A meta-analysis of randomized controlled trials comparing coronary artery bypass graft with percutaneous transluminal coronary angioplasty: one- to eight-year outcomes


CRD summary
This review compared bypass grafting (CABG) with percutaneous transluminal coronary angioplasty (PTCA) in patients with coronary artery disease. The authors concluded that CABG was associated with improved survival at 5 years (5-8 years for those with multi-vessel disease). Unclear inclusion criteria, a limited search and methodological weaknesses mean that the conclusions should be treated with caution.

Authors' objectives
To compare coronary artery bypass grafting (CABG) and percutaneous transluminal coronary angioplasty (PTCA) for the treatment of coronary artery disease, focusing on the long-term effects in particular.

Searching
MEDLINE was searched from 1966 to 2001; the search terms used were reported. To identify additional studies, personal files and the bibliographies of previous systematic reviews and retrieved articles were searched, and expert advice was sought. One additional trial published after the search dates was included.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were eligible for inclusion.

Specific interventions included in the review
Studies comparing CABG and PTCA were eligible for inclusion. This included studies where stents were used as an adjunct to PTCA.

Participants included in the review
Participants who had multi-vessel disease, or proximal left-anterior descending coronary artery disease, suitable for either CABG or PTCA were eligible for inclusion. No other inclusion or exclusion criteria were stated. However, one study was excluded because the participants had severe disease that would have excluded them from the other included studies. In the included studies, the mean age of the participants ranged from 56 to less than 75 years. The majority of the participants were male (72 to 89%). Some participants were smokers, or had prior myocardial infarction (MI), angina, diabetes, hypertension or dyslipidaemia.

Outcomes assessed in the review
The outcomes of interest included all-cause and cardiac mortality, nonfatal MI, subsequent revascularisation (CABG or PTCA), angina, and a combined end point of death, MI or revascularisation. The follow-up times were up to 8 years.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Two reviewers independently extracted the data. Any discrepancies were discussed with a third reviewer. The outcomes
at a follow-up of 2 to 3 years, 4 to 5 years and 6 to 8 years were extracted as 3-year, 5-year and 8-year end points, respectively. Published survival curves and histograms were digitally scanned and analysed. The outcome data were extracted on an intention-to-treat basis. Summary estimates of effect sizes were calculated for each study.

Methods of synthesis
How were the studies combined?
The studies were combined in a meta-analysis, using the random-effects model of DerSimonian and Laird. The weighted percentage risk difference (RD) with 95% confidence intervals (CIs) was calculated and used to estimate the numbers-needed-to-treat (NNT).

How were differences between studies investigated?
Statistical heterogeneity was tested using the Q statistic (P<0.1 was considered significant). To explain heterogeneity, the studies were ranked by the event rate in the CABG group, then the characteristics of the studies that contributed most to the heterogeneity in the pooled analysis were examined. Pre-specified subgroup analyses were carried out for single- or multi-vessel disease, the presence or absence of diabetes, and the use or non-use of stents in the initial PTCA strategy.

Results of the review
Thirteen RCTs (7,964 participants) were included.

There was no statistically significant difference in the risk of death or cardiac death between CABG and PTCA at 1 year (11 studies), 3 years (11 studies) or 8 years (4 studies). However, the 5-year follow-up data did show a statistically significant benefit for patients who received CABG: the RD at 5 years was 1.9% (95% CI: 0.33, 3.4, P<0.02) for death (7 studies) and 2.0% (95% CI: 0.29, 3.7, P<0.02) for cardiac death (5 studies). The NNT was about 50 patients. Statistical heterogeneity between the trials was not significant.

The number of subsequent revascularisations required was reduced with CABG, compared with PTCA, at all time points (RD: 24 to 38%, P<0.001). There was statistically significant heterogeneity between the trials for this outcome (P<0.02).

There was no statistically significant effect of either CABG or PTCA on the number of nonfatal MIs.

For the combined outcome (death, MI, revascularisation) the risk of an event was greater in the PTCA treated group at 1, 3 and 5 years (RD: 26 to 31%, P<0.001). Statistical heterogeneity between the trials was not significant.

Compared with PTCA, there was a reduction in angina with CABG at 1 and 3 years: the RD was 11% (95% CI: 7.5, 14, P<0.001) at 1 year and 9% (95% CI: 5, 13, P<0.001) at 3 years. There was statistically significant heterogeneity between the trials (P<0.02).

CABG was associated with a reduction in subsequent revascularisations in trials that used stents with PTCA and in trials that did not use stents: the RDs at 3 years were 15% (3 trials; 95% CI: 10, 20, P<0.001) and 34% (7 trials; 95% CI: 28, 40, P<0.001), respectively. There was statistically significant heterogeneity between the trials that did not use stents. No trial directly compared PTCA with and without stents versus CABG.

In the subgroup analyses, CABG provided a survival advantage over PTCA for multi-vessel disease at 5 and 8 years: the RD was 2.3% (95% CI: 0.29, 4.3, P=0.025) at 5 years and 3.4% (95% CI: 0.32, 6.4, P=0.03) at 8 years. At 4 years’ follow-up, CABG provided a survival advantage over PTCA in diabetic patients (RD 8.6%, 95% CI: 2.2, 15, P=0.01), but this was not significant at 6.5 years.

Authors’ conclusions
There was a survival advantage with CABG over PTCA at 5 years, and also a reduction in subsequent revascularisations and less angina. The use of stents in those undergoing PTCA reduced the need for revascularisation by approximately half. CABG provided a survival advantage at 5 to 8 years for those with multi-vessel disease, and at 4 years for diabetic
patients.

CRD commentary
The aims of the review were not fully stated and the inclusion criteria were not well described. A more extensive search strategy would have given more reassurance that relevant studies had not been missed, thereby avoiding publication bias. Since details of the study selection process were not described, we cannot tell whether steps were taken to minimise bias. In addition, as the quality of the included studies was not assessed, the potential for bias in the individual studies is unknown.

The authors commented that due to the particular characteristics of the study participants, the results may not be generalisable to all populations. They rightly pointed out that the multiple comparisons made with the large number of outcomes, different time periods and subgroup analyses, increases the likelihood of finding a statistically significant result by chance. In view of this, the authors' conclusions are selective and should be treated with caution, particularly with respect to the NNT, which were reported without CIs, and conclusions about PTCA with and without stents versus CABG, which were not based on randomised comparisons.

Implications of the review for practice and research
Practice: The authors stated that in choosing between CABG and PTCA, individual patient preferences should be considered in the context of the results of this review.

Research: The authors stated that more studies with longer follow-up assessments are needed to compare CABG with PTCA in conjunction with the use of stents.

Funding
National Library of Medicine, grant number LM07092-10; Agency for Healthcare Research and Quality, grant number HS-06503.

Bibliographic details

PubMedID
12706924

Original Paper URL
http://content.onlinejacc.org/cgi/content/full/41/8/1293

Indexing Status
Subject indexing assigned by NLM

MeSH
Angioplasty, Balloon, Coronary /mortality; Coronary Artery Bypass /mortality; Coronary Disease /mortality /surgery /therapy; Humans; Randomized Controlled Trials as Topic; Survival Analysis; Time Factors; Treatment Outcome

AccessionNumber
12003009356

Date bibliographic record published
30/09/2004
Date abstract record published
30/09/2004

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.