Effect of bariatric surgery on nonalcoholic fatty liver disease: systematic review and meta-analysis
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CRD summary
This review concluded that steatosis, steatohepatitis and fibrosis appear to improve or completely resolve in the majority of patients after bariatric surgery-induced weight loss. The pooling of heterogeneous data, together with the lack of methodological assessment of studies and the presence of publication bias, cast some doubt upon the reliability of the authors’ conclusions.

Authors’ objectives
To evaluate the effect of weight loss after bariatric surgery on liver histopathological aspects of non-alcoholic fatty liver disease.

Searching
MEDLINE, EMBASE, Web of Science and Cochrane Central Register of Controlled Trials were searched from inception until September 2007. Search terms were reported. The reference lists of relevant articles were checked to identify additional studies. Abstracts from four relevant national meetings were checked to identify unpublished studies.

Study selection
Studies that undertook liver histopathology before and after bariatric surgery and included 10 or more patients were eligible for inclusion. Studies that included patients who had a jejuno-ileal bypass were excluded. Data for patients with cirrhosis were excluded. Outcomes of interest were steatosis, steatohepatitis and fibrosis.

In the included studies, the bariatric surgical procedures were Roux-en-Y gastric bypass, laparoscopic adjustable gastric banding, gastroplasty, sleeve gastrectomy, bili-intestinal bypass, vertical banded gastroplasty and biliopancreatic diversion. The time between the two liver biopsies ranged from two months to 111 months. A number of histopathological grading systems were used. Where stated in the included studies: the proportion of females ranged from 50 to 95.6%; mean participant age ranged from 35.6 to 48.6 years; mean BMI at baseline ranged from 43.9 to 56 kg/m² and at follow-up from 28.6 to 39 kg/m².

Two reviewers independently assessed studies for inclusion.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Data were extracted by at least two reviewers and used to calculate the proportion and corresponding 95% confidence intervals (CIs) of patients experiencing improvement and/or resolution of steatosis, steatohepatitis and fibrosis. Disagreements were resolved by discussion.

Methods of synthesis
Pooled proportions and 95% CIs were calculated using the DerSimonian and Laird random-effects model. Heterogeneity was assessed using the I² statistic. Subgroup analyses and sensitivity analyses were undertaken to explore heterogeneity. Publication bias was assessed by visual inspection of funnel plots.

Results of the review
Fifteen studies (766 paired liver biopsies) were included in the review. Eight studies (401 paired liver biopsies) were prospective studies and seven (365 paired liver biopsies) were retrospective studies.
The percentage reduction in BMI ranged from 19.1 to 41.76 kg/m² (where stated).

The pooled proportion of patients with improvement or resolution of steatosis was 91.6% (95% CI: 82.4, 97.6, 15 studies), steatohepatitis was 81.3% (95% CI: 61.9, 94.9, nine studies) and fibrosis was 65.5% (95% CI: 38.2, 88.1, five studies). The pooled proportion of patients with complete resolution of steatohepatitis was 69.5% (95% CI: 42.4, 90.8; 9 studies). All meta-analyses were subject to significant heterogeneity ($I^2 >88\%$).

Subgroup analyses or sensitivity analyses did not significantly affect the results. Publication bias was observed.

**Authors’ conclusions**

Steatosis, steatohepatitis and fibrosis appear to improve or completely resolve in the majority of patients after bariatric surgery-induced weight loss.

**CRD commentary**

The review question and inclusion criteria were appropriate, although broad. Relevant databases were searched and reference lists were reviewed to locate additional information. An effort was made to search for unpublished articles but the authors stated that publication bias was present. It was unclear if language restrictions were applied, so language bias cannot be ruled out. The quality of the studies was not reported and insufficient study details were provided for the reader to make their own judgement regarding study quality; therefore the reliability of the included studies and the synthesis derived from them is uncertain. Both study selection and data extraction were conducted in duplicate, reducing the potential for error and bias. The authors acknowledge that studies varied widely in design, intervention, outcome measurement and reasons for follow-up biopsies. This variability, along with the significant statistical heterogeneity in all the meta-analyses, brings into question if it was appropriate to combine the results in meta-analyses. In addition, not all proposed subgroup analyses (specifically studies which undertook the Roux-en-Y bypass alone), were reported. The authors did not justify the omission of these results. Also, there was marked variability in duration between biopsies and in weight loss. Both these factors are potential confounders which it may have been appropriate to explore further. The authors did acknowledge a number of limitations with their review. The pooling of such heterogeneous data, together with the lack of methodological assessment of studies and the presence of publication bias, cast some doubt upon the reliability of the authors’ conclusions.

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

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

Research: The authors stated that the results of the review need to be confirmed by multicentre, large-scale, well-designed trials that use uniform histopathological assessments of liver biopsy specimens.

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