Cost of routine screening for carotid and lower extremity occlusive disease in patients with abdominal aortic aneurysms


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 selective versus routine preoperative screening through diagnostic imaging for clinically relevant nonaortic atherosclerotic occlusive disease (NAOD) in patients with abdominal aortic aneurysms (AAAs). In the routine preoperative screening strategy, all patients underwent diagnostic procedures. In the selective preoperative screening strategy, only patients with clinical indications of disease were investigated.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis and cost-utility analysis.

Study population
The study population comprised patients undergoing elective AAA repair.

Setting
The setting was secondary care. The economic study was carried out at the Department of Surgery of the University of Michigan, USA.

Dates to which data relate
The effectiveness and resource use data were gathered from January 1995 to October 1998. The price year was not reported.

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 study.

Study sample
Power calculations to determine the sample size were not reported. The medical records of a sample of 206 patients, who had undergone preoperative work-up consisting of abdominal ultrasonographic scan or computed tomographic scan, carotid duplex scan, and lower extremity arterial Doppler scan studies with ankle-brachial index (ABI) determinations, were reviewed and included in the effectiveness analysis. The mean age was 71.6 (+/- 6.9) years and there were 78% men. Fifty-three per cent of the patients had a history of angina, 71% had hypertension, and the AAA
size was 5.8 (+/- 1.3) cm. Seventeen patients did not undergo the intervention after initial work-up because of medical co-morbidities (n=12), death before operation (n=2), aneurysm extent (n=2) and preoperative cerebrovascular accident (n=1). The patients were grouped into four disease categories:

- advanced cerebrovascular disease (symptomatic carotid arterial stenosis, CAS, >60%; asymptomatic CAS >80%);
- all cerebrovascular disease (any CAS, >60%);
- advanced lower extremity peripheral vascular occlusive disease (PVOD) (ABI <0.3), and
- all lower extremity PVOD (ABI <0.6).

Data were not available for 47 patients who were not subjected to the screening protocol. The characteristics of the patients who did and did not undergo the protocol were not statistically different.

### Study design
This was a retrospective review of a case series that was carried out in a single centre. The length of and loss to follow-up were not reported. No blinded assessment method was used.

### Analysis of effectiveness
It was not stated whether all the patients included in the initial study sample were accounted for in the effectiveness study. The clinical outcomes used in the analysis were prevalence of NAOD in the four disease categories and the diagnostic value of clinical indications. The patients were classified as having clinical indications for diagnostic screening for occlusive disease on the basis of the documented history or symptoms. Clinical indications of CAS were patients who had had transient ischaemic attacks, amaurosis fugax, a completed stroke, or a history of prior carotid endarterectomy. Clinical indications of PVOD were claudication, rest pain, or a history of amputation.

### Effectiveness results
The prevalence of NAOD was:

- 3.4% in the group of advanced cerebrovascular disease (71% in symptomatic patients),
- 18% in the group of all cerebrovascular disease (37% in symptomatic patients),
- 3% in the group of advanced lower extremity PVOD (83% in symptomatic patients), and
- 12% in the group of all lower extremity PVOD (61% in symptomatic patients).

The sensitivity (sen), specificity (spec), positive predictive value (PPV) and negative predictive value (NPV) of clinical indications were:

- in the group of advanced cerebrovascular disease, 71% (sen), 85% (spec), 15% (PPV) and 99% (NPV);
- in the group of all cerebrovascular disease, 37% (sen), 88% (spec), 41% (PPV) and 86% (NPV);
- in the group of advanced lower extremity PVOD, 83% (sen), 85% (spec), 15% (PPV) and 99% (NPV); and
- in the group of all lower extremity PVOD, 61% (sen), 88% (spec), 41% (PPV) and 94% (NPV).

### Clinical conclusions
The effectiveness analysis showed that the prevalence rate of advanced nonaortic atherosclerotic disease was low and most of the patients with advanced disease presented clinical indications of their disease. This cast doubts on the...
usefulness of routine preoperative screening for patients with AAA.

**Measure of benefits used in the economic analysis**
The summary benefit measures were the number of cases identified in the cost-effectiveness analysis and the quality-adjusted life-years (QALYs) in the cost-utility analysis. The numbers of cases identified in all patients, in those who presented clinical indications, and in those who did not present clinical indications, were derived directly from the effectiveness study. The QALYs gained with screening in comparison with medical therapy were derived from another study (see Other Publications of Related Interest), but the methods used to calculate the utility weights were not reported.

