

# Review: Magnetic resonance angiography is accurate for detecting high-grade carotid artery stenosis that is suitable for surgery

Westwood ME, Kelly S, Berry E, et al. Use of magnetic resonance angiography to select candidates with recently symptomatic carotid stenosis for surgery: systematic review. *BMJ*. 2002 Jan 26;324:198-201.

## QUESTION

In patients with recently symptomatic internal carotid artery stenosis, is magnetic resonance angiography (MRA) accurate for distinguishing arteries with stenosis that are suitable for surgery from occluded arteries or arteries with noncritical stenosis?

## DATA SOURCES

Studies were identified by searching MEDLINE, EMBASE/Excerpta Medica, Health STAR, Science Citation Index, Index to Scientific and Technical Proceedings, Cochrane Library, Inside (British Library), Online Computer Library Centre, and bibliographies of relevant studies and by hand searching 10 key journals.

## STUDY SELECTION

2 reviewers independently selected original studies published between 1990 and 1999 if they compared MRA with digital-subtraction or cut-film angiography; reported data for use in a 2 × 2 contingency table; reported results for 50% to 99%, 70% to 99%, or 100% stenosis; and included > 10 adults. 8 of 26 studies met these additional criteria: All patients in the study received the diagnostic standard, the method used to determine the degree of stenosis was described, no asymptomatic patients were included, and the time between examinations did not exceed 1 month.

## COMMENTARY

Studies assessing the accuracy of carotid artery stenosis detection should be done by comparing the reference standard, currently biplanar contrast angiography, with the investigation of interest, MRA, for all degrees of stenosis. Studies are typically done in patients already suspected of having substantial stenosis by the presence of a bruit or stenosis on duplex ultrasonography. Most studies therefore have a higher prevalence of stenosis than is seen in routine clinical practice. This higher prevalence may lead to substantial bias in test accuracy assessment. It is important to note that, as Westwood and colleagues correctly recognize, investigations are done to assist clinical decisions (i.e., whether to do carotid endarterectomy). The distinction between occluded and severely stenotic vessels is crucial because occlusions cannot be treated surgically, whereas severe stenosis has a high risk for stroke and can be surgically repaired.

Although MRA was accurate in the identification of severe (70% to 99%) stenosis in this study, the key question is whether MRA alone or in addition to duplex ultrasonography is as effective or as cost-effective as duplex ultrasonography alone in the routine investigation of suspected carotid stenosis. The decision to do carotid endarterectomy is now

## DATA EXTRACTION

Data were extracted for true-positive, true-negative, false-positive, and false-negative results. Sensitivity and specificity data were combined into a summary receiver-operating characteristic (ROC) curve. Results were presented as a Q\* statistic, which is the point on the ROC curve where the sensitivity and specificity are equal (the maximum joint sensitivity and specificity).

## MAIN RESULTS

26 studies met the selection criteria. Sample size ranged from 11 to 101 patients (mean 40 patients). The age range was 18 to 87 years (mean range 43 to 80 y). The proportion of men ranged from 55% to 100% (mean 69%). In the studies evaluating 70% to 99% stenosis, MRA was done by contrast-enhanced techniques (4 comparisons), 3-dimensional time of flight (11 comparisons), and 2-dimensional time of flight

(10 comparisons) and had a maximum sensitivity and specificity of 99% (Table). For 50% to 99% stenosis, the techniques were 3-dimensional time of flight (4 comparisons) and 2-dimensional time of flight (6 comparisons) and had a maximum sensitivity and specificity of 90% (Table).

## CONCLUSION

In patients with recently symptomatic internal carotid artery stenosis, magnetic resonance angiography is accurate for distinguishing stenosis of 70% to 99% that is suitable for surgery from occluded arteries or noncritical stenosis.

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### Test characteristics of magnetic resonance angiography for detecting carotid artery stenosis that is suitable for surgery\*

Degree of stenosis	Q* (95% CI)	+LR	-LR
70% to 99%	99% (98 to 100)	99	0.01
50% to 99%	90% (81 to 99)	9	0.11

\*The Q\* statistic is the point on the receiver-operating characteristic curve where sensitivity and specificity are equal (joint maximum sensitivity and specificity). Other diagnostic terms defined in Glossary.

frequently based on the results of duplex scanning alone, reserving angiography for equivocal or complex cases.

The ability of MRA to accurately identify 50% to 99% stenosis was insufficient to allow the authors to recommend MRA for this range. Although the benefit of endarterectomy for severe stenosis is clear, the benefits from surgery for less severe stenosis are more modest (1). An appropriate recommendation for endarterectomy in patients with less severe stenosis is still largely clinically based, taking into account the apparent severity of stenosis, individual and institutional complication rates of surgery, expected subsequent event rates with best medical treatment, patient age, and comorbid conditions. Other ultrasonic features of the plaque known to be associated with subsequent events are not yet assessed by MRA.

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## Reference

1. Cina CS, Clase CM, Haynes RB. Carotid endarterectomy for symptomatic carotid stenosis. *Cochrane Database Syst Rev*. 2000;(2):CD001081.