Diagnostic accuracy of magnetic resonance imaging and magnetic resonance arthrography for triangular fibrocartilaginous complex injury: a systematic review and meta-analysis

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CRD summary
This review concluded that magnetic resonance arthrography, rather than magnetic resonance imaging, be performed when there were questions about the diagnosis and subsequent management of patients with ulnar-sided wrist pain. The review process was generally well-conducted but limitations of the available evidence and the analysis undertaken mean that the authors' conclusions should be treated with caution.

Authors' objectives
To determine the diagnostic accuracy of magnetic resonance imaging (MRI) and magnetic resonance arthrography (MRA) for detecting triangular fibrocartilaginous complex (TFCC) tears.

Searching
MEDLINE, EMBASE, AMED, BioMed Central, CINAHL, Cochrane Bone, Joint and Muscle Trauma Group register, Cochrane Central Register of Controlled Trials (CENTRAL) and Zetoc were searched from inception to August 2010 without language restrictions; the search strategy was available in an online appendix. OpenSIGLE, WHO International Clinical Trials Registry Platform, Current Controlled Trials, UKCRN Portfolio Database, NTIS and UK NRR Archive were searched to identify unpublished studies. Reference lists of retrieved studies were searched. Study authors contacted.

Study selection
Diagnostic accuracy studies of any design that compared MRI or magnetic resonance arthrography to a reference standard of arthroscopic or open surgical findings for the detection of TFCC tears were eligible for inclusion. Studies in children were excluded. Where reported, the mean age of participants ranged from 22.4 to 43 years. Magnetic resonance magnet strength ranged from 0.5 to 3.0 Tesla. Most of the studies used coronal views; sagittal views were also used often. Most studies did not state who interpreted the scans; where reported, studies used one or two radiologists and several used musculoskeletal specialists. Time from injury to investigation was generally not reported.

One reviewer screened titles and abstracts. Two reviewers then independently assessed potentially relevant titles and abstracts and full papers for inclusion in the review.

Assessment of study quality
Two reviewers assessed study quality using the 14-point QUADAS tool; disagreements were resolved by discussion.

Data extraction
Data were extracted by one reviewer to produce 2x2 tables of test performance. Data were verified by a second reviewer. Sensitivity and specificity with 95% confidence intervals (CI) were calculated. Study authors were contacted for missing data.

Methods of synthesis
Heterogeneity was investigated by assessing the clinical variation across studies and visual inspection of the forest plots. Where no substantial heterogeneity was observed, summary receiver operating characteristic (SROC) plots were produced (Littenberg and Moses model). Pooled estimates of sensitivity and specificity were calculated using a formula suggested by Deeks. Data for MRI and magnetic resonance arthrography were analysed separately and indirect comparisons were made. A sensitivity analysis was conducted to determine the impact of magnet strength.

Results of the review
Twenty-one studies met the inclusion criteria (982 patients, 982 wrists; range 11 to 125). Seventeen studies assessed MRI and eight assessed magnetic resonance arthrography. Seventeen of the 21 studies reported recruiting a representative patient spectrum, six avoided progression bias, 15 avoided partial verification bias, 19 avoided...
differential verification bias, 19 avoided incorporation bias, 13 reported blinding of interpreters of the index test, three reported blinding of interpreters of the reference standard and 11 reported uninterpretable/intermediate results.

**MRI (17 studies):** The summary estimate of sensitivity for detecting acetabular labral tears was 75% (95% CI 70 to 79) and specificity was 81% (95% CI 76 to 86). Technology using 3.0 Tesla magnets (sensitivity 86%, 95% CI 65 to 97 and specificity 100%, 95% CI 87 to 100; one study) had higher accuracy than those using 1.5 Tesla (sensitivity 70%, 95% CI 64 to 75 and specificity 79%, 95% CI 72 to 85; 11 studies).

**Magnetic resonance arthrography (eight studies):** The summary estimate of sensitivity was 84% (95% CI 79 to 89) and specificity was 95% (95% CI 92 to 98). Technology using 3.0 Tesla magnets (sensitivity 100%, 95% CI 79 to 100 and specificity 100%, 95% CI 82 to 100; one study) had higher accuracy than those that used 1.5 Tesla (sensitivity 83%, 95% CI 78 to 89 and specificity 95%, 95% CI 91 to 98; three studies).

**Authors' conclusions**

Given its acceptable diagnostic test accuracy, it is recommended that magnetic resonance arthrography, rather than MRI, be performed when there are questions about the diagnosis and subsequent management of patients with ulnar-sided wrist pain.

**CRD commentary**

The review addressed a clear research question supported by reproducible inclusion criteria. The search was extensive and included attempts to reduce publication and language bias. Diagnostic filters were not used in the search strategy, which reduced the potential for missing studies. Apart from the initial scanning of titles and abstracts, each stage of the review was conducted in duplicate, which reduced risks of error and bias. Study quality was assessed using appropriate criteria and the results were reported fully in an online appendix.

Pooled results of sensitivity and specificity were calculated separately which could overestimate accuracy; there were few study details reported so it was unclear how clinically heterogeneous the studies were. As a result, the reliability and generalisability of the pooled estimates was uncertain. The authors produced SROC curves but more robust SROC models are available from which estimates of sensitivity and specificity could be derived. All studies were at an unclear or high risk of at least one major bias, which limited the reliability of the results further.

The review process was generally well-conducted but limitations of the available evidence and the analysis undertaken mean that the authors' conclusions should be treated with caution.

**Implications of the review for practice and research**

**Practice:** The authors did not state implications for practice beyond those in the overall conclusion.

**Research:** The authors stated that further studies were needed to investigate whether slice thickness and the position of the wrist were important in optimising diagnostic accuracy.

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