Coronary artery bypass grafting (CABG) after initially successful percutaneous transluminal coronary angioplasty (PTCA): a review of 17 years experience

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
The use of percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass grafting (CABG) was examined.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients requiring myocardial revascularisation procedures for coronary disease.

Setting
The setting was a hospital. The economic study was carried out in Australia.

Dates to which data relate
The effectiveness and resource use data were gathered from January 1981 to December 1997. The costs were estimated using 1995-1996 prices.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was performed retrospectively on the same sample of patients as that used in the clinical study.

Study sample
Power calculations were not reported. Patients were retrospectively identified from the hospital database. During the study period, 361 patients who had undergone a successful PTCA ultimately required subsequent CABG (interval group). These patients had a mean age of 60 years (age range: 30 - 81) and 75% were male. During the same timeframe (17 years), 11,909 patients had undergone primary elective CABG without a preceding PTCA (control group). These patients had a mean age of 61.6 years (age range: 22 - 89) and 80% were male. Clearly, patients receiving PTCA to coronary grafts were excluded from the interval group, and patients undergoing second-time CABG were excluded from the control group. Moreover, patients requiring emergency CABG (within 24 hours) following initial PTCA, or those who had unsuccessful angioplasty, were excluded from the interval group. Successful PTCA was defined as
dilatation of a targeted coronary stenosis (stenoses) such that the residual luminal narrowing was less than 40% and not associated with complications.

**Study design**
This was a retrospective cohort study that was carried out at a single centre, the Royal Prince Alfred Hospital in Sydney. The length of follow-up was not reported. Data were available for all patients. The outcomes were estimated from the coronary artery surgery register at the study hospital.

**Analysis of effectiveness**
All of the patients included in the initial study sample were accounted for in the analysis of effectiveness. The outcome measures used were:

- preoperative procedures and degree of coronary artery disease;
- several postoperative criteria, including intra-aortic balloon pump, low cardiac output syndrome, prolonged ventilation, dialysis, haemorrhage greater than 1.5 L, neurological injury, wound infection, myocardial infarction, atrial fibrillation and ventricular fibrillation;
- 30-day mortality; and
- the length of hospital stay.

At baseline, the study groups were comparable in terms of the incidence of major medical co-morbidities or coronary artery disease factors. However, the control group had a slightly greater proportion of male patients than the interval group (80% versus 75%; p<0.05) and a lower mean preoperative left ventricular ejection fraction (0.56 versus 0.65; p<0.05). In addition, a greater proportion of patients in the control group were classified as obese (47% versus 33%; p<0.05) and had a history of smoking (67% versus 60%; p<0.05) compared with the interval group. A significantly higher number of patients in the interval population presented for CABG with unstable angina pectoris (70% versus 52%; p<0.05).

**Effectiveness results**
In the interval group, the mean number of coronary angiograms per patient was 1.7 (median 1; range: 1 - 5) and the mean number of PTCAs per patient was 1.2 (median 1; range: 1 - 4).

The mean interval from initial PTCA to graft surgery was 13.7 months (range: 1 day - 149 months) and the median interval was 4 months.

The time interval decreased over the study period (17 years).

The degree of coronary artery disease differed between groups:

- preoperative angiography revealed a greater proportion of patients in the control with triple-vessel coronary advanced ischaemic pathology in comparison with the interval group;
- control patients had a mean of 2.6 systems with significant atherosclerotic disease, compared with 2 vessels in the interval group, (p<0.05);
- control patients also had greater than 50% stenosis on the left main coronary artery;
- the mean number of distal anastomoses was 2.9 (range: 1 - 8) in the interval group and 4.1 (range: 1 - 8) in the control group, (p<0.05); and
- the mean cardiopulmonary bypass time was 65 minutes (range: 16 - 181) in the interval group and 85.3 minutes (range:...
11 - 308) in the control group, (p<0.05).

None of the differences in terms of postoperative criteria reached statistical significance. The rate of 30-day mortality was 2% in both groups.

The mean hospital stay was 8 days (range: 1 - 49) in the interval group and 9.1 days (range: 0 - 99) in the control group, (p<0.05).

**Clinical conclusions**
The effectiveness analysis showed that the two groups were comparable in terms of effectiveness and safety profile. A longer hospital stay was observed in the control patients.

