Carotid endarterectomy: the financial impact of practice changes
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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 progressive application of a clinical pathway for the reduction of hospital stay, procedures and costs associated with the management of patients undergoing carotid endarterectomy (CEA) for extracranial carotid occlusive disease, was examined. The details of the pathway were not reported clearly.

Type of intervention
Diagnosis and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients undergoing CEA, with the exception of those in which CEA was performed in combination with coronary artery bypass grafting.

Setting
The setting was secondary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness and resource use data were gathered from July 1991 to June 1998. The price year was 1998.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was carried out retrospectively on the same sample of patients as that used in the effectiveness analysis.

Study sample
The use of power calculations was not reported. All CEAAs performed during the study period were included in the analysis. Overall, 960 CEAAs were identified. Three years (1992, 1996 and 1998) were selected for comparison purposes. The number of CEAAs performed was 113 in 1992, 167 in 1996 and 138 in 1998. The mean ages of the patients undergoing CEA were 68.8 years (1992), 69.3 years (1996) and 68.1 years (1998), respectively. The male-to-female ratio was 1.8:1 for CEAAs performed in 1992, 1.4:1 for those performed in 1996, and 2.3:1 for those conducted in 1998.
Study design
This was a retrospective comparative study with historical controls that was carried out in a single centre, the Geisinger Medical Center in Danville (PA), USA. The patients in each time period were followed for 20 days after the surgical intervention. Loss to follow-up was not reported. The data were obtained from a review of the medical records.

Analysis of effectiveness
It appears that all the patients included in the initial study sample were considered in the analysis of effectiveness. The outcome measures were:

- the 30-day perioperative combined death and stroke rate,
- nonfatal minor and major rates,
- the mortality rate,
- the percentage of preoperative angiography,
- the rate of postoperative intensive care unit (ICU) admissions,
- the rate of same-day admissions,
- the length of stay (LOS), and
- readmission rates within 72 hours.

The study groups were comparable at baseline in terms of their demographics and co-morbidities.

Effectiveness results
The 30-day perioperative combined death and stroke rate was 1.1% for the whole period, 1.8% in 1992, 0.6% in 1996 and 0 in 1998, (p>0.05).

The nonfatal minor and major rates for the whole period were 0.1% (minor) and 0.7% (major), respectively. The mortality rate was 0.3%.

The percentage of preoperative angiography was 98% in 1992, 59% in 1996 and 24% in 1998, (p<0.001).

The rates of postoperative ICU admission were 100% in 1992, 77% in 1996 and 2% in 1998, (p<0.001).

The rates of same-day admissions were 26% in 1992, 82% in 1996 and 94% in 1998, (p<0.001).

The mean LOS was 4.19 days in 1992, 1.76 days in 1996 and 1.28 days in 1998, (p<0.01 for 1992 versus 1996; p<0.02 for 1996 versus 1998).

A LOS of 1 day was 65% in 1996 and 86% in 1998.

Readmission rates within 72 hours were 0.9% in 1992, 3% in 1996 and 1.4% in 1998, (p>0.05).

Clinical conclusions
The effectiveness study showed that the progressive application of a clinical pathway was effective in reducing hospital stay, ICU admissions and pre-operative procedures, without affecting clinical outcomes such as the combined death and stroke rate.
Measure of benefits used in the economic analysis
The health outcomes were left disaggregated and no summary benefit measure was used in the economic study. In effect, a cost-consequences analysis was performed.

Direct costs
Discounting was not relevant since the costs per patient were incurred during a short time. The unit costs were not presented separately from the quantities of resources used. The health services included in the economic evaluation were all inpatient expenses and outpatient angiography. Professional costs were not included. The cost/resource boundary of the study appears to have been that of the third-party payer. The costs were estimated on the basis of hospital charges, which were converted into costs using the cost-to-charge ratio of the study hospital for diagnosis-related group charges. Resource use was estimated from the hospital's financial records for the patients included in the effectiveness study. The costs were adjusted according to the consumer price index from the Bureau of Labor Statistics. The price year was 1998.

Statistical analysis of costs
Statistical tests were conducted to test the statistical significance of differences in the estimated costs.

Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were not performed.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The mean hospital inflation-adjusted costs were $5,494 in 1992, $4,476 in 1996 and $3,350 in 1998. All the differences were statistically significant.

In 1998, the costs were $4,737 for patients undergoing preoperative angiography and $2,912 for patients operated on with duplex scan alone.

For the 67% of patients in 1998 who met the criteria of 1-day LOS and no preoperative angiograms, the costs were $2,801.

Synthesis of costs and benefits
The costs and benefits were not combined as a cost-consequences analysis was carried out.

Authors' conclusions
The implementation of a clinical pathway led to cost-savings from the perspective of the health service payer, without detriment to patient outcomes such as mortality, stroke rates and readmissions.
CRD COMMENTARY - Selection of comparators
The choice of the comparator was appropriate since three time periods were selected to reflect the progressive switch from standard care to the full implementation of the clinical pathway. However, more details on both standard care and the clinical pathway would have been helpful. You should decide whether this represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness evidence was derived from a retrospective observational study, which was used to assess the actual treatment patterns at the study hospital during the 7-year period. This design is subject to some limitations, such as selection and assessment bias and confounding factors. However, it should be noted that the study groups were comparable at baseline. Clearly, the use of a prospective and randomised study would have been more appropriate. All eligible CEAs were considered in the study. Therefore, it is likely that the study sample was representative of the study population. Power calculations were not performed and there was no evidence that the initial study sample was appropriate for the study question. However, statistically significant differences between the groups were observed. These issues tend to limit the internal validity of the analysis.

Validity of estimate of measure of benefit
No summary benefit measure was used in the analysis because a cost-consequences analysis was conducted.

Validity of estimate of costs
The authors stated implicitly which perspective was adopted in the study. It appears that all the relevant categories of costs have been included in the analysis. The price year was reported and, given the long timeframe of the study, the costs were appropriately reflated. However, information on resource use and unit costs was not provided, which will make it difficult to replicate the study in other settings. A cost-to-charge ratio was applied to estimate the true costs of the services. The cost estimates were specific to the study setting and no sensitivity analyses were conducted.

Other issues
The authors stated that the financial advantage of CEA, which was demonstrated in their study, confirmed results published in the literature. However, the issue of the generalisability of the study results to other settings was not addressed, and sensitivity analyses were not carried out. The external validity of the analysis was low. The authors reported some strategies that could be implemented in order to produce further cost-savings. The study referred to patients requiring CEA and this was reflected in the authors’ conclusions.

Implications of the study
The authors stressed that the rate and costs of re-intervention represent key factors in obtaining further cost-savings. This issue should be addressed in future randomised trials.

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