Robotic resection compared with laparoscopic rectal resection for cancer: systematic review and meta-analysis of short-term outcome

CRD summary
This review found that robotic rectal resection had a lower conversion rate and similar operating time to laparoscopic rectal resection, while recovery, oncological and postoperative outcomes were similar. These conclusions may overstate the strength of the evidence, given the lack of randomised data, a strong suggestion of selection bias in the studies, and variability between them.

Authors' objectives
To compare the short-term outcomes of robotic rectal resection versus laparoscopic rectal resection for cancer.

Searching
PubMed, EMBASE, Cochrane Database of Systematic Reviews, EBM Reviews and CINAHL were searched for articles from 1990 to January 2011, without restriction by language or publication status.

Study selection
Randomised and non-randomised studies comparing full robotic or robot-assisted surgery versus laparoscopic rectal resection for cancer were eligible for inclusion. Eligible types of surgery were anterior resection, sphincter-sparing surgery or abdominal perineal resection. The outcomes of interest were operative outcome (operating time and rate of conversion to open surgery), postoperative recovery (length of hospital stay and time to resume regular diet), operative oncological outcome (number of lymph nodes harvested, positivity rate of circumferential margin and length of distal resection margin) and early postoperative outcome (morbidity, mortality, anastomotic leakage, wound infection and prolonged ileus). Studies of trans-anal surgery were excluded.

Procedures in the included studies were fully robotic, robot-assisted or mixed. The type of surgery varied, and included upper, middle or lower anterior resection, abdominoperineal excision and coloanal anastomosis. Total or tumour-specific mesorectal excision was performed for all patients. Operating time was calculated in different ways in the included studies.

Two reviewers independently selected the studies, with disagreements resolved by a third reviewer.

Assessment of study quality
The modified Newcastle-Ottawa scale was used to evaluate the selection, comparability of comparison groups, and methods of outcome assessment. The maximum score was 10 stars. Two reviewers independently assessed study quality.

Data extraction
Data were extracted to permit the calculation of odds ratios, for dichotomous outcomes, and weighted mean differences, for continuous outcomes, both with 95% confidence intervals. One reviewer extracted the data, which were checked by a second reviewer. Disagreements were resolved by a third reviewer. If mean values and standard deviations were not reported, they were estimated (if possible) from median values and ranges.

Methods of synthesis
Data were combined to calculate Mantel-Haenszel pooled odds ratios, weighted mean differences, and 95% confidence intervals. Statistical heterogeneity was assessed using $X^2$ and $I^2$. A fixed-effect model was used if data were homogeneous ($I^2$ was low), and a random-effects model was used otherwise.

Subgroup analysis was conducted by type of intervention: any type of robotic resection; full robotic resection; robot-assisted resection; and robotic total mesorectal resection. For operative time, subgroup analyses were conducted by type of intervention and including or excluding the set-up time and natural orifice specimen removal. Sensitivity analysis was
conducted including only higher quality studies, with at least six Newcastle-Ottawa stars. Publication bias was assessed using funnel plots.

**Results of the review**

Eight non-randomised studies were included, with 854 participants (range 50 to 200). Six were prospective and two were retrospective. Six were of high quality (at least six stars) and two were of low quality. Mean follow-up ranged from 10 to 29 months, where reported.

The rate of conversion to open surgery was significantly lower in the robotic group than in the laparoscopic group (OR 0.26, 95% CI 0.12 to 0.57; I²=0, seven studies).

There were no significant differences between the groups in operating time (seven studies; I²=96%), length of hospital stay (seven studies; I²=61%), time to resume a regular diet (four studies; I²=79%), average number of lymph nodes harvested (seven studies; I²=40%), the circumferential resection margin (six studies; I²=0), length of distal resection margin (six studies; I²=40%), overall morbidity (two studies; I²=64%), overall mortality (four studies; I² not reported), anastomotic leakage (seven studies; I²=0), wound infection (four studies; I²=0), and prolonged postoperative ileus rate (five studies; I²=0). Heterogeneity was very high for several analyses.

No evidence of publication bias was found. The findings of subgroup and sensitivity analyses were reported.

**Authors' conclusions**

Robotic rectal resection had a lower conversion rate and similar operating time to laparoscopic surgery. Recovery, oncological and postoperative outcomes were similar.

**CRD commentary**

The objectives and inclusion criteria were clear and relevant sources were searched for studies, with no restriction on language or publication status. It did not appear that specific attempts were made to locate unpublished studies. No evidence of publication bias was found, but statistical tests with few studies are not reliable. Steps were taken to minimise the risk of reviewer bias and error in the review processes. Adequate study quality details and study characteristics were reported.

Appropriate methods were used to assess and explore heterogeneity between the studies; heterogeneity was still high in many of the subgroup analyses. The authors stated that a major limitation of their review was the lack of randomised controlled trials. They acknowledged a risk of selection bias favouring robotic surgery, and noted that the different rates of neoadjuvant treatment and stoma formation in the two groups provided evidence of selection bias. For several outcomes, there were few studies, confidence intervals were wide and inconsistency was high, suggesting that, although there were no statistically significant differences between groups, there was insufficient evidence to show that the outcomes were similar.

The authors' conclusions may overstate the strength of the evidence, given the lack of randomised data, a strong suggestion of selection bias, and variability between studies.

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

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that randomised studies were needed to compare robotic versus laparoscopic surgery for rectal cancer.

**Funding**

Not stated.

**Bibliographic details**

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.