**Direct costs**
Discounting was not relevant since the costs were incurred in less than two years. The unit costs were presented but resource use data were not. The health services in the economic evaluation were carotid duplex examination and lower extremity Doppler scan studies. The cost/resource boundary of the study was that of the third-party payer. The costs were derived from Medicare fee schedules as a proxy for true institutional costs. Information on resource use was based on actual data coming from the sample of patients included in the effectiveness study from January 1995 to October 1998. The price year was not reported. In the cost-utility analysis, only the cost of carotid duplex examination and the incremental cost of carotid endarterectomy when compared with medical management (derived from the literature) were considered.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
The indirect costs were not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
Sensitivity analyses were not performed.

**Estimated benefits used in the economic analysis**
The number of cases identified in each group (expressed as the percentage of cases) was reported (see the 'Effectiveness Results' section). In the cost-utility analysis, 3 cases of advanced CAS were identified in the sample of all patients, versus 2 in the sub-group of patients with clinical manifestations and 1 in the sub-group of those without clinical manifestations. Consequently, the number of QALYs gained (based on an increase of 0.25 QALYs per patient treated) was 0.75 in the sample of all patients, 0.50 in the sub-group of patients with clinical manifestations, and 0.25 in the sub-group of those without clinical manifestations.

**Cost results**
In the cost-effectiveness analysis, the total costs were not reported. In the cost-utility analysis, the total costs (including initial and subsequent treatment) were $44,234.75 for all patients, $10,372.29 in the sub-group of patients with clinical manifestations, and $33,862.46 in the sub-group of those without clinical manifestations.

**Synthesis of costs and benefits**
Average and incremental cost-effectiveness and cost-utility ratios were calculated to combine the costs and benefits of the screening programmes. The average costs per case identified were:

- in the group of advanced cerebrovascular disease, $5,445 (all patients), $1,258 (with history or symptoms) and $15,911 (without history or symptoms);
- in the group of all cerebrovascular disease, $1,003 (all patients), $449 (with history or symptoms) and $1,326 (with history or symptoms);
- in the group of advanced lower extremity PVOD, $3,732 (all patients), $785 (with history or symptoms) and $18,470 (without history or symptoms); and
- in the group of all lower extremity PVOD, $974 (all patients), $280 (history or symptoms) and $2,052 (no history or symptoms).

The average cost per QALY was $58,979.68 in the overall group of patients, $20,744.58 in the sub-group of patients with clinical manifestations, and $135,449.83 in the sub-group of those without clinical manifestations.

Authors’ conclusions
Routine screening was resource intensive and did not lead to the identification of a sufficient number of patients with occlusive disease due to the low prevalence rate of the disease. The use of selective screening in patients with clinical symptoms and a history of disease represented a cost-effective option, with a cost per quality-adjusted life-year (QALY) well below the standard threshold of $50,000.

CRD COMMENTARY - Selection of comparators
The authors did not explicitly justify the choice of the comparators, but it appears that all standard diagnostic procedures performed in patients with AAA have been considered. You should decide whether this approach is valid in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used data coming from a case series, which was based on a descriptive design and thus represents a weak source of effectiveness evidence. The retrospective nature of the study and the lack of an explicit control group represent further limitations to the internal validity of the analysis. The use of a prospective randomised study would have been more appropriate. The authors stated that the sample of patients considered in the effectiveness analysis was representative of the study population.

Validity of estimate of measure of benefit
Two benefit measures were used in the economic analysis as both cost-effectiveness and cost-utility analyses were carried out. In cost-effectiveness analysis, the use of cases identified represented a disease-specific measure, which would be difficult to compare with the benefits of other health care programmes. On the other hand, the use of QALYs ensures the comparability of the benefits of the current screening programme with those associated with other interventions. However, the calculation of the QALYs was not described since it was taken from a published study.

Validity of estimate of costs
The perspective adopted in the study reflected that of the third-party payer. In the cost-effectiveness analysis, only the costs strictly related to the screening tests were included in the calculations, while in the cost-utility analysis, the costs of subsequent treatment were further considered. The source of the cost data was reported, as were the unit costs. However, the costs were treated deterministically and no sensitivity analyses were conducted. The resource use data and the price year were not reported, thus making reflation exercises and transferability of the results to other settings difficult.
Other issues
The authors compared their findings with those from other studies and found similar incidence rates of occlusive disease. Further, other studies showed that a more focused use of preoperative imaging evaluation should be carried out rather than universal screening. However, the issue of the generalisability of the study results to other settings was not addressed and sensitivity analyses were not carried out. Therefore, the external validity of the analysis was low and the interpretation of the results requires caution. The authors noted some limitations of their analysis. For example, the retrospective design of the study, the unblinded nature of the clinical analysis, and the cost associated with the treatment of false-positives.

Implications of the study
The main implication of the analysis is that preoperative imaging should be limited to patients with clinical indications of underlying arterial occlusive disease. The authors stated that the use of minimally invasive examinations makes universal screening an attractive option, although the value of this new diagnostic approach is unclear.

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Other publications of related interest

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