Laparoscopic surgery for colon cancer: a systematic review
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CRD summary
This review aimed to show that laparoscopic-assisted colorectal resection for cancer is not inferior to open resection in terms of cancer survival and peri-operative outcomes. The authors concluded that laparoscopic resection appears equally safe and effective. The authors' conclusions adequately reflect the existing published evidence; more information will be available from currently ongoing trials.

Authors' objectives
To show that survival rates and peri-operative outcomes associated with laparoscopic-assisted colorectal resection for cancer are not inferior to those associated with open resection.

Searching
MEDLINE, EMBASE and the Cochrane Library were searched to 2004, Cancerlit was searched to 2002, and FirstSearch was searched for conference proceedings; the search terms were reported. The authors checked links to related articles in PubMed and the Science Citation Index and examined the reference lists of retrieved articles. Five high-profile journals were handsearched, and experts and trial authors were consulted. No language restrictions were applied. Only published trials were selected.

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

Specific interventions included in the review
Studies that compared laparoscopic-assisted colorectal resection with open or conventional resection were eligible. The interventions in the included studies were right and left hemicolectomy, sigmoid resection, anterior resection and abdominoperineal resection.

Participants included in the review
Studies of adults aged over 16 years with documented colorectal cancer were eligible for inclusion. The participants in the included studies had colon cancer and/or rectal cancer. The mean age of the participants ranged from 56 to 73 years and in most cases the pre-operative stage was Duke's B or C. Most studies excluded patients having emergency surgery.

Outcomes assessed in the review
The primary outcome was cancer-related mortality. Studies that did not report colorectal cancer recurrence rates were excluded. The secondary outcomes were all-cause mortality, all recurrence, local recurrence, port-side recurrence and morbidity. The review also reported operating room time, number of days to a full diet, reoperation rate and conversion rate. The mean follow-up time ranged from 14 to 59 months.

How were decisions on the relevance of primary studies made?
Two reviewers independently selected studies for inclusion. Where disagreements could not be resolved by discussion, the reviewers consulted the full team.

Assessment of study quality
The authors assessed whether studies met the following quality criteria: centrally concealed random allocation; intention-to-treat analysis; clearly defined outcomes measured similarly in both groups; a follow-up rate of over 90%; standardisation of operating technique, follow-up care and post-operative treatment; equal demographics in the comparison groups at baseline; and a sample size of over 500.
Two authors blinded to study identity independently conducted the validity assessment. Where disagreements could not be resolved by discussion, the authors consulted the full team.

**Data extraction**
Two authors independently extracted the data. Where disagreements could not be resolved by discussion, the authors consulted the full team. Data were extracted as the number of events in each group or, for continuous data, as group means and standard deviations or as medians and ranges. Trial authors were contacted for missing information.

**Methods of synthesis**

How were the studies combined?
For primary and secondary outcomes, the data were pooled using a random-effects model to obtain a combined odds ratio (OR) with 95% confidence interval (CI). The number-needed-to-treat (NNT) was also assessed. Publication bias was assessed using a funnel plot.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the chi-squared test (p<0.10 indicated statistical significance). A sensitivity analysis was conducted in which studies with participants who had rectal disease were excluded.

**Results of the review**
Six RCTs (n=1,262) were included.

Most of the RCTs were of poor to average quality. Only one used centralised concealed random allocation and only two met more than half of the nine quality criteria. Baseline prognostic factors differed between the groups in four of the studies, for example with respect to cancer staging and location.

**Mortality.**

The pooled analysis showed that cancer-related mortality was significantly lower in the laparoscopy group than in the group having open resection (OR 0.67, 95% CI: 0.48, 0.94; 4 RCTS, n=1,194). The NNT for this outcome was 23 (or 21 after the sensitivity analysis excluding studies involving rectal disease). For all-cause mortality there was no statistically significant difference between the groups (OR 0.76, 95% CI: 0.52, 1.11; 4 RCTS, n=1,194).

**Recurrence.**

The pooled analysis showed no statistically significant differences between the groups for all recurrences or port-side recurrence, but local recurrences were significantly lower in the laparoscopy group than in the group having open surgery (OR 0.39, 95% CI: 0.17, 0.89; 5 RCTs, n=388).

**Morbidity (6 RCTs, n=1,262).**

The pooled analysis showed no significant difference between the groups in terms of morbidity (various definitions used across the trials); there was evidence of statistically significant heterogeneity.

The results of the sensitivity analysis, which excluded studies involving rectal disease, did not change the significance of any of the findings. The funnel plots did not show any evidence of publication bias. The review reported further data.

**Authors' conclusions**
Although there is no definitive answer, current evidence indicates that laparoscopic colon cancer resection is as safe and efficacious as the conventional open technique. More conclusive evidence will be available when data from 4 large studies currently in progress are available.
CRD commentary
This review addressed a clear objective with defined inclusion criteria. Several relevant sources and strategies were used in the literature search but only published trials were included, thus raising the possibility that publication bias might have been introduced into the review. The quality of the included studies was assessed in detail. Adequate steps were taken to minimise potential error and bias during the review process. Suitable meta-analytic techniques appear to have been used to pool the main results; heterogeneity was assessed and, where present, discussed. The authors' conclusions adequately reflect the existing published evidence; more information will be available from currently ongoing trials.

Implications of the review for practice and research
The authors did not state any implications for practice or further research.

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