Screening for carotid artery stenosis with the continuous wave Doppler listening examination

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of audible interpretation of continuous wave (CW) Doppler for the screening of asymptomatic carotid artery stenoses in patients referred to the vascular diagnostic laboratories.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients referred to the vascular diagnostic laboratories for examination for asymptomatic carotid artery stenoses.

Setting
The setting was hospital. The economic study was carried out in Florida, USA.

Dates to which data relate
The authors did not specify the dates over which the effectiveness and resource use data were gathered. The price year was 1996.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was performed on the same patient sample as that used in the effectiveness analysis, but it was unclear whether the costing was performed prospectively or retrospectively.

Study sample
Power calculations were not used to determine the sample size. The study sample consisted of 207 patients and involved 414 complete examinations of the right and left carotid arteries, which were deemed independent. The mean age of the participants was 64 (standard deviation 11) years and 80% were men. Two certified vascular technologists performed the CW Doppler listening examinations before standard carotid duplex examinations were performed. A vascular surgeon reviewed the videotaped duplex examinations to determine the degree of stenosis. In total, 103 patients were enrolled in one study institution, and 104 were enrolled in the other. To assess the possible effects of experience gained
by the vascular technologists, the estimated results of 214 examinations in 107 patients in phase I were compared with the corresponding outcomes for 200 examinations of 100 patients in phase II of the study.

**Study design**
This was a prospective cohort study, carried out in two centres. The duration of the follow-up was until the degree of stenosis was classified as either greater than or equal to 50%, or less than 50%. No loss to follow-up was reported.

**Analysis of effectiveness**
The outcome measures were the classification of the degree of stenosis as either less than, or greater than or equal to 50%, and the overall sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the CW Doppler relative to the standard carotid duplex. The corresponding outcomes were obtained for phases I and II of the study.

**Effectiveness results**
The results showed there were:

- 87 cases where the degree of stenosis was classified as greater than or equal to 50% by both CW Doppler and duplex;
- 9 cases were classified as at least 50% by CW Doppler and less than 50% by duplex;
- 27 cases were classified as less than 50% by CW Doppler and at least 50% by duplex, although for duplex, 21 of these were stenoses between 50 and 69%; and
- 291 cases were classified as less than 50% by both CW Doppler and duplex.

CW Doppler had an overall sensitivity of 76% (95% confidence interval, CI: 67.4 - 83.8), specificity of 97% (95% CI: 94.4 - 98.6), PPV of 91% (95% CI: 83 - 95.6), and NPV of 92% (95% CI: 87.9 - 94.3).

The corresponding values for phase I and phase II of the study, respectively, were 68 versus 85% (p<0.05) for sensitivity, 98 versus 96% (p=0.44) for specificity, 93 versus 89% (p=0.71) for PPV, and 89 versus 95% (p=0.11) for NPV.

**Clinical conclusions**
This study suggests that, despite the limited application of CW Doppler since the introduction of the carotid duplex technology, similar accuracy may still be achieved after a short learning curve.

**Measure of benefits used in the economic analysis**
The measure of benefit used was PPV, based on 5 and 20% disease prevalence rates for a carotid stenosis of at least 50%.

**Direct costs**
The costs were not discounted due to the short timeframe adopted for cost analysis. The quantities of resource use were reported only in terms of the time required to perform the listening and duplex examinations, and separately from the costs. The cost items were not reported separately. Cost analysis covered the fixed costs, such as the vascular laboratory and its personnel, and the variable costs of each screening strategy. The procedural code of carotid duplex examination was used to determine its total costs. The cost analysis appeared to have been conducted from a hospital perspective. The cost data were obtained from the financial office of one of the study institutions. The price year was 1996. The costs, i.e. fees, for the interpretation of the carotid duplex examination were not included in the cost analysis.
Statistical analysis of costs
No statistical analysis of costs was performed

Indirect Costs
Indirect costs were not considered.

Currency
US dollars ($)

Sensitivity analysis
No sensitivity analysis was conducted.

Estimated benefits used in the economic analysis
The estimated PPVs based on 5 and 20% disease prevalence were 57 and 87%, respectively.

Cost results
CW Doppler had an average total cost of $22.95 per patient, compared with $166.47 for the duplex examination.

Synthesis of costs and benefits
The measure of cost-effectiveness was the calculated cost of screening per positive study, i.e. for a carotid stenosis of at least 50%, based on 5 and 20% disease prevalence. The cost-effectiveness ratio for a 5% prevalence rate was $459 for CW Doppler, compared with $3,329.40 for the duplex examination. The corresponding values for the 20% prevalence rate were $114.75 and $832.35, respectively.

Authors' conclusions
The CW Doppler carotid listening examination is an accurate, cost-effective alternative to the carotid duplex examination for screening asymptomatic patients for significant carotid artery stenosis.

CRD COMMENTARY - Selection of comparators
The comparator was justified on the basis that it was the standard screening approach in the context in question, at the time of the study. You, as a database user, should consider whether this is a widely used health technology in your own setting.

Validity of estimate of measure of benefit
Appropriate statistical analyses were performed in order to increase the internal validity of the study. However, it may have been useful to have investigated the consequences, in terms of quality of life and costs, of false negatives resulting from the CW Doppler screening technique.

Validity of estimate of costs
All relevant costs were reported given the perspective of the study. Total costs were obtained from the data and resources used were, in part, reported separately. Additional details about single categories of costs would have been helpful, and some sensitivity analyses of costs would have been useful for addressing the issue of generalisability.

Other issues
Appropriate comparisons were made with other studies and the results obtained were consistent with the findings of this investigation. The carotid duplex technique is defined as the 'gold' standard in this analysis. It would have been interesting to have compared the sensitivity and specificity of CW Doppler with other screening strategies for the detection of carotid stenosis, such as X-ray carotid angiography and magnetic resonance angiography.

Implications of the study
The results of the current study pose the broader questions of whether it is cost-effective to screen for asymptomatic carotid artery stenoses and if so, what is the most cost-effective screening technique.

Source of funding
None stated.

Bibliographic details

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