Colloids versus crystalloids as priming solutions for cardiopulmonary bypass: a meta-analysis of prospective, randomised clinical trials

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CRD summary
This poorly reported review aimed to assess whether colloids are more beneficial than crystalloids when used for cardiopulmonary bypass pump-prime. The author concluded that too few prospective trials on prime solutions are available for definitive conclusion; this is an appropriate conclusion given the number of small studies included.

Authors' objectives
The author's objectives were to determine whether using colloids for the cardiopulmonary bypass (CPB) pump-prime is more beneficial than crystalloids, and whether the choice of pump-prime can modify post-operative blood loss.

Searching
MEDLINE and EMBASE were searched up to December 2002. In addition, the reference lists of published meta-analyses evaluating the use of colloids were checked, and conference reports and abstracts (source not specified) were searched.

Study selection
Study designs of evaluations included in the review
Prospective, randomised clinical trials were eligible for inclusion.

Specific interventions included in the review
Studies evaluating albumin, hydroxyethyl starches, or gelatins as components of the CPB pump-prime were eligible for inclusion. Varying regimens were used across the included studies.

Participants included in the review
Studies of people undergoing CPB were eligible for inclusion.

Outcomes assessed in the review
Mortality was considered the primary outcome of interest. The included studies reported mortality, fluid balance, colloid osmotic pressure, blood loss, acid-base status, platelet counts and function, clinical score and hospital stay. Studies were excluded if they reported an outcome that was not reported in at least one other selected study.

How were decisions on the relevance of primary studies made?
The author did not state how the papers were selected for the review, or how many reviewers performed the selection. The author stated that Cochrane methodology was used, but no further details were reported.

Assessment of study quality
The author did not state that they assessed validity.

Data extraction
The author did not state how the data were extracted for the review, or how many reviewers performed the data extraction. The author stated that Cochrane methodology was used, but no further details were reported. The extracted data included the composition of the prime and major end points. Standardised mean differences (SMDs) and 95% confidence intervals (CIs) were calculated for continuous data such as fluid balance and blood loss, while odds ratios (ORs) were calculated for mortality data.
Methods of synthesis
How were the studies combined?
Pooled ORs or SMDs, along with 95% CIs, were calculated for mortality and continuous data, respectively. For a meta-analysis to be carried out, a minimum pool of 150 patients across studies was required for an outcome.

How were differences between studies investigated?
The author reported that heterogeneity was assessed, but neither the method used, nor the results of the test, were reported.

Results of the review
Seventeen randomised controlled trials (RCTs; n=997) were included in the review.

Mortality.
Five RCTs reported on mortality. The results of 4 studies (6 comparisons, n=326) comparing colloids and crystalloids were pooled, and showed no significant difference (P=0.619). The results of 3 studies (3 comparisons, n=150) comparing albumen and synthetic colloids were pooled; these also showed no significant difference (P=0.709).

Fluid balance.
The results from 7 studies (11 comparisons, n=493) reporting on fluid balance were pooled. A significant improvement in fluid balance with colloids, compared with crystalloids, was shown (P<0.001).

Colloid osmotic pressure.
The results from 4 trials (5 comparisons) reporting on colloid osmotic pressure were pooled. There was a significant improvement in colloid osmotic pressure with colloids compared with crystalloids (P<0.001).

Blood loss.
There was no significant difference in blood loss between starches and albumen (7 studies, n=404; SMD -0.05, 95% CI: -0.29, 0.19), or gelatins and albumen (6 studies, n=385; SMD -0.03, 95% CI: -0.23, 0.17).

Platelet counts.
The pooled results from 6 studies (6 comparisons) reporting platelet counts (n=321), showed albumen to significantly improve platelet counts compared with starches (P<0.001). However, the pooled results from 3 studies (3 comparisons) showed no significant difference in platelet counts between the use of albumen and gelatins (P=0.990). Platelet counts were significantly higher with crystalloids than with colloids (5 studies, n=465; SMD 0.42, 95% CI: -0.68, -0.16).

Authors’ conclusions
The incorporation of artificial colloids into CPB fluid regimens may have beneficial implications on hospital stay and clinical scores. However, considering the number of procedures using CPB, too few prospective trials on prime solutions are available for more definitive conclusions.

CRD commentary
The review question and inclusion criteria were clearly stated. Two electronic databases were searched, although neither the search terms nor strategy were reported. There did not appear to be any specific attempt to locate unpublished studies and it is unclear whether language restrictions were applied, thus some studies might have been missed. The author stated that the study selection and data extraction processes were performed using Cochrane methodology, but no further details were given. In addition, it is unclear what efforts were made to reduce error and bias in the review process. The author did not report a systematic validity assessment of each study, although he did restrict the review to RCTs.
Appropriate measures of effect were calculated and the author stated that statistical heterogeneity was assessed; however, the results of these tests were not reported. Given the lack of information on the assessment of statistical heterogeneity, and lack of study and population details to assess clinical heterogeneity, it is unclear whether it was appropriate to pool the studies. The author’s conclusions appear appropriate given the few, small trials included in the review.

**Implications of the review for practice and research**

Practice: The author suggested that the use of crystalloids as a single pump-prime should be avoided because of the pronounced positive fluid balance.

Research: The author suggested that future trials should define a priori non-surrogate outcomes of interest to be recorded consistently. The use of identical measures and participants in studies may make summary statistics more relevant and conclusive. The author stated that trials of acid-base status, systemic inflammation, ischaemic reperfusion, and intensive care and hospital stays are justified.

**Bibliographic details**


**PubMedID**

14598617

**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Cardiopulmonary Bypass /methods /mortality; Colloids; Data Interpretation, Statistical; Endpoint Determination; Humans; Isotonic Solutions; Plasma Substitutes; Platelet Count; Prospective Studies; Randomized Controlled Trials as Topic; Water-Electrolyte Balance /physiology

**AccessionNumber**

12003006845

**Date bibliographic record published**

30/04/2005

**Date abstract record published**

30/04/2005

**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.