Improving perioperative outcomes: fluid optimization with the esophageal Doppler monitor, a metaanalysis and review
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CRD summary
The authors concluded that oesophageal Doppler monitoring increases the use of perioperative colloid fluid and reduces length of hospital stay, the time taken to return to oral diet and the risk of post-operative complications. This is a generally well-conducted review but, given concerns about some aspects of the analyses, the reliability of the authors’ conclusions is unclear.

Authors' objectives
To evaluate the benefits of intra-operative oesophageal Doppler monitoring to guide intravenous fluid therapy.

Searching
MEDLINE, EMBASE and Cochrane Central Register of Controlled Trials were searched. Search dates varied across databases and spanned 1970 to 2008, week 19. Search terms were reported. The bibliography of retrieved articles and relevant reviews were handsearched.

Study selection
Randomised controlled trials (RCTs) of oesophageal Doppler monitoring used to guide intra-operative intravenous fluid therapy to optimise intravascular volume in the perioperative setting were eligible for inclusion. Length of stay in an acute care hospital setting was the primary outcome of interest. Other outcomes eligible for inclusion were: return to full oral diet; morbidity; mortality; and colloid and crystalloid volumes. Length of stay in a rehabilitation hospital was excluded.

Included RCTs were of oesophageal Doppler monitoring guided intra-operative intravenous fluid therapy in patients undergoing major bowel surgery, colorectal surgery, proximal femoral fracture surgery, cardiac surgery, trauma, or major gynaecological, general or urological surgery. In the majority of trials, fluid administration was triggered by a stroke volume change of more than 10% and a flow corrected time less than 0.35. Where stated, the colloids used were 4% hydroxyethylstarch or gelatin-based fluids.

Two reviewers independently selected the studies for review, with disagreements resolved by consensus.

Assessment of study quality
The methodological quality of the included trials was assessed according to the Cochrane guidelines, with trials awarded a low, moderate or high risk of bias according to blinding, randomisation, allocation concealment and use of intention-to-treat analysis.

The validity assessment was conducted independently by two reviewers.

Data extraction
Means and standard deviations were extracted for continuous outcomes. Where means and standard deviations were not available, the median was extracted and the standard deviation was estimated from the interquartile range. The number of events in each group were extracted for dichotomous outcomes and used to calculate odds ratios with the corresponding 95% confidence intervals. Authors were contacted to obtain additional data.

The data extraction was performed independently by two reviewers. Any disagreements were resolved through discussion.
Methods of synthesis
Continuous data were pooled by calculating the weighted mean difference (WMD) using a fixed effects model and dichotomous data were combined using pooled odds ratios with 95% confidence intervals. One study with two different control groups was entered into the analysis separately for each control group. Heterogeneity was assessed using the $\chi^2$ statistic and quantified using the $I^2$ statistic. A sensitivity analysis was conducted excluding low quality trials and the meta-analysis was repeated using a random-effects model for some outcomes. Publication bias was assessed using a funnel plot using length of stay as the end-point.

Results of the review
Nine RCTs were included for review (n=910 patients). Five RCTs were classified as having a low risk of bias, two with a moderate risk of bias and two with a high risk of bias.

Oesophageal Doppler monitoring was associated with a significantly reduced length of hospital stay (weighted mean difference -2.34 days, 95% confidence interval (CI): -2.91 to -1.77; p<0.00001, nine RCTs, n=910 patients), reduced risk of post-operative morbidity or complications (odds ratio 0.37, 95% CI: 0.27 to 0.50; p<0.00001, eight RCTs, n=874 patients) and an increased amount of intravenous colloid fluid administered (weighted mean difference 736mL, 95% CI: 680 to 792; p<0.00001, eight RCTs, n=786 patients) compared to controls. There was no significant difference between the groups in mortality or the amount of intravenous crystalloid fluid used. There was evidence of statistical heterogeneity for the outcome length of hospital stay ($p=0.10$) and amount of colloid fluid used ($p<0.00001$). A random-effects model was also used to investigate length of hospital stay and morbidity; the results remained statistically significant.

Subgroup analyses of patients undergoing colorectal surgery found a significant reduced length of hospital stay (weighted mean difference -2.17 days, 95% CI: -3.16 to -1.17; p<0.00001, four RCTs, n=388 patients) and a faster return to oral diet (weighted mean difference -1.65 days, 95% CI: -1.83 to -1.46; p<0.00001, four RCTs, n=388 patients) with oesophageal Doppler monitoring compared to control groups. There was no evidence of statistical heterogeneity. When the two trials with a high risk of bias were removed, length of hospital stay and morbidity were still significantly lower with oesophageal Doppler monitoring compared to control groups (both $p<0.00001$). The funnel plot indicated a lack of small positive trials.

Cost information
None of the trials evaluated the cost-effectiveness, but the authors stated that the association between oesophageal Doppler monitoring and length of hospital stay and post-operative implications means that its use is potentially cost effective.

Authors' conclusions
Oesophageal Doppler monitoring increased the use of perioperative colloid fluid and reduced the length of hospital stay, the time taken to return to oral diet and the risk of post-operative complications.

CRD commentary
The review addressed a clear question with appropriate inclusion criteria. Three relevant databases were searched, but it is unclear whether appropriate steps were taken to minimise language bias. There did not appear to be a search for unpublished studies, raising the possibility of publication bias. Publication bias was assessed and there was evidence of plot asymmetry. Appropriate steps were taken throughout the review process to minimise the risk of reviewer error and bias. A suitable validity assessment was conducted. The majority of trials were of moderate to high quality and sensitivity analyses were carried out to exclude lower quality studies. Suitable methods were used to combine the included trials. However, there was evidence of significant statistical heterogeneity that was not fully explored. Also, one trial was entered separately for each control group, which may have affected the summary estimate, so the results of these analyses may be unreliable. This is a generally well-conducted review but, given concerns about some aspects of the analyses, the reliability of the authors' conclusions is unclear.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.
Research: The authors stated that further research is needed evaluating oesophageal Doppler monitoring in wider groups of surgical patients, to compare its effectiveness to other intra- or post-operative monitoring devices and evaluate its cost-effectiveness.

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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.