One-year outcomes of coronary artery bypass graft surgery versus percutaneous coronary intervention with multiple stenting for multisystem disease: a meta-analysis of individual patient data from randomized clinical trials


CRD summary
This individual patient data meta-analysis concluded that, after 1 year, percutaneous coronary intervention (PCI) with multiple stents and coronary artery bypass graft (CABG) provided a similar degree of protection against death, heart attack or stroke in people with multi-vessel coronary disease. More people needed repeat revascularisation with PCI than with CABG. The authors' conclusions are likely to be reliable.

Authors' objectives
To compare the effects of percutaneous coronary intervention (PCI) with multiple stenting to coronary artery bypass grafting (CABG) in people with multi-vessel coronary artery disease (CAD).

Searching
MEDLINE was searched; the search terms were reported. The reference lists of identified papers, as well as scientific session abstracts from Circulation, the Journal of the American College of Cardiology and the European Heart Journal, were checked. The dates of the searches were not given; the studies enrolled participants from 1995 to 2000.

Study selection
Study designs of evaluations included in the review
The review included individual patient data (IPD) from randomised controlled trials (RCTs).

Specific interventions included in the review
Studies that compared PCI with multiple stenting to CABG were eligible for inclusion. In the included studies, a median of 2 lesions were successfully revascularised in the PCI group and stents were implanted in 79% of lesions. Glycoprotein IIb/IIIa inhibitors were used peri-procedure in 6.7% of the participants. In the CABG group, a median of 3 anastamoses were performed with a median of 2 conduits; in 90% of the participants at least one arterial conduit was used.

Participants included in the review
Studies of people with multisystem CAD were eligible for inclusion. The included participants had stable or unstable angina, or other objective evidence of CAD, where both PCI and CABG were considered to be appropriate treatments. Disease had to be present in at least two coronary arteries (assessed by angiography). People with previous CABG or PCI were excluded. In some studies those in need of concomitant major cardiovascular surgery, and in others those with valvular heart disease, were also excluded. The participants had a mean age of 61 years and 77% were men. Some participants had diabetes, hypertension, hypercholesterolaemia, were current smokers, or had a history of myocardial infarction (MI). The mean ejection fraction was 60% and details of coronary vessel disease were reported. Some participants were also taking medications such as aspirin, beta-blockers, calcium-channel blockers, nitrates and statins.

Outcomes assessed in the review
The outcomes of interest were death, MI, stroke, repeat revascularisation (PCI or CABG) and anginal status at 1 year' follow-up. The primary outcome reported was a composite of death, MI or stroke. The results for 30 days' follow-up were also reported. Anginal status was classified according to the Canadian Cardiovascular Society functional class. Definitions of the outcomes were taken as those in the individual studies.

How were decisions on the relevance of primary studies made?
The authors contacted the principle investigators of identified studies for information.
Assessment of study quality
The data were checked for completeness, consistency, as well as for agreement, with published reports of the included studies.

Data extraction
IPD relating to baseline characteristics, procedures and results were obtained from the study investigators and the data were transferred electronically to a central database.

Methods of synthesis
How were the studies combined?
Kaplan-Meier survival curves were constructed and the differences between the two groups were compared using log rank tests. Cox proportional hazard regression models were used to assess the relationship between allocated treatment and outcomes. Hazard ratios (HRs) and 95% confidence intervals (CIs) were calculated; these adjusted for between-trial differences, as well as for age, heart disease risk factors, cardiovascular history, co-morbidities and medication. All analyses were performed on an intention-to-treat basis.

How were differences between studies investigated?
Heterogeneity was assessed by including a trial by treatment interaction term in each model. Subgroup analyses were performed based on age (less than or more than 65 years), gender, diabetes, smoking status (never, former, current) and vessel disease (two, three). Studies were removed from the analysis individually to investigate heterogeneity.

Results of the review
IPD from 4 RCTs (3,051 participants) were included.

Eighty-nine per cent of those randomised to PCI with stents and 96% of those randomised to CABG received the allocated treatment. Complete revascularisation was achieved in 54% of people allocated to PCI with stents and 82% of those allocated to CABG. For the primary outcome of death, MI or stroke at 30 days there was a lower incidence with PCI compared with CABG (3.1% versus 4.8%; HR 0.61, 95% CI: 0.42, 0.89, p=0.01). However, PCI was associated with a higher incidence of repeat revascularisation than CABG (3.3% versus 0.5%; HR 7.8, 95% CI: 3.3, 18.3, p<0.001).

At 1 year, the incidence of the primary outcome was similar in both groups: 8.7% after PCI and 9.1% after CABG (HR 0.95, 95% CI: 0.74, 1.2, p=0.63). Repeat revascularisation was needed more frequently with PCI than with CABG (18.0% versus 4.4%, p<0.001).

At 1 year, the percentage of those classified as free from angina (functional class 0) was lower in the PCI group than in the CABG group (77% versus 82%, p=0.002). The percentage classified as group 0 or 1 was similar in both groups (90% versus 89%, p=0.02).

Heterogeneity was evident between trials for the primary outcome at 30 days (p<0.001), but was no longer present at the 1-year follow-up (p=0.2).

The subgroup analyses found no evidence to indicate any difference between treatments in the primary outcome at 1 year, according to the pre-specified subpopulations.

Authors’ conclusions
At 1 year’ follow-up, PCI with multiple stents and CABG provided similar protection against death, MI or stroke in people with multi-vessel CAD. However repeat revascularisation procedures were higher with PCI than with CABG.
CRD commentary
The inclusion criteria for this review were clearly stated and several sources were searched. However, no mention was made of any restrictions by language or date. It is possible that some relevant studies might have been missed. The authors contacted the principle investigators of the included studies for information and the data were checked appropriately. Appropriate methods were used to analyse and combine the IPD and between-trial heterogeneity was assessed. Details of the included participants were given for all data and not by individual trial. The authors commented that the patient populations differed between the trials. The included patients may represent a selected population of low to moderate risk and these results may not necessarily be generalisable to those at higher degrees of risk. The use of IPD meant that time-to-event data could be analysed for each patient; this was considered to provide a more reliable result than a meta-analysis of summary results. This was a well-conducted review and the authors’ conclusions appear reliable.

Implications of the review for practice and research
The authors did not state any implications for practice or further research.

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