Meta-analysis on diagnostic accuracy of MR angiography in the follow-up of residual intracranial aneurysms treated with Guglielmi detachable coils

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CRD summary
This generally well-conducted review found that time-of-flight and contrast-enhanced magnetic resonance angiography could accurately depict residual aneurysms in patients who had undergone endovascular Guglielmi detachable coil treatment. The accuracy of the two techniques was similar. These findings are likely to be reliable, but should be interpreted with some caution, as some relevant studies may have possibly been missed.

Authors' objectives
To determine the accuracy of time-of-flight magnetic resonance angiography and contrast-enhanced magnetic resonance angiography in the follow-up study of patients with residual intracranial aneurysms after endovascular Guglielmi detachable coil treatment.

Searching
MEDLINE and the Cochrane Library databases were searched from 1966 to December 2007. Search terms were reported and included a diagnostic filter. Bibliographies, review articles and textbooks were also searched. No language restrictions were applied.

Study selection
Studies that evaluated magnetic resonance angiography (time-of-flight or contrast-enhanced) compared to the reference standard of digital subtraction angiography, in patients with intracranial aneurysm after coiling, were eligible for inclusion. Included studies had to report sufficient data to construct a 2 x 2 table of test performance for the detection of residual intracranial aneurysms.

Residual aneurysm was defined as the presence of residual neck and residual flow in the aneurysm.

In the included studies, magnetic field strength ranged from 1 to 3 Tesla.

The authors do not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that a formal quality assessment was undertaken but data were extracted on the following methodological features: study design (prospective, retrospective, unknown); description of patient population; patient selection (consecutive versus non-consecutive); blinded interpretation of results.

Data extraction
Data were extracted as 2 x 2 tables of test performance. If studies reported more than one set of 2 x 2 data, due to evaluation by multiple observers, the highest estimate was selected. Sensitivity, specificity and diagnostic odds ratios together with 95% confidence intervals were calculated for each set of 2 x 2 data. To account for zero cells, 0.5 was added to each cell of the 2 x 2 tables for all studies.

The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
A bivariate model was used to pool estimates of sensitivity and specificity and to examine differences between estimates obtained using the different imaging techniques. Heterogeneity was assessed graphically using forest plots, and statistically using the Q and I² statistics. Publication bias was assessed through visual examination of funnel plots. Meta-regression was used to investigate the following sources of heterogeneity: study design (prospective versus
Results of the review
Sixteen studies were included (n=744). Six studies were prospective, five studies enrolled patients consecutively, and ten studies reported blinded interpretation of results.

Pooled sensitivity and specificity: Both time-of-flight magnetic resonance angiography (MRA) and contrast-enhanced MRA showed good accuracy for detecting residual aneurysms. Pooled sensitivity was 90% (95% confidence interval [CI]: 79 to 95) for time-of-flight MRA (14 studies) and 92% (95% CI: 79 to 97) for contrast-enhanced MRA (six studies). Pooled specificity was 95% (95% CI: 88 to 98) for time-of-flight MRA and 96% (95% CI: 91 to 98) for contrast-enhanced MRA.

Heterogeneity: There was strong evidence of heterogeneity (p<0.001) in sensitivity with $I^2$ of 70% for time-of-flight MRA and 75% for contrast-enhanced MRA. There was also substantial heterogeneity in estimates of specificity for time-of-frame MRA (p<0.001; $I^2$=83%) but not for contrast-enhance MRA (p=0.29; $I^2$=19%). There was no difference in sensitivity (p=0.545), specificity (p=0.394) or diagnostic odds ratio (p=0.24) between the two techniques. Meta-regression analysis failed to explain any of the observed heterogeneity.

Authors’ conclusions
Both time-of-flight magnetic resonance angiography and contrast-enhanced magnetic resonance angiography accurately depicted residual aneurysm. The accuracy of the two techniques was comparable.

CRD commentary
The review addressed a focused question, supported by clearly defined inclusion criteria. The literature search was limited to one medical database and included a diagnostic filter, so it is possible that relevant studies have been missed. Specific attempts were not made to locate unpublished studies and, although the authors stated that publication bias was assessed, the results were not reported. Details on the review process were limited, so it is not clear whether appropriate steps were taken to minimise bias and errors. A formal quality assessment was not conducted. Data were extracted on relevant methodological features; some of these were considered in the analysis. Very few details were reported on the included studies, so the generalisability of the findings was unclear. Methods used to synthesise studies were appropriate, based on the most robust models currently available for diagnostic meta-analysis. The authors’ conclusions are supported by the data presented and are likely to be reliable, but should be interpreted with some caution, given the high levels of heterogeneity between studies and the possibility that some relevant studies may have been missed.

Implications of the review for practice and research
Practice: The authors stated that both time-of-flight magnetic resonance angiography and contrast-enhanced magnetic resonance angiography could be considered reliable substitutes for digital subtraction angiography in discerning residual aneurysms after endovascular Guglielmi detachable coil treatment.

Research: The authors did not state any implications for research.

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