Crystalloids vs colloids in fluid resuscitation: a systematic review
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Authors' objectives
To systematically review the effects of isotonic crystalloids compared with colloids in fluid resuscitation.

Searching
MEDLINE and CINAHL were searched for the years 1966 to November 1996 (search strategy provided). Additional studies were identified through searching the bibliographies of retrieved articles. No language restrictions were reported.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs).

Specific interventions included in the review
Isotonic crystalloid and colloid fluid infusions. Isotonic crystalloid infusions reported in the review included lactated Ringer's solution, normal saline, Ringer's acetate and balanced electrolyte solution. Colloid fluids included varying concentrations of albumin, 5% plasma protein fraction, synthetic starches (hetastarch and pentastarch), and dextrans (dextran 60 and 70). Regimens varied from a preset volume to titration of fluid to specific physiologic or clinical end points.

Participants included in the review
Adults requiring fluid resuscitation. Participants reported in the review included patients with acute burns, abdominal trauma, pulmonary edema, septic shock, shock, vascular leak syndrome, patients undergoing various types of surgery, hypovolemic trauma patients undergoing surgery and post-operative patients.

Outcomes assessed in the review
Primary outcomes included pulmonary edema and mortality. Other outcomes included the length of hospital stay and physiologic parameters (e.g. hemodynamic and volume status, pulmonary function, renal function and coagulation).

How were decisions on the relevance of primary studies made?
Two reviewers screened all citations and classified them into primary studies, review articles, or other. Two authors then independently reviewed all of the primary studies in a blinded fashion (blinded to the journal, author(s), publication year, results and discussion) for inclusion. Agreement between reviewers was assessed using the kappa statistic with quadratic weights and found to be high (kappa=0.76).

Assessment of study quality
The following criteria were assessed: study methods (randomisation method and blinding), population (patient selection and description), intervention (description and co-interventions) and outcomes (only pulmonary edema and mortality were assessed). Two reviewers independently assessed study validity. Agreement was assessed using the kappa statistic and found to be moderate (kappa=0.54). Validity was assessed using a scoring system similar to that described by Detsky et al (see Other Publications of Related Interest no.1). Studies were awarded 0 (did not fulfil the criteria or not reported), 1 (partial fulfilment of the criteria) or 2 (fulfilment of criteria) points to generate an overall possible validity score of between 0 and 16 (details of the scoring system reported in a table).

Data extraction
Data were extracted in duplicate. Length of stay and follow-up of study patients were recorded as well as the parameters used to evaluate methodologic quality. Disagreement was resolved by consensus.
**Methods of synthesis**

How were the studies combined?

Pooled relative risks (RR) and associated 95% confidence intervals (CI) were calculated for pulmonary edema and mortality outcomes. Estimate for subgroups of studies were also calculated using a random-effects model to account for interstudy heterogeneity with the assumption that the analysed studies were part of a larger group of studies on crystalloid versus colloid fluid resuscitation. A student’s t-test with an alpha of 0.05 was used to compare lengths of stay between crystalloid and colloid groups.

How were differences between studies investigated?

Sub-group analyses were performed for studies with well-described randomisation procedures versus pseudorandomisation or unclear descriptions, and studies with quality scores of 8-16 points versus <8 points. The Breslow-Day method was used to compare the summary odds ratios between subgroups of studies. Significant differences were indicated by p<0.05.

**Results of the review**

Seventeen RCTs (including 814 participants) were included.

**Pulmonary edema:**

No significant differences between crystalloids and colloids were seen overall (6 studies, 180 participants). Subgroup analyses (random-effects model) only suggested significant differences in the effect size between studies of trauma and non-trauma populations. However, the 95% CI of the effect size of the non-trauma group (RR=0.98, 95% CI: 0.70, 1.36) fell completely within the 95% CI of the trauma group (RR=0.39, 95% CI: 0.17, 0.89) suggesting that the observed difference may be due to chance, reflecting the small number of patients in each subgroup (430 and 302 respectively).

**Mortality:**

No significant differences between crystalloids and colloids were seen overall (15 studies, 732 participants). Significant differences were however seen in trauma patients (5 studies, 302 participants) in favour of the use of crystalloids (RR=0.39, 95% CI: 0.17, 0.89). No other subgroups showed significant differences between crystalloid and colloid resuscitation. There was homogeneity of effect size across each subgroup.

**Physiologic outcomes:**

The different types of measurements used were diverse and were not reported in the review. Readers were referred to the original papers for details.

**Length of stay (6 studies):**

Length of hospital or intensive care unit stay were not significantly different between crystalloid or colloid resuscitation groups (p>0.05).

**Study quality:**

Scores ranged from 4 to 12 points. Eight out of 17 studies described the method of randomisation, and 3/17 studies used blinded assessors. None used blinded caregivers. Eleven out of 17 studies reported mortality ranging from 24-hr to 90-day and three studies reported mortality for the duration of the hospital stay. Two out of six studies reporting pulmonary edema outcomes described specific radiologic criteria, three stated criteria but did not specify details, and one failed to report criteria.

**Authors’ conclusions**

Overall, there is no apparent difference in pulmonary edema, mortality, or length of stay between isotonic crystalloid

**CRD commentary**
This is a good quality systematic review. The author's clearly report their methods and inclusion criteria. The studies are quality assessed prior to pooling and the heterogeneity between subgroups of studies is assessed. The methods used to pool the studies would appear to be appropriate. In addition the review was based on a reasonable search of the literature although no attempt was specifically made to try and locate unpublished data, so there is a possibility of publication bias. However, the authors' conclusions would appear to be supported by the data presented.

**Implications of the review for practice and research**
Practice: The authors did not state any implications for practice.
Research: The authors state that 'larger well-designed randomised trials are needed to achieve sufficient power to detect potentially small differences in treatment effects if they truly exist'.

**Bibliographic details**

**PubMedID**
9934917

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Colloids /adverse effects; Critical Care /methods; Fluid Therapy /methods; Humans; Isotonic Solutions; Length of Stay; Plasma Substitutes /adverse effects; Pulmonary Edema /etiology; Randomized Controlled Trials as Topic; Rehydration Solutions /adverse effects; Shock, Septic /therapy

**AccessionNumber**
11999000309

**Date bibliographic record published**
31/10/2000

**Date abstract record published**
31/10/2000

**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.