Title	Accurate, Practical, and Cost-Effective Assessment of Carotid Stenosis in the UK
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Aim

To assess the cost effectiveness of various imaging strategies to diagnose carotid stenosis in stroke prevention clinics.

Conclusions and results

In 41 included studies (2404 patients, median age 60–65 years), most data were available on 70% to 99% stenosis. Contrast-enhanced magnetic resonance angiography (CEMRA) was the most accurate (sensitivity 0.94, 0.88–0.97; specificity 0.93, 0.89–0.96) compared with ultrasound (U/S), magnetic resonance angiography (MRA), and computed-tomographic angiography (CTA) which were all similar (eg, for U/S: sensitivity 0.89, 0.85–0.92; specificity 0.84, 0.77–0.89). Data for 50% to 69% stenoses and on tests used in combination were too sparse to be reliable. There was heterogeneity between studies for all imaging modalities except CTA, and some evidence of publication bias. The individual patient data (2416 patients) showed that the literature overestimated test accuracy in routine practice, and that tests perform differently in symptomatic and asymptomatic arteries. It provided data on an older and more representative population than did the literature, and information on tests used in combination. In the cost-effectiveness model, strategies allowing more patients to reach endarterectomy quickly, and where those with 50% to 69% stenosis would be offered surgery (as well as the 70–99% group), prevented most strokes and produced the greatest net benefit. This included most strategies with U/S as first or repeat, but generally not those with intra-arterial angiography (IAA). However, the model was sensitive to less-invasive test accuracy, cost, and timing of endarterectomy. In surgery occurring by 80 days or later, strategies relying on U/S were no longer cost effective since patients with lesser degrees of stenosis would not benefit. Hence, in patients investigated late after transient ischemic attack (TIA), accuracy is crucial and CEMRA should be used to identify patients for surgery.

Recommendations

In the UK, less-invasive tests can be used in place of IAA if radiologists trained in carotid imaging are available to perform and interpret them. Imaging should be carefully audited. Stroke prevention clinics should strive to reduce waiting times at all stages to improve speed of access to endarterectomy. Imaging accuracy is very important in patients presenting late, and U/S results should be confirmed by CEMRA, as patients with 50% to 69% or less stenosis are less likely to benefit. Although one U/S alone seemed to provide the greatest net benefit, lack of confidence in, and the operator dependence of this technique mean that at least a second independent U/S should be obtained prior to surgery.

Methods

See Executive Summary link above.

Further research/reviews required

Methodology for evaluating imaging tests needs to improve (blinding, prospective studies, and carefully differentiating the symptomatic from the asymptomatic artery in analyses). More data are required on the accuracy of less-invasive tests. More data are required on all modalities, CTA in particular. Randomized trials should be considered to evaluate less-invasive imaging strategies in stroke prevention prior to endarterectomy. Streamlined methods of collecting routine audit data on less-invasive tests in routine clinical practice are required, as are streamlined and reliable methods for evaluating new technologies. Better cost information is required for stroke care, surgical procedures, outpatient visits, and imaging tests. More information is needed on the effect of secondary prevention drugs in combination. More and better information is needed from stroke epidemiology studies to determine the distribution of carotid disease by age, gender, and TIA/minor stroke type. A more sophisticated model could be developed from the one constructed in this work to include, eg, differences in the risks of endarterectomy between men and women.

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