Evaluation of lesions of the internal ligaments of the wrist: conventional magnetic resonance imaging vs MR arthrography

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Purpose

To assess the diagnostic value of direct MR arthrography compared to conventional MR imaging in the diagnosis of different pathologic entities affecting the internal ligaments of the wrist mainly the scapholunate and lunotriquetral ligaments.
Methods and materials

This study included fifty-one patients; (33 males, 18 females). Consent was obtained from all patients before doing this study. All patients complained of chronic refractory unexplained wrist pain, whether post traumatic (30) 58.85%, or non-traumatic (21) 41.2%.

All patients were subjected to the following:

_ History taking, and clinical provisional diagnosis,

_ Radiological investigations:
  o Conventional unenhanced MRI.
  o X-ray and conventional arthrography films.
  o MR arthrography.

_ Surgical arthroscopy as gold standard was performed for 44 patients. Three patients refused to undergo the procedure, and four patients improved on medical treatment and physiotherapy. Two musculoskeletal radiologists assessed the MR images for internal ligaments lesions before and after contrast injection, but were unaware of the arthroscopic results.

MRI was performed using GYROSCAN INTERNA 1.5T Scanner. The patients were scanned in the supine position, with the arms alongside the body and the dorsum of the hand parallel to the coronal plane of the magnet. A circular coil (C 200) was placed over the wrist joint, and was secured by rubber bands.

Preliminary scout localizers in axial, coronal and sagittal planes were done. N.B.: Additional coronal STIR images were done.

MRA was performed guided by fluoroscopy, using Omni Diagnost Multipurpose X-ray system.

The area of interest was prepared and draped in a sterile fashion using Betadine solution. The subcutaneous tissue was locally anesthetized, using 4-5 ml of xylocaine 0.5% solution for injection. Gadopentetate dimeglumine 0.1 ml was
added to 3 ml nonionic contrast medium, 5 ml xylocaine, and sterile saline solution was added to form a mixture of 20 ml.

Mid carpal injection: The needle tip (22 gauge) of a 5 cm syringe was advanced through a dorsal approach into the mid carpal joint compartment at the scaphocapitate space, and injection was continued until contrast was visualized within the capitolunate joint space. Single mid carpal injection was done only in 10 patients, where leakage into the radio carpal joint was encountered. The remaining 41 patients underwent double injection into the mid carpal, and radio carpal joints.

Radiocarpal injection: The needle was advanced 0.5 cm distal to Lister’s tubercle at the dorsum of the radius, either the needle was volarly angulated 10-15° to avoid striking the dorsal lip of the radius, or the joint was flexed over a sponge, and the needle was advanced perpendicular to the joint.

Three to four milliliters of contrast mixture was injected into the mid carpal compartment, until the patient felt some pressure in the joint, then radio carpal injection was done using 4-5 ml or more if communication with the distal radioulnar joint (DRUJ) was established.

The patient was transferred to the MRI unit after 30 min and active exercise of the joint was advised to ensure uniform dispersion of the contrast. The same surface coil was used and T1 fat suppression sequences (TR 550, TE 24, FOV 10, SL 2.5, gap 0.3 MATRIX 256 • 516, NEX 4) in coronal, axial and sagittal planes were done, also coronal T1 3D FFE was done (TR 25 TE 5 FOV 100, SL 1.5, MATRIX 224 • 516, NSA 2).
Results

Conventional MRI findings: The SL ligament was normal in 38 patients (74.5%), partially torn in 4 patients (7.8%), and completely torn in 9 patients (17.6%), Fig. 1(A) while the LT ligament was normal in 48 patients (94%) Fig. 3(A), and torn completely in 3 patients (5.9%).

Perilunate instability as a result of ligamentous disruption was found in the form of DISI (dorsal intercalated segmental instability) in 9 patients (17.6) Fig. 1(C), VISI (volar intercalated segmental instability) in 1 patient (2%).

MR arthrography findings: The SL ligament was normal in 28 patients (54.9%), partially torn in 11 patients (21.5%) Fig. 2, and completely torn in 12 patients (23.5%) Fig. 1(B), while the LT ligament was normal in 35 patients (68.6%), and completely torn in 14 patients (27.5%) Fig. 3(B), and partially torn in 2 patients (3.9%).

Comparative statistical analysis: Comparing the sensitivity of conventional MRI versus MRA to achieve accurate diagnosis was done by correlating the final diagnosis of each modality with the results of arthroscopy

(Charts from 1-4).
Fig. 1: Fig (1): chronic ulnar sided wrist pain after direct trauma to the left wrist. Conventional MRI. Coronal T2 3D FFE (A) shows a linear bright signal traversing the SL (scapho-lunate) ligament (long arrow). Single intra articular injection into the mid carpal compartment was performed, with free leakage into the radio carpal joint compartment through the scapho-lunate interval, followed by MRA. Coronal T1 Fat suppressed T1 WIS (B) revealed a linear band of contrast seen traversing the scapholunate (SL) ligament (long arrow) denoting its tear. Sagittal Fat suppressed T1 WIS (C) revealed DISI (dorsal intercalated segmental instability) of the lunate bone (Curved arrow).

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Fig. 2: Pain of the right wrist following history of direct trauma. Conventional MRI which revealed normal internal ligaments. Intra articular injection into both mid carpal and radio-carpal joint compartments was performed, followed by MRA. Coronal T1 Fat suppressed image shows bright contrast signal traversing the SL (scapho-lunate) ligament suggesting partial tear.

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Fig. 3: Fig (3): chronic ulnar sided right wrist pain, with no history of direct trauma. Conventional MRI. Coronal T2 3D FFE (A) revealed: Subchondral cystic and sclerotic changes at the proximal pole of the lunate bone (thin straight arrows). Intra articular injection of contrast into the mid carpal & radio carpal compartments was performed, and followed by MRA. Coronal T1 3D FFE MR Arthrographic images revealed: Torn LT (luno-triqueteral) ligament (thin straight arrow).

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Charts (1 & 2): Scapho-lunate ligament lesions

Fig. 4

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Charts (3 & 4): Luno-triquetal ligament lesion

Fig. 5

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Conclusion

We believe that direct MR arthrographic imaging is well suited for detecting intra-articular lesions of the wrist. The presented diagnostic results of MR arthrography are superior to the results of un-enhanced MRI. Direct MR arthrography as a reliable diagnostic tool is strongly recommended if lesions of the internal ligaments are suspected.

MR arthrography cannot replace arthroscopy; however, it could be a potent additional tool for wrist imaging. It can facilitate the diagnosis and the indication for surgery of the wrist and help to reduce arthroscopic interventions for purely diagnostic purposes and without any therapeutic consequences.
References


