Off-pump surgery decreases postoperative complications and resource utilization in the elderly


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
Off pump coronary artery bypass (OPCAB) was compared against the conventional treatment of coronary artery bypass graft (CABG). OPCAB was performed through either a limited left anterior thoracotomy or median sternotomy. For the CABG surgery, cardiopulmonary bypass (CPB) was instituted with a single two-stage right atrial cannula, and an ascending aorta perfusion cannula.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The population consisted of patients aged over 70 years requiring myocardial revascularisation. Patients aged over 70 were selected because bypass surgery in this group is associated with increased risks of mortality and morbidity.

Setting
The study was carried out in a secondary care setting in Canada.

Dates to which data relate
Effectiveness and resource data were taken from patients undergoing surgery between November 1996 and June 1998. The price year and dates to which costs relate were not explicitly stated. However the costs were taken from an article published in 1997.

Source of effectiveness data
Outcomes and effectiveness data were taken from a single study.

Link between effectiveness and cost data
Costing was undertaken on the same patient sample as that used in the effectiveness section of the study. Resource use was collected retrospectively.

Study sample
Patients aged over 70 years undergoing OPCAB or CABG between November 1996 and June 1998 were identified from the hospital database. 30 and 60 consecutive patients who had undergone OPCAB and CABG respectively were selected from this sample. Sample size was not determined in the planning phase of the study to assure a certain power.
No patients were excluded from the analysis.

Power calculations were retrospectively performed based on the existing sample size. Continuous variables were analysed by analysis of variance. Categorical variables were analysed using either Chi square analysis or Fisher’s exact test. The statistical level of significance was assumed to be 5%.

**Study design**

This was a non-randomised, non-blinded controlled retrospective study based in a single centre. Patients were followed up until discharge or death, whichever was earlier. There was no loss to follow up.

**Analysis of effectiveness**

All patients selected completed treatment and were included in the analysis.

The primary health outcomes were the incidences of:

- low-output syndrome (failure to maintain cardiac index greater than 2.1 L/min/m sq postoperatively without inotropic support or intraaortic balloon pump for longer than 30 minutes);
- atrial fibrillation (duration longer than 30 minutes or treatment required due to haemodynamic instability);
- stroke (cerebrovascular injury leading to neurologic deficits present at discharge), respiratory complications; and death.

The two treatment groups were shown to be comparable in terms of age, risk-acuity score (Parsonnet 1989; Tu 1995), sex, incidences of diabetes, chronic obstructive pulmonary disease and peripheral vascular disease. They were also comparable in terms of the number of renal failure patients on dialysis, patients with impaired left ventricular function and patients with Canadian Cardiovascular Society classification IV symptoms at time of surgery.

The groups differed significantly in terms of the proportion of urgent or emergent cases (46.7% for OPCAB, 28.3% for CABG; p=0.001).

**Effectiveness results**

Mortality rates did not differ significantly between the OPCAB and CABG groups (0% versus 1.7%; p=0.5).

Statistically significant differences in morbidity were found for low-output syndrome (10% in the OPCAB group versus 31.7% in the CABG group; p<0.02) and atrial fibrillation (10.0% in the OPCAB group versus 28.3% in the CABG group; p<0.05).

**Clinical conclusions**

The authors concluded that OPCAB in the elderly is a safe alternative to CABG, offering reduced postoperative complications and blood usage.

**Measure of benefits used in the economic analysis**

No summary measure of benefit was used in the economic analysis. A cost-consequences analysis was therefore performed. Various health outcomes were investigated and the reader is referred to the effectiveness results reported earlier.

**Direct costs**

Quantities and costs were reported separately. Only direct costs to the hospital were included. These costs were...
operating room and supply costs, hospital stay (days), intensive care unit (ICU) hours and ventilation time (hours). Operating room and supply costs were a fixed cost applied to all patients. Professional fees were not included in the analysis. The perspective taken was that of the hospital.

Direct cost data were based on a previous article (Calafiore et al. 1997). The price year was not reported.

No cost adjustments were made for learning how to perform the alternative treatment, OPCAB.

Unit costs used were average costs.

Discounting was not relevant because all costs were incurred within a year.

**Statistical analysis of costs**
Resource use and total cost per patient were analysed statistically using analysis of variance at the 5% level of significance and their mean and standard deviation presented. The parameters tested were total cost, hospital length of stay and time in ICU and on ventilation. No test for distribution was reported in the article.

