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REVIEW ARTICLE

A meta-analysis of maternal and fetal outcomes of pregnancy after bariatric surgery

Xiao-yan Yi [a], Qi-fu Li [a], Jun Zhang [b], Zhi-hong Wang [a,*]

[a] Department of Endocrinology, First Affiliated Hospital of Chongqing Medical University, Chongqing, China
[b] Department of General Surgery, First Affiliated Hospital of Chongqing Medical University, Chongqing, China

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ABSTRACT

Background: The effects of bariatric surgery (BS) on outcomes in subsequent pregnancies are unclear. *Objectives:* To compare maternal and fetal outcomes among women who become pregnant after BS and obese women who have not undergone BS before pregnancy. *Search strategy:* PubMed and Embase were searched for relevant reports, and the reference lists of identified articles were hand-searched. *Selection criteria:* Cohort studies that compared outcomes among women who had undergone any type of BS and obese women who had not undergone surgery were included when results were reported as risk ratios or odds ratios (ORs). *Data collection and analysis:* Summary ORs were estimated using a random effects model. *Main results:* Eleven studies were included. Compared with obese women who had not undergone BS, women who had undergone BS had significantly lower odds of gestational diabetes (OR 0.31; 95% CI 0.15–0.65), hypertensive disorders (OR 0.42; 95% CI 0.23–0.78), and macrosomia (OR 0.40; 95% CI 0.24–0.67). However, their odds of small-for-gestational-age newborns were increased (OR 2.16; 95% CI 1.28–3.66). No significant differences were recorded for cesarean, postpartum hemorrhage, and preterm delivery. *Conclusions:* BS reduces the odds of some adverse maternal and fetal outcomes among obese women.

1. Introduction

The prevalence of obesity is a public health concern worldwide [1]. Obesity is associated with an increased risk of obstetric complications, such as gestational diabetes, pre-eclampsia, eclampsia, macrosomia, and fetal growth restriction [2,3]. Therefore, in view of the substantial increase in the prevalence of obesity among women of child-bearing age, a rise in the frequency of adverse maternal and fetal outcomes should be expected [4]. Weight loss can reduce the likelihood of these adverse outcomes [5]. However, dietary changes, exercise, and medical management result in only short-term benefits, which are not sustained in the long term [6].

Bariatric surgery (BS) is thought to be an effective intervention to sustain weight loss [7]. BS procedures are generally categorized into three groups. Restrictive procedures (e.g. laparoscopic adjustable gastric banding [LAGB] and sleeve gastrectomy [SG]) lead to weight loss by reducing gastric capacity which in turn restricts energy intake [8,9]. Malabsorptive procedures (e.g. biliopancreatic diversion [BPD]) lead to weight loss by restricting absorption of nutrients [10]. Finally, malabsorptive and restrictive procedures (e.g. Roux-en-Y gastric bypass [RYGB]) reduce stomach capacity, thereby causing malabsorption and a certain degree of restriction of food intake [8].

BPD is rarely used because it is associated with substantial long-term complications—hepatic failure, calcium oxalate kidney stones, renal failure, arthritis, and malnutrition [11]. The most performed procedures today are LAGB and RYGB, although SG is becoming the principal treatment option in many countries for obese women [9].

Although these procedures are beneficial in terms of weight reduction, reports of their implications on maternal and fetal outcomes have been inconsistent. The aim of the present meta-analysis was to compare maternal and fetal outcomes among women who have undergone BS with those among obese women who have not undergone BS.

2. Materials and methods

2.1. Search strategy

The PubMed and Embase databases were searched from inception to October 7, 2014, with the keywords “bariatric surgery,” “pregnancy,” “obstetric,” “maternal,” “neonatal,” “perinatal,” and “fetal.” There were no language restrictions. The references of identified articles were hand-searched for further relevant reports.

* Corresponding author at: Department of Endocrinology, First Affiliated Hospital of Chongqing Medical University, Chongqing 400016, China. Tel.: +86 23 89011554; fax: +86 23 89011552.
E-mail address: towzh713@126.com (Z. Wang).

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2.2. Study selection

Cohort studies that reported on maternal and/or fetal outcomes among pregnant women after BS and among obese women before/without BS were included if the results were reported as risk ratios (RRs) or odds ratios (ORs) with corresponding 95% confidence intervals (CIs).

Studies were excluded when they were of any type other than cohort studies, they compared deliveries before and after BS in the same individuals, data were not available, or they included women who were not obese or who underwent BS during pregnancy. If two studies included overlapping populations, the study for which most information was available was included and the other was excluded. If similar studies from the same authors in which data were duplicated were identified, the largest was included and the others were excluded.

2.3. Data extraction and quality assessment

For all included studies, two reviewers (X-y.Y. and Q-f.L.) independently extracted the first author's name, country, publication year, sample size, maternal age, BMI, type of procedures, time from surgery to conception (S-C time), and maternal and/or fetal outcomes. When data were missing, J.Z. would email the authors of the relevant articles.

A body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) of 30 or greater was considered obese. BS included any type of weight-loss procedure. The maternal outcomes assessed were gestational diabetes mellitus (GDM), hypertensive disorders (including gestational hypertension, pre-eclampsia, and eclampsia), postpartum hemorrhage, and cesarean delivery. The fetal outcomes assessed were preterm delivery, macrosomia, and being small for gestational age (SGA).

