Weight and type 2 diabetes after bariatric surgery: systematic review and meta-analysis

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CRD summary
The review concluded that clinical and laboratory manifestations of type 2 diabetes were resolved or improved in the greater majority of obese patients after bariatric surgery. These responses were more pronounced in surgical procedures associated with a greater percentage of excess body weight loss. Given methodological concerns in the review methods, the authors' conclusions may be not reliable.

Authors' objectives
To assess the effect of bariatric surgery on type 2 diabetes and weight loss.

Searching
MEDLINE, Current Contents and The Cochrane Library were searched for published English-language studies from January 1990 to April 2006. Search terms were reported. Reference lists of relevant publications were screened.

Study selection
Interventional or observational studies that evaluated the effect of any form of bariatric surgery on type 2 diabetes and weight loss were eligible for inclusion. Review outcomes included absolute weight loss, percentage of excess body weight loss and diabetes resolution (resolution of clinical and laboratory manifestations of type 2 diabetes).

Most of the included studies were retrospective single-arm series. Included patients underwent gastric banding, gastroplasty, gastric bypass or biliopancreatic diversion/duodenal switch. Bariatric surgery was open or using laparoscopy. Mean age of included patients was 40.2 years (range 16 to 65 years). Mean body mass index (BMI) at baseline was 47.9kg/m^2. Most included patients were female. Some patients had comorbid conditions and 22.3% of included patients had type 2 diabetes. Studies were conducted in Europe, America, Australia, New Zealand, Asia and the middle east.

The authors did not state how many reviewers assessed studies for inclusion.

Assessment of study quality
Quality of randomised controlled trials (RCTs) was assessed using the Jadad five-point scale of randomisation, blinding and withdrawal. The authors graded the level of evidence for each study using the hierarchy of study design described by Oxford Centre for Evidence-based Medicine Levels of Evidence: level 3 represented case-control studies, level 4 represented case-series or poor quality cohort and case-control studies and level 5 represented expert opinion.

The authors did not state how many reviewers performed the validity assessment.

Data extraction
Weight loss was calculated at the time for which data were available on at least 50% of the initial patient population.

The authors explicitly stated neither how data were extracted nor how many reviewers performed data extraction.

Methods of synthesis
Studies were combined in meta-analyses with a random-effects model. Pooled mean changes with 95% CIs were calculated. Statistical heterogeneity was assessed using the Cochran Q and I^2 statistics. Sensitivity analyses were performed on levels of evidence and different lengths of follow-up (less than two years versus at least two years). Subgroup analyses were performed on different types of bariatric surgery and on diabetic patients.

Results of the review
Meta-analyses included 621 studies (n=135,246), among them were 29 RCTs, 49 non-randomised controlled trials, 60 comparative retrospective studies, 187 uncontrolled prospective case series, 266 single-arm retrospective studies, 25 observational studies and two case-control studies. Most included studies were classified as III or IV level of evidence. Most RCTs had a Jadad score of 1 to 3.

Bariatric surgery was significantly associated with an overall absolute weight loss of 38.5kg (95% CI 36.6 to 40.4; 300 treatment groups, n=23,380) and with excess body weight loss of 55.9% (95% CI 54.1 to 57.8; 319 treatment groups, n=34,329). Significant heterogeneity was observed in both outcomes (I^2=99%).

Bariatric surgery led to an overall 78.1% of patients with resolution of clinical manifestations of diabetes. Diabetes was improved or resolved in 86.6% of patients. It was not possible to access the on-line report to gauge the 95% CIs for these values. Results of statistical heterogeneity assessment on these outcomes were not presented.

Sensitivity analyses did not materially affect the results. Subgroup analyses showed that weight loss and diabetes resolution were largest in patients who underwent biliopancreatic diversion/duodenal switch, next-largest for gastric bypass and least for banding procedures. Subgroup analyses that included diabetic patients only were reported.

Authors' conclusions
The clinical and laboratory manifestations of type 2 diabetes were resolved or improved in the greater majority of obese patients after bariatric surgery. These responses were more pronounced in surgical

procedures associated with a greater percentage of excess body weight loss and were maintained for two years or more.

CRD commentary
The review question was clear and appropriately supported by broad inclusion criteria. Relevant sources were searched. The decision to restrict the review to published studies reported in English may have increased the possibility of publication and language biases. It was unclear whether sufficient attempts were made to minimise the errors and biases in the review process. Relevant criteria were used to assess study quality of RCTs and it was found to be poor. No formal quality assessment was performed for other types of studies, but the level of evidence reported gave some indication of the limited quality of these studies. The authors acknowledged high attrition rates in the included studies and diversity of reporting formats for diabetes outcomes. Given the diversity of included studies, a pooled analysis may not have been appropriate. Statistical heterogeneity was assessed and presented for some outcomes, but the high level of significant statistical heterogeneity meant that the pooled results were of limited value. Given the methodological concerns, the authors' conclusions may be not reliable.

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

Research: The authors stated that further RCTs that compared bariatric surgery and medical therapies for type 2 diabetes were required. Trials should evaluate the risk/benefit ratio of bariatric surgery in less obese patients (BMI 30 to 35kg/m^2) as well as morbidly obese patients (BMI≥35kg/m^2).

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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.