The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: a meta-analysis of randomized controlled trials
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CRD summary
This review concluded that ERAS pathways reduced length of hospital stay and complications after major elective open colorectal surgery without compromising patient safety. The authors' conclusions reflected the evidence presented, but generalisability of the results to specific applications of this complex intervention was uncertain.

Authors' objectives
To compare outcomes of patients who underwent major elective colorectal surgery within an enhanced recovery after surgery (ERAS) pathway with those of patients treated with conventional perioperative care.

Searching
The authors searched MEDLINE, EMBASE, Science Citation Index and CINAHL up to November 2009. Search terms were reported. No language restrictions were imposed. References from relevant articles and systematic reviews were screened and subject experts contacted to identify additional studies.

Study selection
Randomised controlled trials (RCTs) that compared enhanced recovery programmes with conventional perioperative care in patients who underwent elective open colorectal surgery were eligible for the review. Enhanced recovery programmes had to include a minimum of four elements (from 17 listed in the paper) covering the pre-operative, intra-operative and postoperative periods. The primary outcome was length of hospital stay. Postoperative complications, readmission rates and mortality were secondary outcomes.

Few details of participants in included studies were provided. Mean or median age ranged from 33 to 73 years. The number of enhanced recovery elements used in the included studies ranged from four to 12 (mean nine). Pre-operative counselling, no routine use of nasogastric tubes, enforced post-operative mobilisation and enforced postoperative oral feeding were used in all studies.

Two reviewers independently selected studies for the review. Disagreements were resolved by consensus discussions with a third reviewer.

Assessment of study quality
Validity was assessed by two independent reviewers using the five-point Jadad scale. Disagreements were resolved by consensus discussions with a third reviewer.

Data extraction
For continuous outcomes, group means and standard deviations were used to calculate the weighted mean difference (WMD) between groups, with associated 95% confidence interval (CI). For dichotomous outcomes, data on participants and events in each group were used to calculate the relative risk (RR) and 95% CI.

Data were extracted by two reviewers independently. Authors were contacted to obtain missing data.

Methods of synthesis
Studies were pooled by meta-analysis using a Mantel-Haenszel random-effects model. Statistical heterogeneity was assessed using \( I^2 \) and \( X^2 \). \( I^2 \) values of 25%, 50% and 75% were considered to represent low, moderate and high heterogeneity.

Results of the review
Six RCTs (452 participants, range 25 to 151) were included. Thirty-day follow-up data were available for all trials. Five trials scored 3 on the Jadad scale and one scored 2.

Length of hospital stay (WMD -2.51 days, 95% CI -3.54 to -1.47) and risk of complications (RR 0.53, 95% CI 0.41 to 0.69) were significantly reduced in the ERAS group. There was no statistically significant difference for readmission or mortality. Moderate heterogeneity was present for length of stay ($I^2=55\%$).

**Authors' conclusions**

ERAS pathways appeared to reduce length of hospital stay and complications after major elective open colorectal surgery without compromising patient safety.

**CRD commentary**

The review question and inclusion criteria were clear. The search was adequate and included some attempts to identify unpublished studies. Risk of publication bias was not assessed. Appropriate methods were used to minimise errors or bias in study selection, quality assessment and data extraction. Study quality was assessed using a standard scale. Relevant details of included trials were presented, although participant characteristics were not reported.

Meta-analysis showed moderate levels of heterogeneity for the primary outcome, possibly reflecting differences in ERAS and comparator interventions between the included trials. As noted by the authors, details of compliance with protocols were not reported in the included trials and this limited the review's ability to identify the most important elements of the ERAS pathway.

The authors' conclusions reflected the evidence presented, but generalisability of the results to specific applications of this complex intervention was uncertain. The authors' recommendations for further research seem appropriate.

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

**Practice:** The authors stated that there was supportive evidence from the included studies that enhanced recovery programmes should be considered as standard peri-operative care.

**Research:** The authors stated that future studies of ERAS pathways should evaluate protocol compliance to identify elements of the pathway that contributed most to successful outcomes.

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