The diagnostic accuracy of anterior cruciate ligament rupture using magnetic resonance imaging: a meta-analysis

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CRD summary
This well-conducted review concluded that magnetic resonance imaging was highly accurate for the diagnosis of complete anterior cruciate ligament rupture. Its use was recommended to confirm diagnosis before surgery. The review methods were robust and the authors' conclusions reflected the data presented and are likely to be reliable.

Authors' objectives
To assess the diagnostic utility of magnetic resonance imaging (MRI) in assessing anterior cruciate ligament rupture, in patients with symptomatic tibiofemoral instability.

Searching
MEDLINE, EMBASE, AMED, BioMed Central, CINAHL, HMIC, PEDro, Zetoc, and two Cochrane trial registers were searched, from inception to September 2010, and an example search strategy was reported. Unpublished studies were sought in OpenSIGLE and four trials registers. The bibliographies of retrieved articles were screened, and the authors of included studies were contacted, to identify additional studies. No language restrictions were applied.

Study selection
Studies of any design, which assessed the diagnostic accuracy of MRI for the detection of complete anterior cruciate ligament rupture, and used surgical findings (arthroscopic or open surgery) as the reference standard to confirm diagnosis, were eligible for inclusion. Studies of arthrograms, and animal and cadaver studies were excluded.

Where reported, the age of participants, in the included studies, ranged from four to 88 years, and the time from injury to imaging ranged from less than a day to 52 days. About half the studies used 1.5 Tesla (T) MRI, about 20% used 0.5T or less and, where reported, the remaining studies used 1.0T, 3.0T, or a variety of strengths. In most studies, images were interpreted by one or more general or musculoskeletal radiologists.

Two reviewers independently assessed studies for inclusion.

Assessment of study quality
The methodological quality of included studies was assessed using the 14-item QUADAS tool. Assessment was performed by one reviewer and checked by a second. Any disagreements were resolved through discussion.

Data extraction
Data were extracted on the numbers of true-positive, false-negative, false-positive and true-negative results. These were used to calculate sensitivity and specificity, with 95% confidence intervals. Study authors were contacted for additional data, if needed.

Data were extracted by one reviewer and checked by a second. Any disagreements were resolved through discussion.

Methods of synthesis
Pooled estimates of sensitivity and specificity, with 95% confidence intervals, and summary receiver operating characteristic curves were generated, using a bivariate random-effects model. Summary positive and negative likelihood ratio and diagnostic odds ratio estimates were reported.

Homogeneity was assessed by visual inspection of the study populations and methods used. Studies that showed considerable heterogeneity were excluded from the pooled results. Subgroup analyses were performed for adults and patients under 16 years old, and for a MRI field strength of 0.5T or less, compared with 1.5T.

Results of the review
Fifty-three studies, with 4,673 participants or 4,683 knees, were included in the review. Quality weaknesses were the poor reporting of: whether or not surgeons were blinded to the results of the MRI; withdrawals; frequency of non-interpretable MRI findings; and time between imaging and surgery.

The overall summary estimate of sensitivity was 94.5% (95% CI 91.7 to 96.3) and specificity was 95.3% (95% CI 92.7 to 97.0).

The subgroup analysis of adult patients resulted in summary estimates of sensitivity of 91.6% (95% CI 81.3 to 96.4) and specificity of 93.2% (95% CI 85.7 to 96.9). There were insufficient data to generate pooled estimates for participants under 16 years old. Subgroup analyses by MRI field strength gave similar summary estimates of sensitivity and specificity for studies using 0.5T or less, and for studies using 1.5T.

**Authors’ conclusions**

MRI was highly accurate for the diagnosis of complete anterior cruciate ligament rupture.

**CRD commentary**

The review reported a clearly stated research objective, which was defined by appropriate inclusion criteria. A range of sources were searched for relevant studies. No language restrictions were applied and efforts were made to identify unpublished studies. The methodological quality of included studies was assessed and the results of the assessment were reported in full. The main areas of weakness related to the quality of the reporting. Measures to minimise error and bias were applied throughout the review process, and robust meta-analytic methods were used.

The authors’ conclusions reflect the data presented and are likely to be reliable.

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

**Practice:** The authors stated that MRI should be used to confirm a diagnosis of anterior cruciate ligament rupture before surgery. This could avoid unnecessary surgical risk, ensure the efficient use of resources, and optimise patient management.

**Research** The authors noted that issues, such as the potential for injury change between the MRI and surgery, should be considered when designing future diagnostic accuracy studies. They also noted that the cost-effectiveness of MRI, compared with proceeding directly to arthroscopy, had not been formally assessed.

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