Accurate, practical and cost-effective assessment of carotid stenosis in the UK

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Executive summary

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Background

Carotid endarterectomy reduces the risk of stroke in patients with tight symptomatic carotid stenosis [70–99% on North American Symptomatic Carotid Surgery Trial (NASCET) criteria] and may also benefit patients with milder (50–69% NASCET) stenoses. The particularly high risk of stroke early after transient ischaemic attack (TIA) has recently been emphasised. Accurate carotid imaging is important to avoid operating on patients with less severe stenoses in whom the risk of surgery may outweigh the benefit. Carotid stenosis was measured originally on intra-arterial angiography (IAA), which is risky. Less invasive imaging tests [ultrasound (US), magnetic resonance angiography (MRA), computed tomographic angiography (CTA) and contrast-enhanced MRA (CEMRA)] have improved and could be accurate enough to replace IAA.

Objectives

The aim of the study was to determine whether less invasive imaging tests, alone or combined, could replace IAA, what effect this would have on strokes and deaths, endarterectomies performed and costs, and whether less invasive tests were cost-effective.

Methods

The authors constituted a panel of experts in stroke, imaging, vascular surgery, statistics and health economic modelling. The accuracy of less invasive carotid imaging was systematically reviewed using Standards for Reporting of Diagnostic Accuracy (STARD) methodology, supplemented by individual patient data from primary research and audit studies in the UK. A systematic review of the costs of less invasive tests, outpatient clinics, endarterectomy and stroke was performed, along with a microcosting exercise. A model of the process of care following a transient ischaemic attack (TIA)/minor stroke was developed, populated with data from stroke epidemiology studies in the UK, effects of medical and surgical interventions, outcomes, quality of life and costs. A survey of UK stroke prevention clinics provided typical timings. Twenty-two different carotid imaging strategies were evaluated for short- and long-term outcomes, quality-adjusted life-years and net benefit.

Results

In 41 included studies (2404 patients, median age 60–65 years), most data were available on 70–99% stenosis. CEMRA was the most accurate [sensitivity 0.94, 95% confidence interval (CI) 0.88 to 0.97; specificity 0.93, 95% CI 0.89 to 0.96], compared with US, MRA and CTA, which were all similar (e.g. for US: sensitivity 0.89, 95% CI 0.85 to 0.92; specificity 0.84, 95% CI 0.77 to 0.89). Data for 50–69% stenoses and on combinations of tests were too sparse to be reliable. There was heterogeneity between studies for all imaging modalities except for CTA. The individual patient data (2416 patients) showed that the literature overestimated test accuracy in routine practice and that, in general, tests perform with higher sensitivity and specificity in asymptomatic than in symptomatic arteries. In the cost-effectiveness model, on current UK timings, strategies allowed more patients to reach endarterectomy very quickly, and where those with 50–69% stenosis would be offered surgery in addition to those with 70–99%, prevented most strokes and produced greatest net benefit. This included most strategies with US as first or repeat test, and not those with IAA. However, the model was sensitive to less invasive test accuracy, cost and timing of endarterectomy. In patients investigated late after TIA, test accuracy is very important and US results should be confirmed by CEMRA, as patients with 50–69% stenosis are less likely to benefit.

Conclusions

In the UK, less invasive tests can be used in place of IAA if radiologists trained in carotid imaging are available. Imaging should be carefully audited. Stroke prevention clinics should reduce waiting times at all stages to improve speed of access to endarterectomy. In patients presenting late after TIA, test accuracy is very important and US results should be confirmed by CEMRA, as patients with 50–69% stenosis are less likely to benefit.
Recommendations for research

The first six recommendations are as follows:

- More data are required to define the accuracy of less invasive tests used at 50–69% stenoses, and in combination (e.g. US plus CEMRA).
- The methodology for primary studies of the accuracy of less invasive imaging tests needs to improve.
- Clearer presentation of data in reports of primary studies of diagnostic test accuracy would enable more key sensitivity analyses to be performed in future meta-analyses.
- Methods of evaluating new technologies as they emerge are required.
- Consideration should be given to new randomised trials to evaluate different less invasive imaging strategies before endarterectomy.
- Streamlined methods of collecting data to audit less invasive tests when used in routine clinical practice are required to monitor test accuracy.

Publication

The research findings from the NHS R&D Health Technology Assessment (HTA) Programme directly influence key decision-making bodies such as the National Institute for Health and Clinical Excellence (NICE) and the National Screening Committee (NSC) who rely on HTA outputs to help raise standards of care. HTA findings also help to improve the quality of the service in the NHS indirectly in that they form a key component of the ‘National Knowledge Service’ that is being developed to improve the evidence of clinical practice throughout the NHS.

The HTA Programme was set up in 1993. Its role is to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and provide care in the NHS. ‘Health technologies’ are broadly defined to include all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care, rather than settings of care.

The HTA Programme commissions research only on topics where it has identified key gaps in the evidence needed by the NHS. Suggestions for topics are actively sought from people working in the NHS, the public, service-users groups and professional bodies such as Royal Colleges and NHS Trusts. Research suggestions are carefully considered by panels of independent experts (including service users) whose advice results in a ranked list of recommended research priorities. The HTA Programme then commissions the research team best suited to undertake the work, in the manner most appropriate to find the relevant answers. Some projects may take only months, others need several years to answer the research questions adequately. They may involve synthesising existing evidence or conducting a trial to produce new evidence where none currently exists.

Additionally, through its Technology Assessment Report (TAR) call-off contract, the HTA Programme is able to commission bespoke reports, principally for NICE, but also for other policy customers, such as a National Clinical Director. TARs bring together evidence on key aspects of the use of specific technologies and usually have to be completed within a short time period.

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Reports are published in the HTA monograph series if (1) they have resulted from work commissioned for the HTA Programme, and (2) they are of a sufficiently high scientific quality as assessed by the referees and editors.

Reviews in Health Technology Assessment are termed ‘systematic’ when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

The research reported in this monograph was commissioned by the HTA Programme as project number 01/37/03. The contractual start date was in March 2003. The draft report began editorial review in October 2004 and was accepted for publication in September 2005. As the funder, by devising a commissioning brief, the HTA Programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors’ report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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