Sleeve gastrectomy and type 2 diabetes mellitus: a systematic review

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CRD summary
The aim was to assess the efficacy of laparoscopic sleeve gastrectomy for weight loss and resolution of type 2 diabetes mellitus in obese patients. The authors concluded that most patients experienced resolution or improvement following surgery. The overall conclusion should be treated with caution due to considerable variation between the studies and the risk of bias.

Authors' objectives
To assess the efficacy of laparoscopic sleeve gastrectomy for weight loss and the resolution of type 2 diabetes mellitus in obese patients.

Searching
MEDLINE, PubMed, EMBASE, Scopus, DARE, Clinical Evidence, BIOSIS Previews, TRIP, HTA Database, The Cochrane Library, conference abstracts and clinical trials databases were searched without language restrictions for the period 2000 to April 2010. Reference lists of included studies and several sources of grey and unpublished literature were searched.

Study selection
Studies that evaluated laparoscopic sleeve gastrectomy as a solitary procedure or as a first-stage procedure in a staged bariatric procedure in clinically obese adults with type 2 diabetes were eligible for inclusion. Clinical obesity was defined as a body mass index (BMI) of more than 30kg/m². Randomised controlled trials (RCTs), non-randomised controlled trials and prospective and retrospective case series with more than five participants were included. The primary outcome of interest was resolution of type 2 diabetes. This was defined as discontinuation of all hypoglycaemic medications and/or insulin and a normal fasting plasma glucose level, normal postprandial glucose excursions and normal haemoglobin A1c (HbA1c) levels.

Mean patient age in the included studies, where reported, ranged from 42 years to 50.6 years. The proportion of females ranged from 55% to 79%. Mean BMI at baseline ranged from 31 to 53.5kg/m².

Two reviewers independently selected studies for inclusion.

Assessment of study quality
Two reviewers independently assessed methodological quality using the Cochrane risk of bias tool.

Data extraction
Two reviewers independently extracted data. The percentage of patients whose type 2 diabetes had resolved was calculated using the number of patients evaluated as the denominator. For the calculation of percentage of excess weight lost, excess weight was defined as the total preoperative weight minus the ideal weight.

Methods of synthesis
The authors stated that a meta-analysis was not appropriate due to high heterogeneity between studies and an absence of RCTs. Descriptive data were reported and the pooled unweighted mean was calculated for each outcome.

Results of the review
Twenty-seven studies (n=673 participants) were included: three prospective non-randomised controlled trials, three retrospective controlled studies, 15 prospective case series and six retrospective case series. Mean follow-up was 13.1 months (range three to 36 months).

The mean rate of type 2 diabetes resolution was 66.2% (range 14% to 100%). In 16 studies that reported resolution and improvement, 97.1% of participants experienced one outcome or the other.
Mean excess weight loss was 47.3% (range 6.3% to 74.5%; 11 studies). Mean BMI decreased from 47.4 kg/m\(^2\) at baseline to 35.9 kg/m\(^2\) at follow-up (range 24.6 to 44.7; eight studies). Plasma glucose levels decreased from a mean of 181.2 mg/dL to 119.2 mg/dL (range 96.7 to 157.2; seven studies). HbA1c levels decreased by 1.7% at follow-up (range 0.5% to 3%; 11 studies).

Adverse events data were derived from 1,117 patients who underwent laparoscopic sleeve gastrectomy (not all patients had diabetes mellitus). Operative mortality in the first 30 days was 0.36%, postoperative complications such as bleeding occurred in 1.79% of patients, postoperative abscess or infection occurred in 0.27% of patients and postoperative leaks occurred in 1.97% of patients.

**Authors’ conclusions**
Laparoscopic sleeve gastrectomy produced resolution or improvement in most cases of type 2 diabetes and was a promising surgical procedure for the treatment of morbid obesity and type 2 diabetes.

**CRD commentary**
The review included explicitly stated inclusion criteria. Several relevant sources of published and unpublished studies were searched. Appropriate methods were used to minimise error and bias in the review processes. The authors reported that they assessed study quality, but did not report the results in the review. The tool that they used was developed mainly for RCTs and was likely to have had limitations when applied to case series. Controlled studies were included in the review, but only the results from the sleeve gastrectomy arm were reported.

The authors stated that a meta-analysis was not appropriate due to the high heterogeneity between studies and for the same reason their pooled unweighted mean should be treated with caution. Although the conclusions focus on resolution and improvement of type 2 diabetes, the primary outcome was specified as resolution and there was considerable variability between studies for this outcome.

The authors appropriately stated in the discussion that the risk of bias inherent in the included study designs meant that the results of the review should be interpreted with caution.

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

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

**Research:** The authors stated that the review could serve as the basis for a randomised controlled trial of the effect of laparoscopic sleeve gastrectomy on type 2 diabetes.

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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.