Meta-analysis of randomized trials comparing the effectiveness of on-pump and off-pump coronary artery bypass

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CRD summary
This review concluded that off-pump coronary artery bypass surgery did not differ from on-pump surgery for rates of stroke or myocardial infarction but reduced the risk of postoperative atrial fibrillation. Most of the data came from small trials with unclear details and there were questions about some of the review methods so the conclusions should be treated with caution as they may not be reliable.

Authors' objectives
To assess the differences in incidences of stroke, atrial fibrillation and myocardial infarction between off pump coronary artery bypass graft (OPCAB) and conventional coronary artery bypass grafting (CCABG).

Searching
MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL), Science Citations Index Expanded and CBM were searched to March 2010. Some search terms were reported. Related articles facilities, bibliographies, meeting abstracts and relevant journals were checked. Only studies in English or Chinese were eligible.

Study selection
Randomised controlled trials (RCTs) of at least 15 adults that compared OPCAB to CCABG and reported on the incidence of postoperative stroke or myocardial infarction at one month and atrial fibrillation at three months after operation were eligible for inclusion.

In the included trials, the mean age of participants was 63 years and 20% were women. The authors stated that there were no significant differences between participants in the trials in age, diabetes, left ventricular ejection fraction, three vessel disease and number of distal anastomoses. Patients with ejection fraction were not represented in 29 trials.

Two reviewers independently assessed studies for inclusion. Disagreements were resolved by discussion or consultation with a third reviewer.

Assessment of study quality
Quality was assessed in accordance with the Cochrane Handbook and based on adequate sequence generation, allocation concealment, blinding, incomplete outcome data addressed, free of selective reporting and free of other bias. Studies were classified as low, high or unclear risk of bias.

The authors did not state how many reviewers performed the quality assessment.

Data extraction
Data were extracted to calculate odds ratios (ORs) and 95% confidence intervals (CIs).

The authors did not state how many reviewers extracted data.

Methods of synthesis
Where there was no significant statistical heterogeneity, pooled odds ratios and 95% CIs were calculated using a fixed-effect model; otherwise a random-effects model was used. The authors stated that where there were zero events in one arm of a trial they intended to add 0.01 to facilitate calculations and use a random-effects model; this did not appear to have been undertaken for stroke. Statistical heterogeneity was assessed using $I^2$. Funnel plots were used to assess for publication bias.

Results of the review
Forty-three RCTs (16,828 participants) were included. Study size ranged from 37 to 2,203 participants. Follow-up
ranged from 30 days to six years. Studies were published between 2000 and 2010.

Allocation concealment was unclear in around 10% of the studies and blinding was unclear in around 15%. Otherwise all studies were considered at low risk of bias on all items. Funnel plots for the outcomes of stroke and myocardial infarction showed no evidence of publication bias; those for atrial fibrillation showed asymmetry.

Compared to CCABG there was a statistically significant reduction in atrial fibrillation with OPCAB (OR 0.65, 95% CI 0.52 to 0.82; I²=58%; 27 trials). Removal of two trials resulted in I²=0% and the results still showed a statistically significant reduction in atrial fibrillation. There was no statistically significant difference between OPCAB and CCABG for stroke (16 trials; I²=0%) or myocardial infarction (25 trials; I²=0%).

Authors’ conclusions
OPCAB surgery did not differ from on-pump surgery with regard to the rates of stroke or myocardial infarction but reduced the risk of postoperative atrial fibrillation.

CRD commentary
The aims of this review were clearly stated in terms of the inclusion criteria. The search covered several relevant sources and included looking for unpublished studies. Language limitations mean that there was a potential for language bias in the review. Methods of study selection were aimed at reducing reviewer error or bias; methods for quality assessment and data extraction were unclear. The methods of quality assessment and data synthesis appeared appropriate although it was not clear what methods were used to deal with studies with zero events in particular outcomes and whether these were appropriate. Heterogeneity was investigated. Summary information about the included studies was presented; without information about individual studies and participants it was difficult to assess the generalisability of the results. Follow-up periods differed significantly between studies (up to six years) and it was not clear how this may have affected the results. The reviewers included reporting of appropriate outcomes as part of their quality assessment but did not make it clear why the clinically relevant outcomes of death and/or revascularisation were not included. The outcomes assessed in the review may not have been the outcomes of interest in the included studies and it was possible that these were under-reported.

Most of the data came from small trials with unclear details and there were questions about some of the review methods so the conclusions should be treated with caution as they may not be reliable.

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

Research: The authors stated that large multicentre RCTs were needed to confirm outcomes of OPCAB compared to CCABG.

Funding
Not stated.

Bibliographic details

PubMedID
22340570

DOI
10.3760/cma.j.issn.0366-6999.2012.02.032

Original Paper URL

Indexing Status
Subject indexing assigned by NLM

MeSH
Atrial Fibrillation; Coronary Artery Bypass; Coronary Artery Bypass, Off-Pump; Female; Humans; Incidence; Male; Middle Aged; Myocardial Infarction; Randomized Controlled Trials as Topic; Stroke; Treatment Outcome

AccessionNumber
12012007821

Date bibliographic record published
12/04/2012

Date abstract record published
20/10/2012

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.