Cost-effectiveness of percutaneous treatment of iliac artery occlusive disease in the United States


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
Percutaneous transluminal angioplasty (hereafter referred to as angioplasty), and stent placements in patients with iliac artery occlusive disease.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
A hypothetical cohort of patients was used in the model. Baseline analysis considered the costs and effects to a 60-year old male with life-limiting claudication due to stenoses in the iliac arteries, for whom a percutaneous intervention was indicated.

Setting
A hospital in the United States.

Dates to which data relate
Effectiveness data were collected from sources dated 1988-1998. Resource use data were collected from sources dating 1987-1998. Cost data were collected from sources dating from 1997-1999, and these were then converted into 1998 US dollars using the consumer price index.

Source of effectiveness data
A review of the literature was undertaken to obtain parameters for the model. The methods of the review were not described in the paper, nor were the data obtained synthesised in any way. However a published meta-analysis was used to provide the majority of data for the model.

Modelling
A Markov model was used to represent the possible costs and outcomes for the simulated patients. Specific details of the model were referenced to Bosch et al (1998).

Outcomes assessed in the review
Outcomes that were sought for the model were: annual excess mortality rate caused by peripheral arterial occlusive disease (PAOD), procedure mortality rate, complication rate, initial technical success rate for stenoses, long term
patency after angioplasty (immediately, and at 1 year, 2-years, 3-years and 4 years), relative risk for long term failure and quality of life. The number of cases in which stent placement followed angioplasty, and the effectiveness of stent placement were also derived from the literature.

Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
6 primary studies were used to populate the model, however one of the references was a meta-analysis of the results of percutaneous transluminal angioplasty and stent placement for aortoiliac occlusive disease.

Methods of combining primary studies
Primary studies were not formally combined, however one of the references used to provide the majority of the model data was a published meta-analysis.

Investigation of differences between primary studies
Not reported.

Results of the review
Estimates derived from the review were as follows:

Annual excess mortality rate caused by PAOD: ankle brachial index greater than 0.30 = 0.02, ankle brachial index equal or lower than 0.30 = 0.12.

Procedure mortality rate = 0.01.

Complication rate = 0.05.

Initial technical success rate for stenoses: stent = 1.00, angioplasty = 0.96.

Long term patency after angioplasty: immediately = 0.91, at 1 year = 0.74, at 2-years = 0.66, at 3-years = 0.61, and at 4 years = 0.58.

Relative risk for long term failure (patency): stent versus angioplasty = 0.61.

Quality of life: Successfully treated = 0.82, after failure = 0.70.

The number of cases in which stent placement followed angioplasty = 40% in the basecase.
Measure of benefits used in the economic analysis
The economic analysis used quality adjusted life years (QALYs) as the measure of benefit. A Markov model was used to estimate QALYs resulting from each of the treatment options. QALY estimates were obtained from a previously performed randomised trial, the Dutch Iliac Stent trial.

Direct costs
Costs were estimated from patients with iliac artery occlusive disease admitted to the Brigham and Women's hospital in Boston. The guidelines of the Dutch Guidance Group for Future Scenarios in Health Care were used for cost assessment. Costs were converted to 1998 US dollars using the consumer price index. Microcosting techniques were undertaken to calculate the costs to the radiology department. Costs considered were staff costs, procedure costs, costs of electrical equipment and costs of maintenance of equipment and housing. Procedure costs of two-sided angioplasty were estimated by presuming that the time taken to perform the procedure was the same as for a one-sided angioplasty. Additional hospital costs were estimated for 54 patients admitted to Brigham and Women's hospital, undergoing diagnostic angiography followed by angioplasty alone or angioplasty plus stent placement for an inadequate angioplasty result. Costs were based on the charge per admission multiplied by a department specific, year specific cost-to-charge ratio. All costs were discounted by 3%. Costs and resource use were not reported separately.

Statistical analysis of costs
No additional statistical tests for costs were carried out. Costs were treated stochastically using the Markov model.

Indirect Costs
Patient time costs were also considered. These were estimated by multiplying the mean number of days in hospital by the average gross earnings of a full-time 60-year old male employee. Additional societal costs were calculated using the Markov model. These included the cost of subsequent events, follow-up visits and procedures performed for recurrent symptoms. All costs were discounted by 3%.

Currency
US dollars ($).

