Coronary stenting: costly or cost-effective

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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
Elective single-vessel coronary revascularization by (1) angioplasty, or (2) coronary stenting, or (3) initial angioplasty followed by stenting to treat symptomatic restenosis.

Type of intervention
Treatment, secondary prevention.

Economic study type
Cost-utility analysis.

Study population
Patients with symptomatic, single-vessel coronary disease undergoing elective single-vessel coronary revascularization.

Setting
Hospital. The economic study was performed at Boston’s Beth Israel Hospital, USA.

Dates to which data relate
Effectiveness data were derived from a review of the literature published as of December 1994. The resources were estimated using cost data from Boston's Beth Israel Hospital. There was no clear statement of what prices were used.

Source of effectiveness data
The estimate for final outcomes was based on a review of previously completed studies.

Modelling
A decision analytic model was applied. The authors did not specify the model but further information is available in Cohen et al(1994).

Outcomes assessed in the review
Baseline outcomes included in the model due to the interventional procedures were: procedural mortality rate; probability of emergency bypass surgery; probability of subacute thrombosis; probability of failure to dilate; angiographic restenosis rates; probability of vascular complications; probability of symptoms with angiographic restenosis.

Study designs and other criteria for inclusion in the review
The study designs included were mainly observational studies but there were also randomized controlled trials (the
randomised STRESS and Benestent trials). In case of unpublished literature, the authors included studies which used techniques and definitions comparable to the head-to-head trials published and already included in their review.

**Sources searched to identify primary studies**
Literature published as of September 1993 was included. Unpublished studies were included as well in order to minimise selection bias. More details about the databases searched were not given.

**Criteria used to ensure the validity of primary studies**
The best studies currently available were chosen.

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

**Number of primary studies included**
Twenty-seven studies were included overall.

**Methods of combining primary studies**
Where applicable, the data were pooled, but the method used was not specified.

**Investigation of differences between primary studies**
Studies with comparable patients and using similar definitions were included.

**Results of the review**
Respectively, the results for PTCA and stenting were as follows:

(a) Procedural mortality rate: 0.002 vs 0.002.

(b) probability of emergency bypass surgery: de novo lesion 0.01 vs 0.006; multiplier for restenosis lesion 0.5 vs 0.5.

(c) probability of subacute thrombosis: elective procedure 0.005 vs 0.02; emergent procedure 0.15 for stenting alone.

(d) probability of failure to dilate: de novo lesion 0.01 vs 0.01.

(e) angiographic restenosis rates: de novo lesion 0.37 vs 0.20; multiplier for second procedure 1.1 vs 1.4; multiplier for third procedure 1.5 for PTCA alone.

(f) probability of vascular complications: 0.01 vs 0.13.

(g) probability of symptoms with angiographic restenosis: 0.70 vs 0.70.

**Measure of benefits used in the economic analysis**
Quality-adjusted life expectancy expressed as Quality-Adjusted Life Years (QALYs). Authors' values were used. Other details were not given.

**Direct costs**
All the costs were discounted. Some costs and quantities of resources were reported separately. Direct health service costs were used and related to costs of treatments and long-term medical care costs. Direct costs of treatments were
identified by assessing the resource utilization of 177 patients at Boston's Beth Israel Hospital. Cardiac catheterization laboratory costs (including angioplasty balloons, devices, guiding catheters, guide wires, and contrast dye) were based on measured resource utilisation for each procedure and actual hospital acquisition costs during the study period. Additional equipment costs, laboratory room costs, and personnel costs were based on an average cost per procedure with data adjusted for actual procedure duration. Direct hospital room and nursing costs were determined from hospital accounting data adjusted for patient's nursing intensity. All other hospital service costs were based on number of units used and the cost of units were calculated as the charge per unit multiplied by the specific cost-to-charge ratio for the hospital department providing the service. The date of price data was not clearly specified in the paper.

Statistical analysis of costs
Confidence intervals for costs were calculated and p-values of the estimation were reported.

Currency
US dollars ($).

Sensitivity analysis
A one-way sensitivity analysis was carried out on the reduction in clinical restenosis rate in order to test the incremental cost-effectiveness ratio of initial stenting to PTCA. A two-way sensitivity analysis was carried out on the restenosis rate and the PTCA abrupt closure rate to test the incremental cost-effectiveness ratio of initial stenting to PTCA. Authors' values assigned to quality of life were also subjected to sensitivity analysis.

Estimated benefits used in the economic analysis
The study predicted that a 55 year-old man with symptomatic, single-vessel disease would have a quality-adjusted life expectancy of 19.24 years if treated by angioplasty alone, a quality-adjusted life expectancy of 19.25 years if treated by angioplasty with stenting for restenosis, and a quality-adjusted life expectancy of 19.27 years if treated by initial stenting. Therefore, the authors found that the intervention with initial stenting would save an additional 0.03 quality-adjusted life years (2 healthy weeks) with respect to standard angioplasty, while angioplasty with stenting for restenosis would save an additional 0.01 quality-adjusted life years, with respect to standard angioplasty. The results were discounted at a rate of 5%.

Cost results
The average initial cost of angioplasty was $5,396 (+/-$2,829), while the lifetime cost of angioplasty was $52,100. The average initial cost of initial stenting was $7,878 (+/-$3,270), while the lifetime cost of initial stenting was $52,700. The 2,500-dollar difference between the initial costs of the two treatments was statistically significant (p<0.0001). The difference was reduced to $600 when looking at the lifetime costs as a result of the higher long-term medical costs of angioplasty. The lifetime cost of angioplasty with stenting for restenosis was $52,400. All the costs were discounted at a rate of 5%.

Synthesis of costs and benefits
The incremental cost-effectiveness ratio per QALY gained was $33,700 for the initial stenting compared to angioplasty. The incremental cost-effectiveness ratio per QALY gained was $72,500 for angioplasty with stenting for restenosis compared to angioplasty.

Authors' conclusions
The authors defined a treatment as quite favourable if the incremental cost/QALY gained was less than $20,000 and they also defined treatments as consistent if the incremental cost/QALY gained was between $20,000 and $40,000. Therefore they concluded that initial stenting could be regarded as a cost-effective alternative in comparison with many other accepted therapies.
CRD Commentary
Information about the review of the clinical literature has been gathered from a previous, detailed manuscript published in Circulation (Cohen, 1994). Overall, this was a well conducted study, but a few comments need to be made:

a) Although the review of the literature was conducted in a systematic and rigorous way, the sources searched for the published literature and the methods used for combining the studies were not specified.

b) The method of deriving QALYs should have been discussed in more detail. The authors report that their own values were used to judge quality of life. These were tested by an extensive sensitivity analysis.

c) The authors pointed out that patients in the study of costs were not randomly assigned to PTCA or stenting treatment. Patients undergoing stenting were more likely to undergo treatment of a saphenous vein graft stenosis than PTCA patients. This may have caused bias in the cost-effectiveness analysis. Further analysis of the effects of patient selection on costs could have helped to avoid bias and strengthen the internal validity of the study.

Bibliographic details

Other publications of related interest

Indexing Status
Subject indexing assigned by CRD

MeSH
Angioplasty, Transluminal, Percutaneous Coronary /economics; Boston; Coronary Disease /economics /therapy; Cost-Benefit Analysis; Decision Support Techniques; Hospital Costs; Life Expectancy; Quality of Life; Recurrence; Stents /economics

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