Meta-analysis of standard, restrictive and supplemental fluid administration in colorectal surgery

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CRD summary
The authors concluded that findings suggested that morbidity after colorectal resection was reduced by restricted fluid amounts and goal-directed oesophageal Doppler-guided fluid administration. There were limitations in the reporting of review methods but overall the authors’ conclusions appeared to reflect the evidence and are likely to be reliable.

Authors’ objectives
To evaluate the effects of the amount of infused fluid and guidance on fluid administration using oesophageal Doppler-derived variables in patients undergoing colorectal surgery.

Searching
MEDLINE, EMBASE and the Cochrane Library were searched from inception to November 2007. Search terms were reported including the use of a randomised controlled trial (RCT) filter. No language restrictions were applied. In addition, reference lists of relevant articles were screened and researchers and experts in colonic surgery and anaesthesia were contacted. Published and unpublished studies were eligible.

Study selection
RCTs were eligible if they compared different amounts of fluid administered during and after surgery, or compared fluid administration strategies guided by haemodynamic variables with goal-directed fluid administration strategies based on Doppler-derived variables. At least 50% of patients in included trials had to be undergoing elective surgery of the colon and/or rectum. Studies of paediatric patients and studies that compared endoscopic or laparoscopic techniques alone or with each other were excluded. The primary review outcome was postoperative morbidity. Secondary outcomes included in-hospital mortality, recovery of bowel function, hospital stay and specific causes of morbidity (including anastomotic leakage and wound infections).

The included trials evaluated fluid administered for the intraoperative and postoperative periods, or for only the intraoperative or postoperative periods. The review compared restrictive versus standard fluid amount, supplemental versus standard fluid amount, and goal-directed fluid versus fluid administration guided by conventional cardiovascular parameters. All of the trials (except one) only included patients undergoing colorectal resections.

Two reviewers independently selected studies. Disagreements were resolved with the help of another two reviewers.

Assessment of study quality
Validity was assessed using a modification of a published rating scale that evaluated sample size calculation, generation of allocation sequence, allocation concealment, adequacy of randomisation, blinding and description of protocol deviations, withdrawals and drop-outs.

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

Data extraction
For each trial, recommendations for perioperative fluid replacement were used to categorise amounts of fluid replaced in each of primary trials as standard, restrictive or supplemental (see Other Publications of Related Interest field). Data were extracted on postoperative morbidity (defined as the number of patients who developed at least one complication after surgery) and specific causes of morbidity.

The authors did not state how data were extracted for the review, or how many reviewers performed the data extraction.
Methods of synthesis
Pooled odds ratios (ORs) with 95% confidence intervals (CI) were calculated using a random-effects model. Heterogeneity was assessed using $I^2$ statistics (values greater than 50% were taken as indicating a high level of heterogeneity). A priori sensitivity analyses were conducted to explore the influence of trial quality (allocation concealment and blinding) and patient population (colorectal only versus mixed groups). Trials were also stratified by time of fluid administration. The number needed to treat (NNT) was calculated. Publication bias was assessed using a funnel plot.

Results of the review
Nine RCTs were included in the review (n=971 patients). Trials were generally of moderate to high quality (scores 8 to 10 points; the maximum possible score was not reported). All of the trials reported a power calculation but they used different primary endpoints. Sample size ranged from 20 to 253. Seven trials reported standardised perioperative treatment.

Standard versus restrictive fluid administration (four RCTs, n=393 patients): Restrictive fluid administration was associated with a statistically significant reduction in postoperative morbidity (OR 0.41, 95% CI 0.22 to 0.77; $I^2$=37%; NNT 6, 95% CI 4 to 7). There was significant reduction in morbidity when the period over which restricted fluid was administered included the intraoperative period (OR for perioperative restriction 0.35, 95% CI 0.18 to 0.70; OR for intraoperative restriction 0.46, 95% CI 0.21 to 0.99). There was no significant reduction in morbidity when restricted fluid was only given in the postoperative period.

Standard versus supplemental fluid administration: There was no significant reduction in overall morbidity between standard and supplemental fluid administration in the one study reporting this outcome.

Fluid administration strategy (three RCTs, n=288 patients): Goal-directed fluid administration based on oesophageal Doppler-guidance was associated with a statistically significant reduction in postoperative morbidity (OR 0.43, 95% CI 0.26 to 0.71; $I^2$=0%; NNT 6, 95% CI 4 to 12).

The funnel plot showed no evidence of relevant publication bias.

There were no significant differences for secondary outcomes (results were reported in the review).

Authors’ conclusions
Findings suggested that morbidity after colorectal resection was reduced by restrictive compared to standard fluid amounts and goal-directed oesophageal Doppler-guided fluid administration strategies compared to strategies based on conventional haemodynamic variables.

CRD commentary
The review question was clearly stated and inclusion criteria were appropriately defined. Several relevant sources were searched and no restrictions were applied to language or publication status. A funnel plot showed no evidence of publication bias, but only a small number of trials were available. Methods were used to minimise reviewer errors and bias in the selection of studies, but it was not clear whether similar steps were taken in the assessment of validity or extraction of data. Only RCTs were included and validity was assessed, but only the composite score was presented, making it difficult to independently comment on the reliability of the evidence presented. Appropriate methods were used for the meta-analyses. Heterogeneity was assessed and predefined subgroup analyses conducted. There were limitations in the reporting of review methods, but overall the authors’ conclusions appeared to reflect the evidence and are likely to 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 future research should compare fluid administration based on oesophageal Doppler-guidance with restrictive fluid administration. There is also a need to identify more reliable non-invasive methods to guide fluid administration.
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