Systematic review and meta-analysis of bariatric surgery for pediatric obesity

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CRD summary
This review assessed the effects of bariatric surgery in obese paediatric patients and concluded that it produced sustained and clinically significant weight loss, but could cause serious complications. The quality of the studies was low and the reporting of the review process and results was poor, which makes the reliability of the conclusion unclear.

Authors' objectives
To review the effects of bariatric surgery, for obese paediatric patients, on weight loss, obesity-related comorbidities, quality of life, and survival.

Searching
The reviewers searched MEDLINE, EMBASE, and 13 other databases for relevant articles. The last search was conducted at the end of 2007. There were no date restrictions, but only English-language studies were sought; the search terms were not reported. The bibliographies of identified studies, reviews, and grey literature were searched for further studies.

Study selection
To be eligible for inclusion, studies had to include at least three patients, who were aged up to 21 years at the time of surgery and these patients had to be at least 50% of the paediatric patients enrolled in the study. The studies had to be of a procedure that was used in the United States and report any outcome of weight, body mass index (BMI), comorbidity resolution, quality of life (QOL), or survival. Weight and BMI had to be reported with a follow-up of at least one year, while QOL had to be measured before and after surgery. Where more than 15% of patients in a study had different bariatric procedures, the study was only eligible if the data were reported by procedure. Where more than one study was conducted in one surgical centre, only the results from the largest eligible study were included.

In the included studies, the mean age ranged from 15.6 to 18.1 years, the percentage of patients who were female ranged from 53 to 81, and the mean baseline BMI ranged from 42.4 to 56.5. The dates of surgery ranged from 1976 to 2006 and, where reported, the mean length of follow-up ranged from one year to 11 years. The types of surgery, in decreasing order of prevalence, were laparoscopic adjustable gastric banding (LAGB), Roux-en-Y gastric bypass (RYGB), vertical banded gastroplasty (VBG), biliopancreatic diversion, and banded bypass.

The number of reviewers involved in selecting studies was not reported.

Assessment of study quality
The strength of the evidence was assessed using a formal rating system, which assessed potential bias in the design and conduct of the studies. Points assessed were if it was prospective, had consecutive patients, independent outcome assessment, funding source, objective outcome, and complete data for 85% of patients.

Data extraction
The reviewers extracted the data required to calculate the change in BMI at the longest follow-up period after surgery, and whether obesity-related complications, such as hypertension and diabetes, had been resolved as a result of surgery. Where available, individual patient data (IPD) were used for the before-and-after comparison of BMI.

The number of reviewers involved at this stage was not reported.

Methods of synthesis
The changes in BMI, with 95% confidence intervals, were pooled using a random-effects model, for the two main types of surgery (LAGB and RYGB). A 7% weight loss, which was a reduction of 3.4 BMI units for LAGB patients or 4.1 BMI units for RYGB patients, was considered to be clinically significant. The heterogeneity was assessed using the $\chi^2$ test.
statistic and was considered to be significant when it was greater than 50%. Sensitivity analyses were performed to assess the impact of single studies on the pooled results and if these results were biased by studies with inadequate follow-up.

**Results of the review**
Eighteen studies (n=641, range 10 to 68 patients) were included. One study was prospective and 14 included consecutive series of patients. The completion rates were not clearly reported, none of the studies reported independent outcome assessment, and only one reported the funding source. Nine of the 13 studies that reported the BMI indicated that it was measured at a clinic and not by the patient.

There was a clinically and statistically significant reduction in BMI following LAGB surgery (95% CI -13.7 to -10.6 BMI units; six studies; I²=56%). There was a larger clinically and statistically significant reduction in BMI following RYGB surgery (95% CI -22.3 to -17.8 BMI units; four studies; I²=0%). For both procedures, the results were reported to be robust in the sensitivity analyses.

**Authors' conclusions**
The authors concluded that bariatric surgery in paediatric patients produced sustained and clinically significant weight loss, but could have serious complications.

**CRD commentary**
This review addressed a clear research question, using appropriate study selection criteria. The number of sources searched was substantial, but the restriction to English-language publications might have introduced bias. Sufficient primary study details were reported and almost all the studies were case series, with a high risk of bias compared with clinical trials. The study quality was assessed, using typical criteria for this design of study, but the full results were not reported. The number of reviewers involved at each stage of the review was not reported, reducing its transparency. The synthesis appears to have been appropriate. The results were adequately reported, but few results of the sensitivity analysis were given, and no central estimates were provided for the main results, reducing the clarity of the review.

Because of the low study quality and poor reporting of the review process and results, the reliability of the conclusion is unclear.

**Implications of the review for practice and research**
**Research**: The authors stated that there should be improvements in the reporting of data collection, patient follow-up, and outcomes. Future studies should capture and report long-term data on a large number of participants, including the comorbidity burden and resolution, and compliance with recommendations after surgery. The reporting of the key adolescent health outcomes, such as growth, should be improved to aid future decisions about bariatric surgery.

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

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