The accuracy of transcranial Doppler in the diagnosis of middle cerebral artery stenosis

CRD summary
This review found that the performance of transcranial cerebral Doppler for the diagnosis of middle cerebral artery stenosis is fair. Limitations in the review, including the likelihood that relevant studies have been missed, insufficient details of the included studies, and limitations in the analysis, mean that the authors’ conclusions are unlikely to be reliable.

Authors' objectives
To determine the accuracy of transcranial Doppler (TCD), compared with angiography, for the diagnosis of ≥50% middle cerebral artery (MCA) stenosis in patients with transient ischaemic attack or ischaemic stroke.

Searching
MEDLINE, EMBASE, CINAHL and the Cochrane Library were searched from 1982 to 2005. The search terms, which were reported, included a diagnostic filter. The review was limited to studies published in the English language.

Study selection
Studies that compared TCD against the reference standard of cerebral angiography in adults with a history of stroke or transient ischaemic attack were eligible. Studies had to report sufficient data to enable the calculation of the sensitivity, specificity, and positive and negative predictive values (PPV and NPV, respectively) or likelihood ratios. All of the included studies used 2-MHz non imaging Doppler probes with no angle correction, although the specific instruments varied between studies.

Two reviewers assessed studies for inclusion.

Assessment of study quality
Study quality was assessed according to the following criteria: comparative study design, consecutive patient selection, prospective data collection, observer blinding, sufficient details on both tests, complete verification, sufficient data reporting and sufficient details of the study population. The studies were assigned 1 point according to each item fulfilled, giving a maximum total score of 8.

Two reviewers, blinded to the identity and affiliations of the authors, independently assessed study quality. Any disagreements were resolved through discussion with other reviewers.

Data extraction
For each study, the sensitivity, specificity, PPV and NPV were calculated. These were calculated for all available MCA mean flow velocity (MFV) thresholds.

Two reviewers, blinded to the identity and affiliations of the authors, independently extracted the data. Any disagreements were resolved through discussion with other reviewers.

Methods of synthesis
Simple pooling based on weighted means was used to calculate the summary sensitivity, specificity, PPV and NPV for different MCA MFV thresholds. These values were calculated for all studies and for prospective studies that evaluated consecutive patients. The authors did not state that they assessed heterogeneity.

Results of the review
Six studies (616 MCAs) were included in the review.
All studies fulfilled the quality criteria for study design, provision of appropriate details on both tests, avoidance of verification bias, reporting of appropriate data and provision of sufficient details of the study population. Five studies enrolled consecutive patients, four reported blinding of the observers and three were prospective.

All studies reported sufficient data to estimate accuracy at a threshold of 80 cm/second. The pooled sensitivity was 82.9% and the pooled specificity 85.4%. When the analysis was restricted to the three prospective studies, the pooled sensitivity and specificity were 91.8% and 92.2%, respectively. All other thresholds were evaluated in single studies only. Confidence intervals were not reported.

**Authors' conclusions**
The performance of TCD is fair in comparison with the reference standard of angiography.

**CRD commentary**
The review addressed a focused objective that was supported by clearly defined inclusion criteria. The literature search was restricted to studies published in English, and included a diagnostic filter, so it is likely that relevant studies were missed. Appropriate steps were taken to minimise bias and error in the study selection, quality assessment and data extraction processes. Some relevant quality items were assessed but a key item for diagnostic studies, whether or not an appropriate patient spectrum was included, was not considered. Details of the included studies were not reported, thus the generalisability of the results is unclear. Methods of analysis were limited and the use of more sophisticated methods of pooling diagnostic studies, such as the bivariate model, would have been preferable. Confidence intervals around pooled estimates were not reported, heterogeneity was not assessed, and individual study findings were not presented; these issues make it difficult to draw any conclusions from the results presented. The likelihood that relevant studies have been missed, the lack of details of the included studies, and limitations in the analysis, mean that the authors' conclusions are unlikely to be reliable.

**Implications of the review for practice and research**
Practice: The authors did not state any implications for practice.

Research: The authors stated that further studies to determine optimal velocity values and other criteria, such as velocity ratios, to develop an accurate screening test are required.

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