Off-pump versus on-pump coronary artery bypass grafting: a systematic review and meta-analysis of propensity score analyses

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CRD summary
This review aimed to systematically assess all propensity score analyses that compared off-and on-pump coronary bypass grafting and concluded that the review found off-pump surgery superior to on-pump surgery in all assessed short-term outcomes, including mortality. Risk of bias and unexplained statistical heterogeneity in the included studies mean that the conclusions should be interpreted with caution.

Authors' objectives
To systematically review all propensity score analyses comparing off-and on-pump coronary bypass grafting.

Searching
The reviewers searched MEDLINE, EMBASE, ACP Journal Club, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews, DARE, EBM Reviews and Web of Science databases and three internet search engines were searched for relevant studies. Search terms were reported. Citations on six previously identified articles were searched for further relevant studies. References of all available articles were searched. Meeting abstracts and unpublished reports were searched. Authors of meeting abstracts were contacted for further relevant studies. No language or date restrictions were applied.

Study selection
Eligible studies reported a comparison of at least one off-pump with an on-pump group and used propensity score analysis to compare treatments. Eligible studies had to provide a short-term or in-hospital binary clinical outcome from mortality, stroke, myocardial infarction, atrial fibrillation, renal failure, inotropic support, red blood cell transfusion, wound infection, reoperation for bleeding, intra-aortic balloon pump support (IABP) and prolonged ventilation. Systematic reviews, observational studies without propensity score analysis and randomised controlled trials were excluded.

Included study locations included England, Germany, Italy, Canada and USA. Where reported, average patient age ranged from 61.9 to 73.0 years. Where reported, the proportion of male participants ranged from zero to 90.4%. Single centre and multicentre studies were included. Studies of high risk groups and non-high risk groups were included.

Two reviewers performed the study selection. How disagreements were resolved was not clear. [A: Disagreements were resolved by consensus and discussion with a third reviewer.]

Assessment of study quality
The reviewers did not report that they conducted a quality assessment.

Data extraction
Two reviewers independently extracted data required for a meta-analysis using a standardised form. In most studies, odds ratios (ORs) with 95% confidence intervals (CIs) were extracted or calculated. In one study, risk ratios (RRs) with 95% CIs were extracted and considered equivalent to odds ratios. Studies with zero events were corrected for.

Disagreements were resolved by consensus and discussion with a third reviewer.

Methods of synthesis
Odds ratios with 95% CIs were pooled using random-effects models and weighted by the inverse of the variance. Q test and I² were used to assess statistical heterogeneity. Numbers needed to treat (NNT) were calculated. Meta-regressions were performed using a random-effects framework. Data were pooled using fixed-effect models within a sensitivity
analysis. Publication bias was assessed using funnel plots.

Results of the review
Thirty-five studies (123,137 participants) were included in the review.

The reviewers produced pooled estimates that favoured off-pump over on-pump coronary bypass for the outcomes: mortality (NNT=189; 28 studies), stroke (NNT=104; 22 studies), renal failure (NNT=82; 17 studies), inotropic support (NNT=8; seven studies), red blood cell transfusion (NNT=9; eight studies), wound infection (NNT=314; 13 studies), IABP support (NNT=245; seven studies) and prolonged ventilation (NNT=116; six studies). No statistically significant differences were found for the outcomes myocardial infarction, atrial fibrillation and reoperation for bleeding. Random-effects and fixed-effect results were calculated and reported for all outcomes.

Significant statistical heterogeneity was found for inotropic support, red blood cell transfusion, reoperation and atrial fibrillation; this heterogeneity could not be explained by study location, type of propensity score and a range of other potential confounders.

Authors' conclusions
The review of propensity score analyses found off-pump surgery superior to on-pump surgery in all assessed short-term outcomes, including mortality.

CRD commentary
The search strategy was thorough, clearly reported and performed without language or date restrictions. There was no evidence of publication bias. Study selection was clear and conducted by more than one reviewer, which reduced risks of reviewer error and bias. Data extraction was conducted by two reviewers independently. Few details on the study designs were reported, except that they were observational and as quality assessment was not undertaken the risk of bias of the included studies was unclear. There was evidence of statistical heterogeneity that could not be explained. The results were clearly reported, but only short-term outcomes were included. The NNT estimates were high and with wide confidence intervals.

The risk of bias and unexplained statistical heterogeneity in the included studies mean that the conclusions should be interpreted with caution.

Implications of the review for practice and research
Research: The authors stated that large ongoing randomised trials and long-term follow-up of patients from current trials should provide additional evidence.

Practice: The authors did not state any implications for practice.

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