Cost-effectiveness of screening for carotid stenosis in asymptomatic persons

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
Screening for carotid stenosis using duplex Doppler ultrasonography before carotid endarterectomy in asymptomatic patients.

Type of intervention
Screening.

Economic study type
Cost-utility analysis.

Study population
Asymptomatic sixty-five-year-old men without neurologic symptoms of carotid stenosis such as transient ischemic attack, reversible ischemic neurologic deficit, amaurosis fugax, or previous stroke.

Setting
Hospital. The economic study was carried out in California, USA.

Dates to which data relate
The data for the effectiveness study were obtained from literature published between 1978 and 1995. The cost data were obtained from 1989 data and studies published between 1981 and 1994. The prices used were those prevailing in 1994.

Source of effectiveness data
Effectiveness data were derived from a review of previously completed studies and a Markov model.

Modelling
A decision tree was used in order to deal with uncertainty in terms of outcomes and costs. A Markov model was utilised to estimate the annual transition probabilities.

Outcomes assessed in the review
The outcomes assessed were the prevalence of carotid stenosis, probability of complication from angiography (death, major stroke, and minor stroke), and the probability of complication from carotid endarterectomy (death, major stroke, minor stroke and myocardial infarction). The annual probabilities of survivable strokes were estimated for the following conditions: major and minor stroke after carotid endarterectomy, in patients with no carotid stenosis, and in asymptomatic patients with carotid stenosis. In addition, annual probabilities of death (including death due to stroke) were estimated for the following: major and minor strokes (separately), well patients with and without carotid stenosis,
well patients after endarterectomy, and well patients after myocardial infarction. The sensitivity and specificity of
duplex Doppler ultrasonography (screening tests) were also assessed. Utility values attributed to different health states
were also extracted from the literature.

**Study designs and other criteria for inclusion in the review**
The outcome estimates were obtained mainly from a randomised controlled trial (ACAS). The authors stated that, for
the rest of the values used in the analysis, they "relied whenever possible on published medical literature that reflected
current technology and was specific to elderly men".

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported. The data were extracted by means of summary statistics from each study.

**Number of primary studies included**
A total of 18 studies was included.

**Methods of combining primary studies**
Not combined. The different values found in the literature for a given outcome were used in the sensitivity analysis.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
The estimates obtained were as follows:

prevalence of carotid stenosis, 0.05 (range: 0.02-0.13);

probability of complications from angiography were: death, 0.04 (range: 0.04-0.20), major stoke 0.45, and minor stroke
0.51, (0.012 overall, range: 0.005-0.012);

probabilities of complication from carotid endarterectomy were: death 0.10, major stroke 0.53, minor stroke 0.27 and
myocardial infarction and 0.09 (range: 0.09-0.22), (0.013 overall).

The annual probability of survivable major and minor stroke estimates were as follows: strokes after carotid
endarterectomy, 0.0066 and 0.0136, respectively;

in patients with no carotid stenosis, 0.00325 (range: 0.0011-0.00325) and 0.00650 (range: 0.0022-0.0065), respectively;
and

in asymptomatic patients with carotid stenosis, 0.0146 and 0.0197, respectively.

In addition, annual probabilities of death (including death due to stroke) were estimated to be as follows: major stroke,
0.16; minor stroke, 0.04;
well patients with and without carotid stenosis, 0.0348 and 1 (the Gompertz exponential survival function evaluated in patient age plus a specific time horizon), respectively;
well patients after endarterectomy, 0.0299; and after myocardial infarction, 0.062.

The sensitivity and specificity of duplex Doppler ultrasonography (screening tests) were 0.85 (range: 0.81-0.90) and 0.94 (range: 0.82-0.95), respectively.

The utility values attributed to a well health state, minor stroke state, moderate stroke state, severe stroke state, major stroke state, death state, and myocardial infarction state were 1.00, 0.75 (range: 0-0.75), 0.39, 0.12, 0.30 (range:0-0.30), 0.00, and 0.88, respectively.

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

Quality adjusted life-years (QALYs) gained with the intervention relative to the comparator was the outcome measure used. This was calculated using a decision tree model, a Markov model and the assumption of prolonged benefits of surgery (time-horizon modelling according to the lifetime of the cohort, with age-specific mortality modelled and stroke-specific mortality and morbidity assumptions made), in order to deal with uncertainty along the long-term clinical course of the average patient analysed. The utility weights were derived from patients’ values using a time-trade off method.