The quality of the included studies was evaluated by the Newcastle–Ottawa Scale, with some modifications to match the needs of the present review. The highest score was nine points. Disagreements were resolved by discussion.

2.4. Data analysis

The meta-analysis was performed using Stata 12.0 (StataCorp, College Station, TX, USA). Summary ORs were estimated using a random effects model by the Mantel-Haenszel method. Because the OR is equivalent to the RR when events are rare, it was possible to interpret the OR as the RR. Heterogeneity was assessed with the test of inconsistency (I^2): when the value was greater than 50%, it was deemed statistically significant. Meta-regression, and sensitivity and subgroup analyses were planned to identify possible sources of the between-study heterogeneity if necessary and possible. The subgroups assessed were maternal age (≤32 years vs >32 years), type of BS (restrictive vs malabsorptive and restrictive vs mixed), and S-C time (≤2 years vs >2 years). The publication bias of included studies was assessed using the funnel plot with the Begg and Egger tests. A two-sided P value of less than 0.05 was considered statistically significant. The meta-analysis was conducted according to the Meta-analysis of Observational Studies in Epidemiology (MOOSE) criteria [12].

3. Results

3.1. Description of studies

A total of 781 publications were identified, of which 21 underwent full-text review (Fig. 1). After exclusion of 10 studies (Supplementary Material S1), 11 [13–23] were included in the meta-analysis (Table 1). The outcomes analyzed for each study are shown in Supplementary Material S2, along with the definitions used for each of the outcomes. Two studies from the USA [13,15] had overlapping populations, but they were included because data for hypertensive disorders were extracted from one [13] and data for GDM and postpartum hemorrhage were extracted for the other [15].

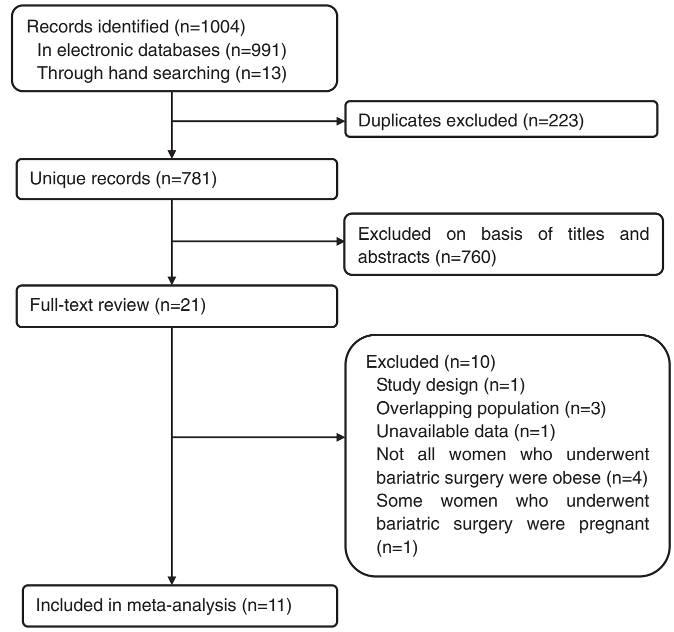

Fig. 1. Identification of eligible articles.

Among the 11 included studies, five were from Europe, four from the USA, one from the Middle East, and one from Australia (Table 1). The mean age of participants was generally older than 30 years. Among the studies reporting relevant data, generally more than half the participants had given birth previously (Table 1). The procedures performed varied; some studies stated that they included only LAGB or RYGB [16–18,20,22]. Among women who had undergone BS, there was an apparent reduction in average BMI from 40–50 to 32–35 (Table 1). Additionally, birth weight was generally lower for the neonates delivered by women who had undergone BS than for those delivered by women who had not undergone BS (Table 1). Only four studies [16,18,20,22] mentioned post-surgery nutritional recommendations and follow-up. Results of quality assessment are shown in Supplementary Material S3.

3.2. GDM

Nine articles that reported the maternal outcome of GDM in women with or without surgery [14–20,22,23] were included in the analysis of GDM, with 711 cases overall. The random effects model showed that GDM was significantly less likely among women who had undergone BS than among those who had not (pooled OR 0.31, 95% CI 0.15–0.65; $I^2 = 85.2\%$, $P < 0.001$) (Fig. 2A). No publication bias was found with either the Begg (0.602) or Egger ($P = 0.240$) tests.

Because the heterogeneity was significant, a sensitivity analysis was performed for GDM. It showed that no article significantly affected the results (data not shown). Subgroup analysis indicated that some heterogeneity could be a result of differences in S-C time. In some studies, the time from surgery to delivery (S-D time) was provided instead of the S-C time. For such studies, an assumption was made that their mean gestational age was 40 weeks, and S-C time was estimated as S-D time minus the length of pregnancy (Supplementary Material S4). Among studies in which women who had undergone BS conceived up to 2 years after surgery, GDM was significantly less likely among women who had undergone BS than among those who had not (OR 0.22, 95% CI 0.14–0.34; $I^2 = 0.0\%$, $P = 0.844$). Similar results were recorded for the subgroup analyses including studies of women who conceived more than 2 years after surgery (OR 0.19, 95% CI 0.04–0.94; $I^2 = 70.8\%$, $P = 0.016$) (Supplementary Material S5).