



Original research

## Miniaturized extracorporeal circulation versus off-pump coronary artery bypass grafting: A meta-analysis of randomized controlled trials



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### HIGHLIGHTS

- Superiority of OPCAB over MECC in reducing CPB-related side-effects is controversial.
- This controversy is due to current available evidence from limited number of small-sized randomised controlled trials.
- Present meta-analysis confirms that MECC has clinical outcomes comparable to OPCAB.
- MECC should be considered as a valid alternative to OPCAB in order to reduce CPB-related morbidity.

### ARTICLE INFO

*Article history:*

Received 18 July 2014

Received in revised form

17 December 2014

Accepted 21 December 2014

Available online 2 January 2015

*Keywords:*

Meta-analysis

Off-pump coronary artery bypass grafting

Minimized extracorporeal circulation

### ABSTRACT

**Background:** Controversies exist whether off-pump coronary artery bypass (OPCAB) is superior to miniaturized extracorporeal circulation (MECC) in reducing deleterious effects of cardiopulmonary bypass as only a number of smaller randomized controlled trials (RCT) currently provide a limited evidence base. The main purpose of conducting the present meta-analysis was to overcome the expected low power in RCTs in an attempt to establish whether MECC is comparable to OPCAB.

**Methods:** A MEDLINE/PubMed search was conducted to identify eligible RCTs. A pooled summary effect estimate was calculated by means of Mantel-Haenszel method.

**Results:** The search yielded 7 RCTs included in this meta-analysis enrolling 271 patients in the OPCAB group and 279 in the MECC group. The OPCAB and MECC groups were comparable in terms of incidence of in-hospital mortality (Risk Difference [RD] 0.01; 95%CI -0.02, 0.03; P = 0.55; I<sup>2</sup> = 0%), stroke (RD -0.01; 95%CI -0.05, 0.04; P = 0.69; I<sup>2</sup> = 0%), need for renal replacement therapy (RD 0.00; -0.06, 0.06; P = 1; I<sup>2</sup> = 0%), postoperative atrial fibrillation (RD -0.03; -0.17, 0.10; P = 0.64; I<sup>2</sup> = 0%), re-exploration for bleeding (RD -0.01; 95%CI -0.03, 0.02; P = 0.65; I<sup>2</sup> = 0%), transfusion rate (RD -0.01; 95%CI -0.03, 0.02; P = 0.65; I<sup>2</sup> = 0%) and the amount of blood loss (weighted mean difference -25 mL; 95%CI -71, 21; P = 0.28; I<sup>2</sup> = 0%).

**Conclusions:** Using a meta-analytic approach, MECC achieves clinical results comparable to OPCAB including postoperative blood loss and blood transfusion requirement. On the basis of our findings, MECC should be considered as a valid alternative to OPCAB in order to reduce surgical morbidity of conventional cardiopulmonary bypass.

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## 1. Introduction

Recognition of the potentially deleterious effects of conventional extracorporeal circulation led to off-pump coronary artery bypass (OPCAB) surgery gaining more popularity worldwide [1]. A number of randomized controlled trials (RCTs) comparing OPCAB to conventional extracorporeal circulation have been completed since then [2]. Although outcomes have been largely comparable [3], the evidence for the benefit of OPCAB has not been as convincing as initially anticipated [4]. Moreover, OPCAB revascularisation can be very demanding, thus leading to the potential for suboptimal revascularization [5]. Therefore, initial enthusiasm for OPCAB became especially tempered by concerns about the completeness of revascularization, the rate of perioperative myocardial infarction and long-term graft patency rates [5].

As an alternative technique, miniaturized extracorporeal circulation (MECC) may provide a more controlled operative field facilitating manipulation of the heart whilst minimizing the inflammatory, coagulopathic and haemodilutional effects of conventional cardiopulmonary bypass [6,7] by reducing foreign surfaces, avoiding blood-air contact and significantly reducing priming volume. However, whether MECC is comparable to OPCAB in terms of operative outcomes still remains unclear. At present, a

number of smaller studies provide a limited evidence base.

