

# Review: Magnetic resonance imaging alone is of limited usefulness in diagnosing multiple sclerosis

Whiting P, Harbord R, Main C, et al. Accuracy of magnetic resonance imaging for the diagnosis of multiple sclerosis: systematic review. *BMJ*. 2006;332:875-84.

**Clinical impact ratings:** Hospitalists ★★★★★☆ Neurology ★★★★★☆

## QUESTION

How accurate is magnetic resonance imaging (MRI) for diagnosing multiple sclerosis (MS)?

## METHODS

**Data sources:** 12 electronic databases (to September or November 2004), bibliographies of included studies, and the National Institute for Health and Clinical Excellence MS guidelines.

**Study selection and assessment:** Published and unpublished studies in any language that evaluated the accuracy of MRI for early diagnosis of MS in patients presenting with suspected disease. 18 prospective cohort studies ( $n = 2102$ ) and 11 studies of other designs (mainly case-control,  $n = 2527$ ) met the selection criteria. The Quality Assessment of Diagnostic Accuracy Studies (QUADAS) criteria were used to assess quality of individual studies.

**Outcomes:** Sensitivity, specificity, positive and negative likelihood ratios (LRs), and diagnostic odds ratio (DOR) (the odds of positive results in persons with MS divided by the odds of positive results in persons without MS).

## MAIN RESULTS

In general, the quality of the studies was poor, with few studies reporting blinding.

The pooled DOR for the accuracy of MRI for diagnosis of MS was 9 (95% CI 5 to 16) in cohort studies. Studies of other designs provided much higher estimates of the diagnostic accuracy (pooled DOR 213, CI 85 to 535). The reference standard was clinical follow-up alone in most studies, with mean duration of follow-up in the cohort studies ranging from 7 months to 14 years (median 3 y). Only 2 studies followed patients for  $\geq 10$  years (Table). Studies with longer follow-up had higher specificity but lower sensitivity. Various criteria were used for the MRI diagnosis of MS. 3 studies using the McDonald 2001 criteria, which combine

MRI with clinical information, showed better test characteristics (+LR range 2.7 to 8.7 and -LR range 0.1 to 0.5) than 6 studies using the Paty, Barkhof, or Fazekas criteria, which are based on MRI alone (+LR range 1.6 to 3.6 and -LR range 0.2 to 0.7).

## CONCLUSION

Magnetic resonance imaging on its own has limited usefulness for ruling in or ruling out multiple sclerosis.

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### Test characteristics of magnetic resonance imaging (MRI) for diagnosis of multiple sclerosis at $\geq 10$ years\*

Study	MRI criteria (nonclinical T2 lesions)	Sensitivity	Specificity	+LR	-LR
Brex 2002†	$\geq 1$	92%	74%	3.4	0.1
	$\geq 4$	58%	83%	3.1	0.5
	$\geq 11$	31%	91%	3.0	0.8
Beck 2003‡	$\geq 1$	68%	68%	2.1	0.5
	$\geq 5$	32%	89%	2.8	0.8
	$\geq 9$	12%	94%	2.0	0.9

\*Diagnostic terms defined in Glossary.

†*N Engl J Med*. 2002;346:158-64.

‡*Arch Ophthalmol*. 2003;121:944-9.

## COMMENTARY

Whiting and colleagues concluded that the diagnostic accuracy of MRI alone is insufficient for it to be useful in ruling in or ruling out a diagnosis of MS. The reference standard considered in most of the included studies, a second clinical episode, is not a gold standard. The gold standard is the pathological confirmation of demyelinating disease. However, biopsy and autopsy data are rarely available. Vague recurring sensory symptoms and "soft" findings on examination, which may be taken as "evidence" for dissemination in time and space, are no more, and may be less, reliable than MRI abnormalities. The accuracy of clinical diagnosis was not addressed in this review.

Many of the included studies addressed the usefulness of MRI in "clinically isolated syndromes," such as optic neuritis, that may herald MS. "Conversion" to definite MS may occur at follow-up intervals longer than those considered by most studies in the review (1). The pretest probability of MS for patients who present with such typical demyelinating syndromes as optic neuritis and partial transverse myelitis is very high. It is hard to substantively augment the probability of "conversion" to MS in these patients with any diagnostic test.

Restricting the review to studies that involved patients presenting with syndromes with a broad differential diagnosis that includes MS, who have a lower pretest probability than those with the classical

"clinically isolated syndromes," might better address the value of MRI in MS diagnosis. Distinguishing the "punched-out" corpus callosum lesions of retinocochlear vasculopathy (the Susac syndrome) from the flame-shaped ovoid lesions of MS (2) or recognizing the typical temporal pole T2 lesions of CADASIL (3) is enormously helpful when seeing patients for whom the diagnosis of MS is reasonably considered but erroneous. The value of MRI in monitoring disease activity and in guiding the implementation of disease-modifying therapy should also be considered.

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## References

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