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## **Diagnostic Performance of Magnetic Resonance Imaging of the Knee Differs According to Lesion**

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## EVIDENCE-BASED ORTHOPAEDICS

DIAGNOSTIC PERFORMANCE OF MAGNETIC RESONANCE IMAGING  
OF THE KNEE DIFFERS ACCORDING TO LESIONOEI EH, NIKKEN JJ, VERSTIJNEN AC, GINAI AZ, MYRIAM HUNINK MG. MR IMAGING OF THE MENISCI  
AND CRUCIATE LIGAMENTS: A SYSTEMATIC REVIEW. RADIOLOGY. 2003 MAR 226:837-48.

**Questions:** Is magnetic resonance imaging (MRI) of the knee accurate in detecting tears of the menisci and cruciate ligaments? Do study design characteristics and magnetic field strength affect diagnostic performance?

**Data sources:** Studies were identified through a search of MEDLINE (1991 to 2000) with use of the search terms "magnetic resonance imaging," "knee," "meniscus," "cruciate ligament," and "arthroscopy."

**Study selection:** Studies included were those in the English-language literature that compared MRI with arthroscopy for detecting lesions of the medial or lateral meniscus, anterior cruciate ligament (ACL), or posterior cruciate ligament (PCL) in  $\geq 30$  patients; defined positivity criteria for MRI; and reported magnetic field strength. Studies were excluded if

patients were infants or adolescents, MRI was used for postoperative evaluation, the study design was case-control, results were reported only in terms of the medial and lateral meniscus combined, various magnetic strengths were used, or only specific features and indirect signs of knee lesions were assessed at the time of MRI.

**Data extraction:** Two authors made use of standardized data extraction sheets to extract data independently on study characteristics, patient characteristics, magnetic field strength, number and type of MRI sequences, and results.

**Main results:** 29 studies (27 on both menisci, 23 on ACL tears, and 12 on PCL tears) were included. For meniscal tears, sensitivity was higher for the medial meniscus than for the

lateral meniscus; specificity was higher for the lateral meniscus than for the medial meniscus (Table). Sensitivity for ACL tears did not differ between ACL and PCL ligaments; specificity was higher for PCL tears than for ACL tears (Table). In a multivariate analysis of summary receiver operating characteristics for all lesions combined, mean age and magnetic field strength were significant predictors of diagnostic performance. In sensitivity analyses, the magnetic field strength remained a consistent, significant, modest predictor of diagnostic performance (odds ratio range, 1.80 to 2.16).

**Conclusions:** Magnetic resonance imaging has a higher sensitivity for the detection of tears of the medial meniscus than for tears of the lateral meniscus. Specificity is higher for tears of the lateral meniscus than for tears of the medial meniscus and for anterior cruciate ligament tears than for posterior cruciate ligament tears. A higher magnetic strength field modestly improves diagnostic performance.

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Diagnostic test characteristics of magnetic resonance imaging of the knee*				
Outcomes	Pooled Sensitivity (95% CI)	Pooled Specificity (95% CI)	Positive Likelihood Ratio	Negative Likelihood Ratio
Medial meniscus tears	93% (92 to 95)	88% (85 to 91)	7.8	0.08
Lateral meniscus tears	79% (74 to 84)	96% (95 to 97)	20	0.22
Complete ACL tears	94% (92 to 97)	94% (93 to 96)	16	0.06
Complete PCL tears	91% (83 to 99)	99% (99 to 100)	91	0.09

\*CI = confidence interval; ACL = anterior cruciate ligament; PCL = posterior cruciate ligament. Sensitivity and specificity were weighted and pooled using the random-effects model.

## Commentary

This meta-analysis by Oei and colleagues combines 29 studies that evaluate the validity of MRI with respect to meniscal and cruciate ligament disorders of the knee. All studies used arthroscopy as the gold standard, and the authors found that MRI had excellent sensitivity and specificity for these diagnoses overall.

The mean age of the patients in the studies ranged from 25 to 40 years, and therefore the results are most applicable to this age group. The review did not evaluate the usefulness of MRI in the detection of articular cartilage disorders, which has gained importance with the advent of new pulse sequences<sup>1</sup>.

Although sample size was limited, increased magnetic field strength (which ranged from 0.1 to 1.5 T) improved the diagnostic accuracy overall. The minimal field strength for acceptable diagnostic accuracy was not determined by this review.

On the basis of this research, the MRI findings for patients in this age group with a meniscal or cruciate ligament disorder should, in

general, be consistent with the diagnosis. The role of diagnostic arthroscopy of patients with negative results on MRI (e.g., a patient with a clear history of repeated mechanical locking) is still undefined. In general, when MRI findings are negative, arthroscopy of the knee should be undertaken with the understanding that there is a high probability that the structures will be found to be normal at the time of surgery.

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- (1) Potter HG, Linklater JM, Allen AA, Hannafin JA, Haas SB. Magnetic resonance imaging of articular cartilage in the knee. An evaluation with use of fast-spin-echo imaging. *J Bone Joint Surg Am.* 1998;80:1276-84.