**Measure of benefits used in the economic analysis**
No summary benefit measure was used in the economic analysis because the two groups of patients were comparable with respect to clinical outcomes. In effect, a cost-minimisation analysis appears to have been performed.

**Direct costs**
Discounting was not relevant since the costs per patient were generally incurred during less than 2 years. The unit costs were not presented separately from the quantities of resources used. The economic evaluation considered all hospital costs associated with coronary angiography, PTCA and CABG (with and without complications). The cost/resource boundary of the study was not reported clearly but it could have been that of the hospital. Resource use was estimated using data derived from the sample of patients included in the clinical study. CABG (with or without complications) also included the cost of one diagnostic angiogram, while the costs in the interval group included a mean of 1.7 angiograms, 1.2 PTCA procedures, and 1 CABG (with or without complications). No stents were used. The costs came from diagnosis-related group (DRG) data, which were estimated at the study hospital. The costs were estimated using 1995-1996 prices.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
The indirect costs were not considered in the economic evaluation.

**Currency**
Australian dollars (Aus$).

**Sensitivity analysis**
Sensitivity analyses were not performed.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
The mean hospital costs were Aus$3,389 for diagnostic angiography and Aus$3,284 for PTCA.

The mean hospital costs per patient in the interval group were Aus$24,220 (average costs of $13,873 for the subsequent
CABG and $10,347 for all preoperative interventional cardiology procedure).

The mean hospital costs for CABG were AUS$11,403 (without complications), or AUS$18,210 (with complications).

**Synthesis of costs and benefits**
A synthesis of the costs and benefits was not relevant since a cost-minimisation analysis was carried out.

**Authors’ conclusions**
Percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass grafting (CABG) were equally effective for the treatment of patients with coronary disease. However, successful PTCA was associated with a significantly higher rate of repeat procedures over time in comparison with CABG. When the multiple percutaneous interventions were incorporated into the financial analysis, CABG (with or without complications) was associated with lower hospital costs relative to PTCA.

**CRD COMMENTARY - Selection of comparators**
The selection of the comparators was appropriate, as PTCA and CABG are two commonly used surgical procedures for the treatment of patients requiring myocardial revascularisation. You should decide whether they are valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness analysis came from a retrospective observational study. Patient allocation to treatment groups was not randomised, which could have introduced some selection bias in the analysis. Indeed, the patient groups were not well balanced at baseline because some significant differences in clinical characteristics were observed. No statistical tests were carried out to take potential confounding factors into account. The evidence came from a large tertiary care centre, which could not be representative of other hospitals. It was unclear whether the study sample was representative of the patient population. No evidence about the appropriateness of the sample size was provided. These issues tend to limit the internal validity of the study.

**Validity of estimate of measure of benefit**
No summary benefit measure was used in the analysis because a cost-minimisation analysis was conducted. Please refer to the comments above in the ‘Validity of estimate of measure of effectiveness’ field.

**Validity of estimate of costs**
The authors did not state explicitly which perspective was adopted in the study. However, it appears that the cost/resource boundary of the hospital was adopted since the costs were estimated from DRG rates. Only hospital costs were included in the analysis. A detailed breakdown of the cost items was not provided since the costs were presented as macro-categories. This reduces the possibility of replicating the study results. The source of the data was reported. The costs were treated deterministically and were specific to the study setting. No sensitivity analyses were performed. The price year was reported, which aids reflation settings in other settings.

**Other issues**
The authors reported the results of studies that had evaluated clinical and economic outcomes associated with the two revascularisation procedures. Generally, the results of the current study were consistent with published evidence. The issue of the generalisability of the study results to other settings was not addressed and sensitivity analyses were not conducted. This reduces the external validity of the analysis. The authors noted that the two patient groups differed in that the CABG cohort had a higher baseline risk for adverse outcomes. Nevertheless, the clinical outcomes were comparable, which further stress the efficacy of CABG. However, since CABG was reserved especially for patients at high risk, it was unclear whether the two procedures could be considered as fully mutually exclusive in all patients.
Implications of the study
The study results supported the use of CABG in appropriately selected patients requiring revascularisation procedures. However, caution is required when interpreting the results of the analysis, owing to the limitations of the study design. The authors suggested that further research should be carried out to determine the rate of myocardial infarction as a result of repeated percutaneous coronary interventions in those patients who required CABG following initially successful PTCA.

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None stated.

Bibliographic details

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Other publications of related interest


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MeSH
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