**Indirect Costs**
Indirect costs were not included in the study.

**Currency**
Canadian dollars (Can$).

**Sensitivity analysis**
A sensitivity analysis was not undertaken.

**Estimated benefits used in the economic analysis**
As a cost-consequences analysis was undertaken, the reader is referred to the effectiveness results reported earlier.

**Cost results**
The mean total cost per patient was Can$6,702 +/- 1,047 (OPCAB) and Can$7,784 +/- 2,846 (CABG). The difference in cost was significant at the 5% level.

The costs of complications and adverse events were included in the total cost calculation, as an assumed longer stay in the ICU.

**Synthesis of costs and benefits**
A synthesis was not undertaken because the analysis showed that OPCAB yielded positive incremental benefits and negative incremental costs (extended dominance) with respect to the comparator, CABG.

**Authors’ conclusions**
The authors concluded that OPCAB in the elderly is a safe alternative to CABG, offering reduced postoperative complications and blood usage. Significantly better postoperative outcomes appear to lead to shorter ICU and hospital lengths of stays, resulting in a significant reduction in cost through the use of OPCAB.

**CRD COMMENTARY - Selection of comparators**
The comparator to OPCAB was CABG. This is justifiable as CABG is the conventional treatment. You, as a user of the database, should decide if this is a widely used health technology for elderly patients in your own setting.

Validity of estimate of measure of effectiveness
The study sample was not randomly selected which compromises the internal validity of the results. In particular, the reader should be aware that patients might have undergone CABG or OPCAB for a particular reason, not necessarily captured by the baseline variable comparisons. If this occurs, the effectiveness of either procedure may have been overestimated. Furthermore, the sample size was limited to a total of 90 patients (30 for OPCAB and 60 for CABG). Despite this, the study results do give an indication of the potential benefits of OPCAB and provide evidence towards confirmation of the hypothesis set out by the authors.

The study sample was taken from the study population and therefore appears to have been representative. As a user of the database, you should decide if the two treatment choices would be appropriate for this study population in your own setting. The patient groups were comparable for the majority of variables at baseline. However, relatively more patients in the OPCAB group were urgent or emergent cases, and had more redo surgery. The authors did not discuss the implications of this and the user of the database should take this into consideration. Appropriate statistical analyses were undertaken and discussed appropriately.

Validity of estimate of measure of benefit
The effectiveness measures were mortality and morbidity, defined by postoperative complications. Health benefits, such as quality adjusted life years, were not captured. However, it is likely that such benefits would have produced a result favourable towards OPCAB treatment, as reduced morbidity can be assumed to lead to better quality of life.

Because no measure of health benefit was used, the cost-effectiveness analysis has been categorised as a cost-consequences study.

Validity of estimate of costs
The authors report costs and quantities separately, although the reader would have to refer to another article to find out how unit costs were derived. The key hospital resources, length of stay and time in ICU, were the main resources costed and are applicable to the hospital perspective adopted. Unfortunately, professional fee costs were excluded and this will alter the magnitude of the total cost results. However, as the professional fee costs are likely to be positively correlated with time spent in theatres, ICU and hospital, the inclusion of them may increase the cost savings as a result of using OPCAB. Discounting was not undertaken which was appropriate, given the timeframe of the study.

A statistical analysis of costs and resources was performed. Tests for the statistical distributions of resource use and costs were not reported and it is therefore impossible to comment on the appropriateness of the type of test performed.

No sensitivity analysis of prices used was undertaken. This would not have affected the overall cost results as all resource quantities were lower for the OPCAB patients. The price year was not stated.

Other issues
The authors discuss several limitations, including the non-randomised approach to the sample selection, lack of long-term data that extend beyond discharge from hospital, lack of long-term quality of life measures, and the relatively small sample size of the groups. For the latter, they correctly suggest that insignificant differences may have been significant if a larger sample size had been used. The authors made appropriate comparisons of their findings with those from other studies and discussed the generalisability of their findings to other health care systems, whilst remaining focussed on the study population under investigation.

Implications of the study
The authors recommend that a prospective randomised clinical trial is necessary to provide definitive comparison
results. They also suggest that the use of OPCAB for elderly patients should be recommended, as it will help cost containment for a group of patients who are typically higher resource utilisers.

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**Other publications of related interest**


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