Off-pump coronary artery bypass surgery versus percutaneous coronary intervention: a meta-analysis of randomized and nonrandomized studies
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CRD summary
The authors concluded there was a decreased rate of revascularisation and 12-month major adverse cardiac or cerebrovascular events for off-pump coronary artery bypass graft compared with percutaneous coronary intervention. The authors’ conclusions represent the evidence presented but, given the possibility of publication bias and the unknown quality of included studies, the authors’ conclusions should be interpreted with caution.

Authors’ objectives
To compare off-pump coronary artery bypass graft surgery with percutaneous coronary intervention for the treatment of coronary artery disease.

Searching
MEDLINE (from 1966), EMBASE (from 1988), Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, and DARE were searched up to 2009 for studies published in English. Search terms were reported. Reference lists of retrieved articles were scanned.

Study selection
Eligible for inclusion in the review were randomised and non-randomised comparative studies of percutaneous coronary intervention (PCI) versus off-pump coronary artery bypass graft (CABG) surgery for the treatment of coronary artery disease.

Outcomes of interest included cerebrovascular event, peri-procedural/post-procedural myocardial infarction, perioperative/postoperative cardiac death, all-cause mortality at 30 days/12 months, repeat revascularisation, and 12-month major adverse cardiac or cerebrovascular events (defined as myocardial infarction, need for repeat revascularisation, and cerebrovascular events including transient ischaemic attacks). Peri-procedural events were defined as occurring within 30 days after intervention or within the same hospitalisation. Post-procedural events were defined as beyond 30 days or after the same hospital admission.

Most included studies used bare metal stents. Patient study eligibility criteria varied between studies. Just under half of the included studies excluded patients who had multi-vessel disease. The mean age of patients in the off-pump CABG group ranged from 54.1 to over 70 years of age; the mean age range in the PCI group was similar.

It was unclear how many reviewers performed study selection

Assessment of study quality
The authors did not appear to formally assess study quality, although they did mention that methodological reasons for heterogeneity were explored.

Data extraction
Data was extracted in order to calculate relative risks (RR) and 95% confidence intervals (CI). Data were extracted independently by two reviewers with any disagreements resolved by discussion and consensus with a third reviewer.

Methods of synthesis
Relative risks were combined in a meta-analysis using both fixed-effect and random-effects models. Only results from random-effects models were presented. Heterogeneity was assessed using $X^2$ and $I^2$. $I^2$ values greater than 50% were taken to indicate substantial heterogeneity.

Subgroup analyses according to study design (RCT only and non-randomised studies only) were provided for the
outcome of stroke, major adverse cardiac or cerebrovascular events, and repeat revascularisation. Subgroup analyses of other factors were not possible as raw data were not available.

Results of the review
Ten studies (seven RCTs and three non-randomised studies; n= 4,821 patients) were included in the meta-analysis. Sample sizes ranged from 100 to 3,321 patients.

Stroke: There was no significant difference in the incidence of stroke between off-pump coronary artery bypass graft (CABG) surgery and percutaneous coronary intervention (PCI; RR 0.85, 95% CI 0.28 to 2.63; I²=0%; six studies). There was also no significant difference in stroke when only RCTs were included in the analysis (four RCTs), or when only non-randomised studies were included (two studies). There was no evidence of heterogeneity.

Twelve-month major adverse cardiac or cerebrovascular events (MACCEs): The incidence of 12-month MACCEs was significantly higher with PCI compared with off-pump CABG (RR 1.56, 95% CI 1.29 to 1.90; I²= 0%; four studies). MACCEs were also significantly higher with PCI compared with off-pump CABG when only observational studies were included in the analysis (RR 1.74, 95% CI 1.04 to 2.91; two studies). There was no significant difference in major adverse cardiac or cerebrovascular events between off-pump CABG surgery and PCI when only RCTs were included (RR 1.76, 95% CI 0.91 to 3.40; two RCTs).

Repeat revascularisation: There was a significantly greater risk in the incidence of repeat revascularisation with PCI compared with off-pump CABG surgery for all studies (RR 2.98, 95% CI 2.24 to 3.97; I² = 0%; 10 studies), RCTs only (RR 4.26, 95% CI 2.43 to 7.46; seven studies), and non-randomised studies only (RR 2.63, 95% CI 1.89 to 3.67; three studies).

Myocardial infarction: There was no significant difference between off-pump CABG surgery and PCI for the incidence of peri-procedural myocardial infarction (nine studies), post-procedural myocardial infarction (10 studies). There was no evidence of heterogeneity.

Mortality: There was no significant difference between off-pump CABG surgery and PCI for the incidence of peri-procedural cardiac death (eight studies) post-procedural cardiac death (six studies), all-cause mortality at 30 days (10 studies) and all-cause mortality at 12 months. There was no evidence of substantial heterogeneity.

Authors' conclusions
There was a decreased rate of revascularisation and major adverse cardiac or cerebrovascular events at 12 months for off-pump coronary artery bypass graft surgery compared with percutaneous coronary intervention

CRD commentary
The review addressed a clear research question and was supported by adequate inclusion criteria. The search strategy included several relevant databases, but the search was limited to studies published in English so there was a risk of publication and language bias.

There was no apparent assessment of study quality, consequently the quality of evidence upon which the authors' conclusions were based was unclear. Adequate details of primary studies were provided.

The authors' conclusions represent the evidence presented, but given lack of study quality assessment and small number of studies (as acknowledged by the authors), the authors' conclusions should be interpreted with caution.

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

Research: The authors stated that the comparison between off-pump CABG surgery and PCI is worthy of further investigation. Rapid improvement in stent technology may make follow-up from earlier trials using bare metal stents irrelevant, and future trials should compare off-pump CABG with drug-eluting stents. The experience level of off-
pump CABG surgeons is an important variable, and should be documented. The higher stroke rate in surgical versus percutaneous coronary revascularisation may be overcome by the use of off-pump CABG and anaortic technique. Further investigation is required.

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