only area of the SLL that can be readily seen by arthroscopy in the absence of scapholunate dissociation.¹²

Lunotriquetral ligament

The lunotriquetral ligament (LTL) is slightly longer, measuring approximately 20 mm in length, and

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