

Efficacy of Magnetic Resonance Imaging and Clinical Tests in Diagnostics of Wrist Ligament Injuries: A Systematic Review



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Purpose: To investigate the diagnostic performance of magnetic resonance imaging (MRI) and clinical provocative tests on injuries to the triangular fibrocartilage complex (TFCC), the scapholunate (SL) ligament, and the lunotriquetral (LT) ligament. **Methods:** An electronic literature search of articles published between January 1, 2000, and February 28, 2014, in PubMed, Embase, and the Cochrane Library was carried out in April 2014. Only studies of the diagnostic performance of MRI and clinical provocation tests using wrist arthroscopy as the gold standard were eligible for inclusion. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist guided the extraction and reporting of data. The methodologic quality of the included articles was assessed with the revised Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool. The primary outcome measure was the negative predictive value (NPV) of wrist MRI and provocative wrist tests, which was defined as the probability of an intact wrist ligament given a negative investigation. The question was whether negative results of MRI or provocative tests were enough to safely discontinue further investigation with arthroscopy. A minimum NPV of 95% was considered a clinically relevant cutoff value. The secondary outcome measures were the positive predictive value (PPV), sensitivity, and specificity. **Results:** A total of 7 articles (327 patients with MRI and 105 patients with clinical tests) were included in this systematic review. The included articles displayed heterogeneity regarding participants, diagnostic methods, and study design. Seven articles investigated the diagnostic performance of MRI, whereas 1 article investigated clinical testing. The NPVs of MRI were as follows: TFCC, 37% to 90%; SL ligament, 72% to 94%; and LT ligament, 74% to 95%. The NPVs of clinical tests were 55%, 74%, and 94% for the TFCC, SL ligament, and LT ligament, respectively. Only 1 study reached the predetermined cutoff value for the primary outcome measure (NPV \geq 95%) but only for MRI of the LT ligament; this study also reached a borderline-cutoff NPV of 94% for MRI of the SL ligament. Another study reached borderline-cutoff NPVs of 94% both for MRI and for clinical tests of the LT ligament. **Conclusions:** A negative result from MRI is unable to rule out the possibility of a clinically relevant injury to the TFCC, SL ligament, or LT ligament of the wrist. Clinical provocation wrist tests were of limited diagnostic value. The current gold standard—wrist arthroscopy—remains the preferred diagnostic technique with sufficient conclusive properties when it comes to wrist ligament injuries. **Level of Evidence:** Level II, systematic review of Level II diagnostic studies.

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Wrist ligament injuries, especially triangular fibrocartilage complex (TFCC) tears and scapholunate (SL) ligament tears, are common and are frequently associated with dislocated distal radial fractures. These ligament injuries, which regularly affect

young individuals, are often overlooked because of a lack of knowledge or experience, as well as difficulties in the diagnostic procedure. The clinical diagnosis, including provocative wrist tests, is complex and challenging, and radiologic examinations have still not

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shown enough sensitivity, specificity, or accuracy.¹ Missed ligament injuries are known to result in persistent pain, instability, and reduced grip force and range of motion, as well as degenerative osteoarthritis.

The initial diagnosis of SL ligament injury can be difficult because it often takes 3 to 12 months before dynamic instability is detected on plain radiographs (with clenched-fist films) with an SL ligament gap greater than 3 mm and an SL ligament angle greater than 60°. In fact, approximately 5% of “wrist sprains” involve an SL ligament tear.² It is well known that associated ligament injuries, particularly SL ligament and TFCC injuries, are common in non-osteoporotic adults with dislocated distal radial fractures.³⁻⁶ Ulnar-sided wrist pain and distal radioulnar joint (DRUJ) instability, due to TFCC injury, are the most common sequelae following distal radial fractures in adults and present as an independent worsening factor.³

A positive Watson test (scaphoid shift maneuver) indicates a total SL ligament injury. However, positive tests occur in approximately 20% of the normal population, which contributes to diagnostic difficulties.^{7,8} When performing the scaphoid shift maneuver, the examiner grasps the wrist from the radial side, placing the thumb on the palmar prominence of the scaphoid while wrapping the fingers around the distal radius.^{7,8} This enables the examiner’s thumb to push on the scaphoid with counter-pressure provided by the fingers. The examiner’s other hand grasps the patient’s hand at the metacarpal level to control the wrist position. Starting in ulnar deviation and slight extension, the wrist is moved radially with a simultaneous slight flexion and with constant thumb pressure applied to the scaphoid. The Watson test is positive if the scaphoid is unstable and can be subluxated dorsally and the patient has pain at the dorsum of the wrist.^{7,8}

A clinical examination of the TFCC and DRUJ should include clinical DRUJ stability tests and a TFCC test called the foveal sign test,⁹ that is, tenderness on the palmar aspect of the fovea located proximal to the pisiform and ulnar to the flexor carpi ulnaris tendon. DRUJ stability is tested with the forearm held in neutral rotation by the examiner, who stabilizes the hand and the distal radius with a firm grip to make them one unit.¹⁰ Then, using the other hand, the examiner forces the ulna as the second unit in a dorsal/palmar direction, relative to the stabilized unit of the hand and radius. The stability of the DRUJ is compared with that of the uninjured wrist. The lunotriquetral (LT) ligament is examined with the ballottement test (Shuck test) and Derby wrist test.^{7,8}

In 2001 Hobby et al.¹ published a systematic review of the diagnostic performance of wrist magnetic resonance imaging (MRI) for tears of the TFCC and the intrinsic carpal ligaments, as well as osteonecrosis of the carpal bones. When it came to wrist ligament injuries, they

reported that high-resolution MRI was an accurate means of diagnosing TFCC tears; although MRI was highly specific for SL and LT ligament injuries, however, its sensitivity was remarkably low. Arthroscopy was concluded to be the gold standard for diagnosing wrist ligament injuries. In 1995 LaStayo and Howell¹¹ reported that wrist provocative tests were effective in identifying patients who required further investigation and, in those patients requiring an arthroscopic diagnostic operation, the provocative tests proved to be more effective in predicting the absence of injury than its presence.

The purpose of this systematic review was to investigate the diagnostic performance of MRI and clinical provocative tests on injuries to the wrist ligaments (TFCC, SL ligament, and LT ligament) with an updated and extended literature search compared with that of Hobby et al.¹ More specifically, the purpose was to assess whether wrist arthroscopy was necessary to make a diagnosis of wrist ligament injuries or whether negative results of MRI and provocative tests were sufficient to discontinue further diagnostic evaluation. We hypothesized that MRI and clinical provocation tests were unable to rule out the possibility of a clinically relevant ligament injury.

Methods

Protocols

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.¹² The quality assessment of included studies was performed using the revised Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool.¹³

Eligibility Criteria

English-language articles published between January 1, 2000, and February 28, 2014, on the diagnostic performance of wrist MRI or provocative wrist tests of injuries to the wrist ligaments (TFCC, SL ligament, and LT ligament) using wrist arthroscopy as the gold standard were eligible for inclusion. Only studies with detailed data enabling the statistical analysis of outcome measures were eligible for inclusion. The exclusion criteria were skeletally immature participants, cadaveric or animal studies, therapeutic and prognostic studies, study protocols, and reinjury and revision surgery, as well as studies of instrumentation and surgical technique. Expert opinions and case reports were also excluded.

Information Sources and Search

A systematic electronic search of PubMed, Embase, and the Cochrane Library was carried out on April 3 to April 4, 2014, by an expert in electronic search

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