Economic evaluation of coronary artery bypass grafting surgery with and without cardiopulmonary bypass: cost-effectiveness and quality-adjusted life years in a randomized controlled trial

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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 examine the cost-effectiveness of coronary artery bypass grafting surgery with cardiopulmonary bypass (CPB) versus with off-pump coronary artery bypass (OPCAB) using data from a randomised controlled trial. The authors concluded that OPCAB surgery was less expensive than CPB and similarly effective over a six-month period. The study was generally well conducted and clearly presented. The authors’ conclusions appear to be valid, but should be confirmed over a longer time horizon.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to examine the cost-effectiveness of coronary artery bypass grafting (CABG) surgery with cardiopulmonary bypass (CPB) compared with off-pump coronary artery bypass (OPCAB) in patients with coronary artery disease (CAD).

Interventions
The two strategies compared were CABG surgery with CPB versus with OPCAB.

Location/setting
UK/tertiary care hospital.

Methods
Analytical approach:
This economic evaluation was based on a single study. The time horizon of the analysis was six months. The authors stated that the perspective of the UK National Health Service (NHS) was adopted.

Effectiveness data:
The clinical data were derived from a randomised controlled trial (RCT), which enrolled 168 patients requiring primary isolated CABG surgery at a single tertiary cardiothoracic centre in Middlesex, UK. The patients were randomly assigned to receive either CPB or OPCAB. There were 84 patients in each group and the length of follow-up was six months. The clinical endpoints were adjusted for baseline differences. The primary clinical endpoints appear to have been patient survival and readmission to hospital for cardiac reasons.

Monetary benefit and utility valuations:
The utility valuations were derived from the sample of patients enrolled in the RCT using the World Health Organization Quality of Life (WHOQOL-100) questionnaire. These assessments took place at baseline and after six months. A measure of health-related quality of life was created by mapping certain questions from the WHOQOL-100 to the European Quality of life scale (EQ-5D).

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure. These were calculated using data from the RCT.
The economic analysis included the costs of the two procedures plus possible readmission to hospital. This included time in theatre, use of blood products, length of stay in a standard ward or in an intensive care unit, physiotherapy sessions, microbiology tests, angiography and echocardiography tests (during readmissions). The unit costs and quantities of resources consumed were presented. The unit costs were derived from standard national sources, such as NHS Reference Costs and NHS salary scales. The costs were in UK pounds sterling (£) and referred to the financial year 2003 to 2004.

Analysis of uncertainty:
Not carried out.

Results
The mean total cost was £5,537 with OPCAB and £7,015 with CPB (difference: £1,478, standard error, SE: £670, p=0.03).

Over six months, the expected QALYs were 0.317 in the OPCAB group and 0.324 in the CPB group (difference: 0.007, SE: 0.002, p=0.65) after adjusting for baseline differences.

Authors' conclusions
The authors concluded that OPCAB surgery was less expensive than CPB and similarly effective over a six-month period. They also noted that a modelling framework could be used to simulate the long-term cost-effectiveness of these two surgical approaches.

CRD commentary
Interventions:
The comparators were appropriately selected. CPB represented the conventional approach for patients with CAD requiring CABG surgery, while OPCAB was a relatively new treatment.

Effectiveness/benefits:
The use of a RCT to derive the clinical data represents a valid source due to the strengths of such a design, which limits the potential impact of selection bias and makes the study groups more comparable at baseline. The details about the methods and results of the RCT were presented in a companion paper. Nevertheless, the authors reported the inclusion and exclusion criteria as well as other key aspects of the study design. These features of the analysis ensure the validity of the clinical estimates. The methodological approach used to elicit the patient preferences for health conditions was extensively described. QALYs are a validated benefit measure and are relevant, especially for CAD, which has a substantial impact on the patient's quality of life. Moreover, they are generalisable and allow cross-disease comparisons. Some drawbacks of the clinical analysis were the short patient follow-up period and the fact that the quality of life questionnaires were only completed by 60% of patients.

Costs:
The analysis was consistent with the economic viewpoint of the study. A detailed breakdown of cost items was provided together with information on the unit costs and quantities of resources used. The sources of costs were reported for all items and the price year was given. The costs common to both surgical procedures were not considered. On the whole, the economic analysis was carried out in a transparent fashion, which will enhance the possibility of replicating the analysis for other settings or time periods. Basic statistical analyses were carried out to examine the statistical significance of the cost differences.

Analysis and results:
A synthesis of costs and benefits was not performed because the two surgical procedures were similarly effective. In effect, a cost-minimisation analysis was undertaken. The issues of uncertainty and generalisability were not addressed. The authors reported and discussed the findings from other published studies, the results of which were generally similar to those from this analysis. The authors acknowledged that the relatively short follow-up represented a limitation of their study.
Concluding remarks:
The study was generally well conducted and clearly presented. The authors’ conclusions appear to be valid, but should be confirmed in a longer time horizon.

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