Sensitivity analysis
A sensitivity analysis was carried out by changing key assumptions used in the model. These included: duration of the procedure, distribution of one versus two sided lesions, price of stents, the discount rate, patient characteristics (age, quality of life, disease severity). Patency data were changed to those for procedures performed for critical ischaemia, and the proportion of stent placement after angioplasty was changed to 90%.

Estimated benefits used in the economic analysis
The discounted quality adjusted life expectancy for each treatment strategy was as follows:

(1) no revascularisation = 7.79;
(2) angioplasty followed by no revascularisation = 8.46;
(3) angioplasty with selective stent placement followed by no revascularisation = 8.63;
4) angioplasty and repeated angioplasty ;
5) angioplasty followed by angioplasty with selective stent placement; 6) initial and repeated angioplasty with selective stent placement.
Cost results
The discounted lifetime policy costs for each treatment strategy were as follows:

no revascularisation = $4,531;
angioplasty followed by no revascularisation = $10,048;
angioplasty with selective stent placement followed by no revascularisation = $10,903;
angioplasty and repeated angioplasty = $12,458;
angioplasty followed by angioplasty with selective stent placement = $12,830;
initial and repeated angioplasty with selective stent placement = $13,158.

Synthesis of costs and benefits
Incremental cost-effectiveness ratios were calculated for 4 of the treatment options, the no revascularisation strategy was only included in the analysis as a reference strategy, and hence a cost-effectiveness ratio was not calculated.

Angioplasty followed by no Revascularisation = Inferior by extended dominance;
Angioplasty with selective stent followed by no revascularisation = $7,624;
Angioplasty and repeated angioplasty = Inferior by extended dominance;
Angioplasty followed by angioplasty with selective stent placement = Inferior by extended dominance;
Initial and repeated angioplasty with selective stent placement = $8,519.

The incremental cost-effectiveness ratio of angioplasty with selective stenting therefore falls within acceptable levels, at below $10,000 per QALY gained. Changing the patency data to those for critical ischaemia resulted in a cost-effectiveness ratio for initial and repeated angioplasty with selective stent placement of $15,558 per QALY gained. A cost-effectiveness ratio of $23,034 per QALY gained was achieved for critical ischaemia with occlusions. When the proportion of stent placement was changed to 90%, initial and repeated angioplasty with selective stent placement was still more cost-effective than treatment options with angioplasty alone, with a cost-effectiveness ratio of $14,544 per QALY gained.

Authors' conclusions
The results of the study suggest that angioplasty with selective stenting for an immediate suboptimal result of angioplasty is a cost-effective treatment strategy compared with angioplasty alone for iliac artery occlusive disease in the USA.

CRD COMMENTARY - Selection of comparators
Six treatment options were used in the model, each consisting of an initial intervention followed by a secondary intervention. These comparators would seem to cover the range of treatment options available for patients facing angioplasty and stent treatment for iliac artery stenosis. No revascularisation was also included as a reference strategy.

Validity of estimate of measure of benefit
The majority of effectiveness data used in the Markov model came from a published meta-analysis, therefore providing a larger sample size on which to derive outcome data. Results from meta-analyses must however be interpreted with caution, as primary studies can differ quite significantly with regard to methodology. A well conducted meta-analysis should however avoid any such problems.
Validity of estimate of costs
The calculation of costs was based on a small sample of patients, therefore requiring a number of assumptions be made regarding the treatments relative costs. Calculation of additional hospital costs was also undertaken in a far less rigorous manner than radiology department costs. The costing that was undertaken was very thorough, and the authors made every effort to identify and collect data on every aspect of resource use.

Other issues
The authors presented a detailed comparison with other similar studies. They highlighted the fact that the results were in line with those reported by a similar analysis including Dutch cost data. The authors recognised that the results of the study were not necessarily generalisable to other settings, and that costs were specific to one particular institution.

Implications of the study
The results of this study suggest that angioplasty with selective stenting for an immediate suboptimal result of an angioplasty, represents a cost-effective treatment strategy, for patients with iliac artery occlusive disease in the USA.

The baseline results would suggest that, when angioplasty is considered for patients with iliac artery occlusive disease due to a stenosis, the preferred treatment option is to perform an angioplasty followed by immediate stent placement, if the results of the angioplasty are not satisfactory.

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None stated.

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Other publications of related interest


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