Influence of intraoperative conversion from off-pump to on-pump coronary artery bypass grafting on costs and quality of life: a cost-effectiveness analysis

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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.

CRD summary
The objective was to determine the cost-effectiveness of standard coronary artery bypass graft (CABG) compared with off-pump coronary artery bypass (OPCAB). The authors concluded that OPCAB surgery, compared with standard CABG, increased the QALYs, at a similar cost. The methodology was good and both the methods and results were reported appropriately. Given the evidence available, and the scope of the analysis, the authors’ conclusions were appropriate, although their results might not be generalisable to the wider population.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to determine the cost-effectiveness of standard coronary artery bypass graft (CABG) and off-pump coronary artery bypass (OPCAB), for myocardial revascularisation, and to determine whether intra-operative conversion to standard CABG reduced the quality of life for patients or increased the costs.

Interventions
This study compared the use of standard CABG with OPCAB.

Location/setting
USA/in-patient secondary care.

Methods
Analytical approach:
A model was used to evaluate the costs and benefits of the two interventions. The model consisted of two major parts: a decision tree model for the operative phase; and a Markov model for the post-operative phase. The time horizon of the study was 10 years. The authors reported that the perspective was that of the US health care system.

Effectiveness data:
The effectiveness and clinical data were derived from a number of published studies. The main clinical efficacy estimates were the probability of peri-operative and post-operative mortality and morbidity. The peri-operative probabilities were derived from a large database containing records of 70,514 surgical coronary revascularisation procedures. The post-operative probabilities were obtained from published randomised trials and observational studies.

Monetary benefit and utility valuations:
Quality of life estimates were derived from published studies, which used either the standard gamble or time-trade-off techniques.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary measure of benefit.

Cost data:
The direct costs were those of the surgical procedures, treatment, hospital care, out-patient care, medications, office visits, and laboratory tests. The costs were derived from published estimates, except for the physician costs, which were
derived from Procedural Terminology codes, and the drug costs, which were taken from average wholesale prices. The authors reported that the costs were adjusted to 2005 prices, using the US consumer price index for all urban consumers. All costs were reported in US dollars ($) and, as they were incurred over a period of 10 years, the future costs were discounted at an annual rate of 3%.

Analysis of uncertainty:
A one-way sensitivity analysis was performed by varying the rate of intra-operative conversion from OPCAB to on-pump CABG surgery. In addition the authors performed a probabilistic sensitivity analysis by assigning probability distributions to all the model variables. All the variables were sampled 10,000 times from their distributions.

Results
The mean discounted QALYs gained in patients receiving OPCAB were 7.64 compared with 7.52 for patients receiving standard CABG.

OPCAB surgery resulted in a discounted average lifetime cost of $91,282 compared with $91,685 for patients receiving standard CABG.

OPCAB was found to be dominant, which is both more effective and less costly, over standard CABG.

Patients who required conversion from OPCAB to standard CABG incurred a cost of $103,909 and gained 6.63 QALYs, whilst successful OPCAB surgery incurred a cost of $90,533 and gained 7.70 QALYs.

The results of the sensitivity analysis showed that OPCAB was dominant if the conversion rate was below 8.5% and the costs increased exponentially when the conversion rate increased above 15%.

The results of the probabilistic sensitivity analysis showed that at a willingness to pay threshold of $50,000 per QALY, the probability that OPCAB was cost-effective was 61%.

Authors’ conclusions
The authors concluded that in low risk patients OPCAB surgery, in comparison with standard CABG, increased QALYs, at a similar cost. This benefit of OPCAB surgery might be offset by the intra-operative risk of conversion from an off-pump to an on-pump procedure.

CRD commentary
Interventions:
The interventions were well reported. Although no explicit justification was given for using standard CABG as the comparator, it would appear to have represented a widely used health technology in the authors’ settings.

Effectiveness/benefits:
The authors did not report if a systematic review of the literature was undertaken in order to identify all the relevant clinical and efficacy parameters. It was therefore not possible to assess if the best available evidence was used to populate the model. The input parameters and their sources, were reported in full, along with any assumptions that were required.

Costs:
The perspective was appropriately reported and all the major costs relevant to this health care perspective appear to have been included. The sources, from which costs were derived, were clearly stated, along with other details such as the time horizon, discount rate, and the price year.

Analysis and results:
The details of the model and a diagram were provided by the authors. The impact of uncertainty on the results was tested in one-way and probabilistic sensitivity analyses. The use of probabilistic sensitivity analyses is the most thorough way of assessing the overall impact of uncertainty in a model. The methods and results were reported adequately. The authors reported the limitations of their study in their discussion. The main limitation they reported, was that their study
was most applicable to male patients, aged approximately 60 years, who had single or multiple-vessel disease, who were in New York Heart Association class I or II, and who were scheduled for elective coronary revascularisation, amongst other characteristics.

Concluding remarks:
The study methodology was good and both the methods and results were reported appropriately. Given the evidence available, and the scope of the analysis, the authors' conclusions were appropriate, although the results might not be generalisable to the wider population.

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