**Direct costs**

The costs were discounted. The main broad resource quantities were analysed separately from the prices according to the decision tree model. The costs measured were operating costs and costs of complications. The boundary adopted was the hospital. The estimation of costs was based on actual data from a review of admissions for elective carotid endarterectomy in California (1991 database of the Office of Statewide Health Planning and Development - OSHPD), a literature search of MEDLINE (studies published in 1981, 1988, 1989, 1993, and 1994), published average charges for Medicare diagnosis-related groups for 1991, and the 1994 Physicians’ Fee and Coding Guide. The prices were adjusted to the price year used, 1994, using the medical component of the Consumer Price Index. Costs associated with longer survival were included in the analysis.

**Indirect Costs**

Not considered.

**Currency**

US dollars ($).

**Sensitivity analysis**

The parameters varied in the sensitivity analysis were as follows: prevalence of disease, costs of screening and surgery, procedure complication rates, and duration of benefits (risk reduction for stroke from endarterectomy). The sensitivity analysis was carried out using one-way simple analysis.

**Estimated benefits used in the economic analysis**

Given a 10-year duration of benefits, screening gained an additional 0.013 QALYs (4.75 days), relative to the comparator. The discount rate applied was 3%.

**Cost results**

The costs were discounted at 3%. The incremental cost for the intervention (screening), relative to the comparator, was $1553 per patient. This estimate was obtained based on the assumption that the risk reduction effect from surgery
lasted until 10 years later.

**Synthesis of costs and benefits**
The (incremental) discounted cost per discounted quality-adjusted life-year gained, at 1994 prices, intervention relative to the comparator was $120,000. The sensitivity analysis showed that, only when a population of 40% prevalence of carotid stenosis could be identified, the cost-utility ratio would be $50,000. All the variations explored according to the values in the literature yielded cost-utility ratios of at least $74,000 (this corresponded to the case of benefits prolonged for the lifetime of the patient population, i.e. 30 years).

**Authors’ conclusions**
Given the ‘threshold’ value of $50,000 per quality-adjusted life year gained reported by the authors as the criteria for determining ”good value for money” strategies, screening for asymptomatic carotid stenosis to identify candidates for carotid endarterectomy ”would be less-cost effective than most accepted health interventions”. This holds for all relevant age groups since the authors argue that the patient population chosen in the study is that with the highest potential in terms of cost-effectiveness. Regarding the sensitivity analysis, the authors add that ”implausible conditions were needed for the marginal cost-effectiveness of screening to approach what is commonly considered to be acceptable (cost utility ratio of $50,000 per QALY gained)”. However, it was noted that, given the sensitivity of the results to the assumptions about duration of benefits from endarterectomy, studies providing more information regarding this would be helpful.

**CRD COMMENTARY - Selection of comparators**
The reason for the choice of the comparator is clear.

**Validity of estimate of measure of benefit**
The final estimate of the measure of benefit used in the study needs to be treated with caution, since the details of the search criteria adopted were not reported and the criteria for assessing the validity of the primary studies were not discussed.

**Validity of estimate of costs**
The resource utilisation estimates were obtained through a literature search and retrospective chart review, which may lead to biases and could limit the generalisability of the results. Adequate details of cost estimation were given, including the criteria used to retrospectively select clinical cases for the cost evaluation of carotid endarterectomy in the OSHPD 1991 database.

**Other issues**
The issue of generalisability of the study results to other countries was not addressed.

**Source of funding**
None stated.

**Bibliographic details**

**PubMedID**
9054277
Original Paper URL
http://www.acponline.org/journals/annals/01mar97/stenosis.htm

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Carotid Stenosis /surgery /ultrasonography; Cerebrovascular Disorders /prevention & control; Cost-Benefit Analysis; Decision Support Techniques; Endarterectomy, Carotid; Health Care Costs; Humans; Male; Mass Screening /economics; Quality-Adjusted Life Years; Sensitivity and Specificity; Ultrasonography, Doppler, Duplex /economics

AccessionNumber
21997008086

Date bibliographic record published
31/03/1999

Date abstract record published
31/03/1999