The main purpose of conducting the present meta-analysis was to overcome the expected low power in most of the individual studies due to the small sample sizes by pooling data in an attempt to establish whether MECC is comparable to OPCAB.

## 2. Material and methods

### 2.1. Search strategy

This meta-analysis of RCTs was performed in accordance with the Cochrane Collaboration and PRISMA statements [8]. A reference search was performed through PubMed and Cochrane Library up to June 2014 for RCTs comparing MECC versus OPCAB in adult coronary artery bypass grafting (CABG). Tangential electronic exploration of related articles and hand searches of bibliographies and related journals were also performed. The search was performed using the following keywords: minimal, miniaturised, minimised, priming, cardiopulmonary bypass, extracorporeal, MECC, ECCO. Studies evaluating MECC with conventional extracorporeal circulation procedure were not included in the analysis. Studies were included if they met each of the following criteria: prospective, randomised study with allocation to MECC versus OPCAB; adult

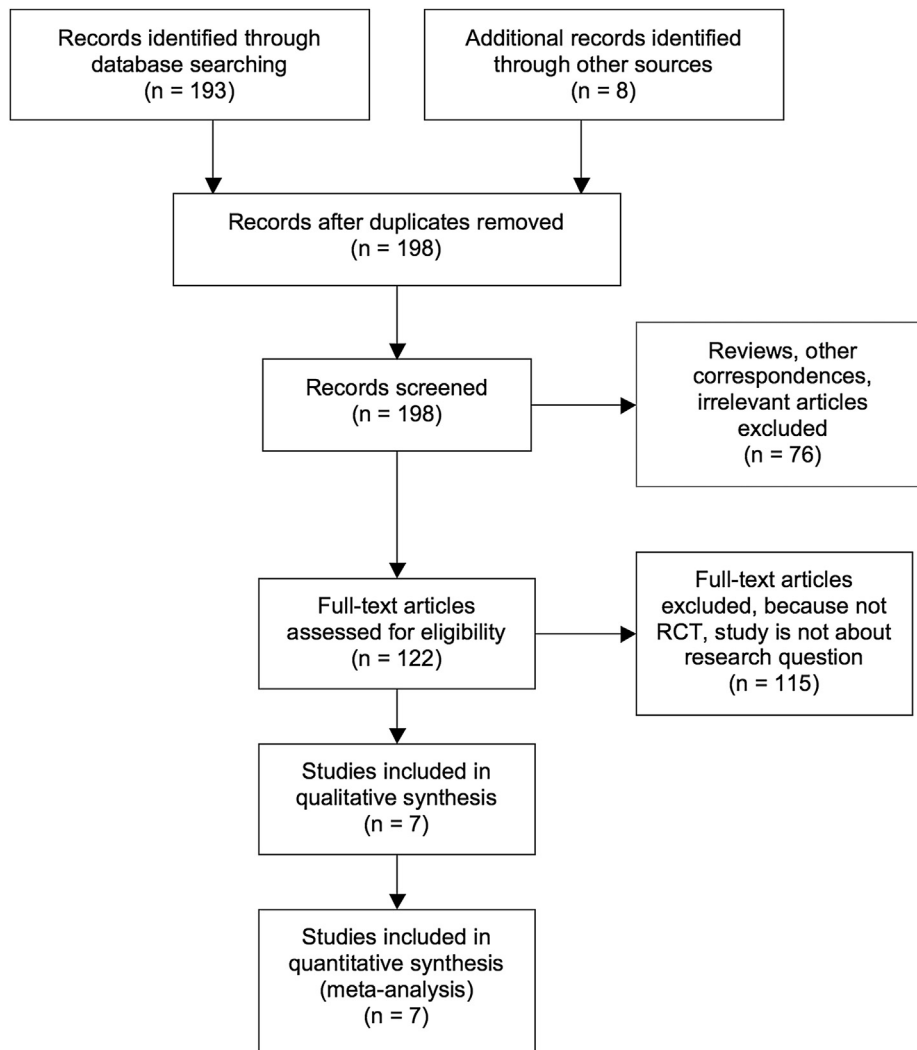


Fig. 1. Study selection flow chart.

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