Cost-effective evaluation and treatment for carotid disease

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
Duplex ultrasonography (DU), a preoperative diagnostic procedure to inform carotid endarterectomy (CEA), compared with DU and arteriography before CEA.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients who underwent CEA at the institution where the study was conducted. 53.1% of the patient population were male and the mean age was 74 years. Symptoms included stroke (10.1% of patients), transient ischemic attack or amaurosis fugax (38.5% of patients), and asymptomatic high-grade internal carotid artery (ICA) stenosis in 45.4% of patients. Additionally 13 CEAs (6%) were performed for global non-hemispheric symptoms. Comorbid patient medical conditions included hypertension (67.5%), a history of smoking (57.2%), coronary artery disease (51.8%) and hypercholesterolaemia (36.6%).

Setting
The setting was tertiary care. The economic analysis was conducted at the University Medical Center, Loma Linda, California, USA.

Dates to which data relate
Effectiveness data were collected between 1 January 1993 and 30 June 1995. Resource use data referred to the same dates. The price year was not specified.

Source of effectiveness data
The evidence/estimate for final outcomes was derived from a single study.

Link between effectiveness and cost data
The costing was undertaken retrospectively on part of the patient sample used in the effectiveness study. Specifically, costing was undertaken on the 171 cases of CEA that were not combined with another major procedure.

Study sample
Power calculations to determine the sample size were not reported. Patients were retrospectively selected on the basis of having undergone a CEA at the hospital between 1 January 1993 and 30 June 1995. 218 CEAs were performed during
that period on 194 patients. DU was the only preoperative study used in 53 CEAs while DUs and arteriography were obtained before 165 CEAs were performed. No patients were excluded from the initial sample since this was a retrospective case study.

**Study design**

The study design was a retrospective case series analysis carried out in a single centre. Subjects underwent DU, or DU and arteriography at the discretion of the attending surgeon. The duration of follow up was 30 days. Assessments of outcomes were not blinded.

**Analysis of effectiveness**

The analysis of effectiveness was based on all patients included in the study. The primary health outcomes used in the analysis were the accuracy of DU and arteriography, their concordance when both procedures were undertaken, change of plans resulting from information gained during the arteriogram, death and stroke rates following CEA. Groups were not shown to be comparable at analysis.

**Effectiveness results**

The effectiveness results were as follows:

There was agreement (Spearman rank order coefficient and k statistic: \(k=0.85, r=0.86, p<0.01\)) between DU and arteriography in the detection of an ICA occlusion or a stenosis greater than 45%.

The accuracy of DU was 99.4% while the sensitivity and specificity were 99.4% and 100% respectively.

The positive predictive value of DU was 100% and the negative predictive value was 75%.

A change in surgical approach based on the arteriography was made 3 times (1.8%).

There was no difference in the stroke and death rate for CEA based solely on DU compared with CEA based on DU and arteriography, \(p=0.43\).

**Clinical conclusions**

Arteriography can be virtually eliminated from the preoperative workup of carotid occlusive disease if DU imaging of the carotid bifurcation is satisfactory. Addition of arteriography to a diagnostic DU study that has already suggested the need for CEA does not change the operative plan in most patients.

**Modelling**

No modelling was undertaken.

**Measure of benefits used in the economic analysis**

As the effectiveness results showed no difference in clinical benefit between the two diagnostic procedures, the economic analysis was based on cost differences only (cost-minimisation).

**Direct costs**

Some resources (length of hospital stay) were reported separately from costs. The perspective was that of the hospital. Direct costs included in the analysis were the actual hospital cost plus a professional fee (no further information was provided on the content of the hospital cost). Direct costs data were based on actual patient data. The estimation of prices appears to have been based on the hospital costs and on the Medicare relative value scale (for the professional fee). Discounting was not conducted despite the two-year time frame of the analysis. The price year was not reported.
Statistical analysis of costs
Length of hospital stay and total costs were treated stochastically, mean differences were tested using a t-test for independent samples at 0.5 level of significance.

Indirect Costs
Indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were not conducted.

Estimated benefits used in the economic analysis
See effectiveness results above.

Cost results
The mean hospital cost for DU only CEA was $5,534 (range: $2,686 - $29,929) and the mean cost for CEA using DU and arteriography was $7,608 (range: $2,826 - $28,344). The mean cost difference between the two groups was $2,074, (p<0.01). It was not clear whether the costs of complications were included in this analysis. The period for which the costs were measured was not specified.

Synthesis of costs and benefits
A synthesis of costs and benefits was not performed.

Authors' conclusions
The addition of carotid arteriography to a diagnostic DU study that already suggested the need for CEA did not change the operative plan in 98% of the cases. Carotid endarterectomy based solely on DU is appropriate and cost-effective.

CRD COMMENTARY - Selection of comparators
Although no explicit justification was given for the comparator used, it would appear to represent current practice in the authors' setting. You, as a user of the database, should decide if the comparator represents current practice in your own setting.

Validity of estimate of measure of effectiveness
The analysis was based on a retrospective case series analysis, which was appropriate for the study question. The study sample was representative of the study population, namely patients undergoing CEA. One problem with the validity of the estimate of effectiveness was that patients groups were not shown to be comparable at analysis, in particular, some patients underwent several operations, so the severity of the condition could be a potential confounding factor. Another problem with the analysis of effectiveness was that the choice of interventions, DU, or DU and arteriography, was left to the discretion of the surgeon, so there may have been non-random bias in the selection of patients. No statistical analyses were undertaken to account for potential bias or confounding factors. Finally, the data on effectiveness was very sparsely reported.

Validity of estimate of costs
In general the analysis of cost was not very good and very little information was reported. From the perspective adopted, it was not possible to tell which categories had been included in the analysis and for which duration, for example, were the costs of complications included in the total costs? Similarly, it was not possible to tell which costs were included in each category of cost. This lack of reporting is likely to affect the authors’ conclusions. Moreover, the analysis of costs was not conducted on the whole patient sample and insufficient information about this sub-sample was reported. Some resources (length of stay) were reported separately from costs, although it was not clear if hospital stay had then been translated into costs. A statistical analysis of costs was conducted, but there were no sensitivity analyses. The source of the costs was unclear from the article and neither source mentioned was referenced. It is likely that charges proxied prices. The price year was not reported and discounting was not conducted, although the timeframe of the study made this necessary.

Other issues
The authors did not make appropriate comparisons of their findings with those from other studies and the issue of generalisability to other settings was not addressed. The authors appear to have presented their results selectively. The study enrolled patients undergoing CEA and this was reflected in their conclusions. The authors did not report any further limitations to their study.

Implications of the study
The authors recommended that arteriography could be virtually eliminated from the preoperative workup of carotid occlusive disease if DU imaging of the carotid bifurcation was satisfactory.

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