Robotic vs. laparoscopic Roux-en-Y gastric bypass in morbidly obese patients: systematic review and pooled analysis
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CRD summary
This review found significant reductions in the incidence of anastomotic stricture with robotic Roux-en-Y gastric bypass surgery compared with laparoscopic Roux-en-Y surgery in morbidly obese patients. Methodological flaws and lack of information about the quality of the included studies means the reliability of the authors' conclusions is unclear.

Authors' objectives
To compare the effectiveness of robotic versus standard laparoscopic Roux-en-Y gastric bypass surgery in patients with morbid obesity

Searching
MEDLINE (from 1950), EMBASE (from 1974), the Current Controlled Trials Register and The Cochrane Library databases were searched to February 2011 for relevant studies; search terms were reported. Published abstracts from a range of conferences and meetings from 2005 to 2011 were also searched for additional studies. The reference lists of the retrieved articles were checked to identify further relevant studies.

Study selection
Controlled trials of robotic or laparoscopic Roux-en-Y gastric bypass surgery undertaken in patients with morbid obesity (defined as a body mass index (BMI) of 35-39 kg/m² with co-morbidities, or BMI of more than 40 kg/m²) were eligible for inclusion. The primary outcomes were incidence of anastomotic leak and anastomotic stricture (defined in the review as symptomatic stricture within six months of surgery that required therapeutic endoscopic treatment). Secondary outcome measures were post-operative complications (within one month of surgery as a direct result of the operation), operative time (including robot set-up time) and length of hospital stay.

The mean age of patients who underwent laparoscopic Roux-en-Y gastric bypass surgery was 43.87 years with a BMI of 44.93 kg/m², and the mean age of patients who underwent robotic Roux-en-Y gastric bypass surgery was 43.31 years with an average BMI of 47.08 kg/m². The anastomotic techniques used were either the use of sutures or stapling.

Two reviewers independently performed the study selection.

Assessment of study quality
The authors did not report any detailed quality assessment of the included trials.

Data extraction
Data were extracted to calculate odds ratios (OR) for discrete outcomes and mean differences (MD) for continuous outcomes and 95% confidence intervals (CI) for the estimates. The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
Pooled odds ratios, weighted mean differences (WMD) and 95% confidence intervals for the summary estimates were calculated using a DerSimonian and Laird random-effects model. Statistical heterogeneity was evaluated using the Cochran's Q-statistic, and the reviewers used the Egger test to evaluate funnel plots for possible publication biases. Subgroup analyses were conducted that compared outcomes in stapled laparoscopic surgery to sutured laparoscopic surgery.

Results of the review
Seven studies (1,686 patients) were included in the review. Sample sizes ranged from 20 to 676 patients. One study was a randomised controlled trial of 50 patients; the remaining studies were comparative studies. There was little information provided on follow-up in the review but the authors stated there was a minimum of six months.
There were no significant differences between groups in the incidence of anastomotic leak between the robotic and standard laparoscopic Roux-en-Y gastric bypass groups. There were no differences reported for the comparison between robotic assisted surgery and stapled laparoscopy. There was insufficient data to analyse the comparison with sutured laparoscopy.

There were statistically significant reductions in anastomotic stricture observed with robotic surgery compared with laparoscopic (OR 0.43, 95% CI 0.19 to 0.98, three studies, 1,299 patients). There were no significant differences observed when robotic-assisted techniques were compared with stapled laparoscopic surgery and there was insufficient evidence to pool data for the comparison of robotic surgery with laparoscopic surgery using sutures.

There were no significant differences between standard and laparoscopic Roux-en-Y gastric bypass surgery observed for the incidence of post-operative complications, operative time and length of hospital stay.

Where calculated, there was no evidence of statistical heterogeneity across the included studies, except for operative time. There was no evidence of publication bias observed for the outcomes.

**Cost information**

Three studies showed significantly greater total costs associated with robotic Roux-en-Y gastric bypass procedures compared with laparoscopic Roux-en-Y gastric bypass procedures; operative times, incidence of post-operative complications and length of hospital stay were similar. The increased costs of robotic procedures were due to significant initial financial outlay required for the purchase of the robotic system and high maintenance costs due to expensive semi-disposable instruments that were used for a pre-determined number of procedures.

**Authors' conclusions**

There was a reduced incidence of anastomotic stricture observed with robotic Roux-en-Y gastric bypass surgery compared with laparoscopic Roux-en-Y surgery in morbidly obese patients over a minimum period of six months.

**CRD commentary**

The review addressed a clearly defined question and criteria for the inclusion of studies in the review were defined and reproducible. Appropriate databases were searched for relevant studies and attempts were made to identify unpublished studies. Steps were taken to minimise errors and biases for study selection, but were not reported for data extraction. There was no formal assessment of methodological quality, so the reliability of the results of the included studies was unknown.

The included studies differed in classification of study design by levels of evidence, which meant that the combination of the results from different study designs may not have been appropriate. Sample sizes in most of the included studies were small and for some outcomes there was insufficient data to enable the statistical pooling of outcomes. Some potential methodological flaws and lack of information about the methodological quality of the included studies means the reliability of the authors' conclusions is unclear and the results should be interpreted with a degree of caution.

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

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

**Research:** The authors stated that further well designed randomised controlled trials were required to determine differences in clinical outcomes between laparoscopically sutured and robotically sutured gastrojejunostomy for anastomotic leak and stricture, with follow-up of longer duration than six months to fully determine differences between groups. Future studies should also focus on weight loss following surgery which will enable true evaluations of the comparative safety and efficacy of these surgical techniques. Cost effectiveness should also be analysed, including costs associated with additional procedures including endoscopic dilatation of anastomotic strictures.

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