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Review

Pregnancy after Bariatric Surgery: Balancing Risks and Benefits

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ABSTRACT

The majority of bariatric surgeries in Canada are performed in women of reproductive age. Clinicians encounter more and more often pregnancies that occur after bariatric surgeries. The appropriate management and education of women who want to conceive after bariatric surgery is still unclear due to the lack of consistent data about maternal and neonatal outcomes following bariatric surgery. Maternal obesity during pregnancy confers a higher risk for gestational diabetes, hypertensive disorders, congenital malformations, prematurity and perinatal mortality. Generally, pregnancies in severely obese women who have undergone bariatric surgery are safe, and the women are at significantly lower risk for gestational diabetes, hypertensive disorders and large-for-gestational-age neonates, but the surgery confers a higher risk for small-for-gestational-age infants and prematurity. This review aims to provide evidence from recent publications about the risks and benefits of bariatric surgeries in the context of future pregnancies.

RÉSUMÉ

La majorité des chirurgies bariatriques au Canada s'effectuent chez des femmes en âge de procréer et les cliniciens sont donc de plus en plus confrontés au suivi de grossesses chez des femmes ayant subi une chirurgie bariatrique. Cependant, la prise en charge et l'éducation appropriées des femmes qui veulent concevoir après la chirurgie bariatrique ne sont pas encore claires en raison du manque de données cohérentes sur les issues maternelles et néonatales à la suite de la chirurgie bariatrique. Il est bien connu que l'obésité maternelle durant la grossesse expose à un risque plus élevé de diabète gestationnel, de troubles hypertensifs, de malformations congénitales, de prématurité et de mortalité périnatale. Généralement, les grossesses chez les femmes ayant subi une chirurgie bariatrique par le passé sont sans danger et améliorent le risque de développer un diabète gestationnel, des troubles hypertensifs ou de donner naissance à un bébé gros pour l'âge gestationnel. Cependant, nous constatons qu'elles sont exposées à un risque plus élevé de donner naissance à un bébé petit pour l'âge gestationnel ou prématuré. La présente revue a pour but de fournir les données scientifiques de récentes publications sur les risques et les avantages des chirurgies bariatriques dans le cadre de grossesses futures.

Introduction

In 2013 and 2014, more than 6500 bariatric surgeries (BSurg) were performed in Canada, and 78% were performed in women; more than half were of reproductive age (1). The most recent clinical practice guidelines for the perioperative nutritional, metabolic and nonsurgical management of patients undergoing BSurg were published in 2013, cosponsored by the American Association of Clinical Endocrinology (AACE), The Obesity Society (TOS) and the American Society for Metabolic and Bariatric Surgery (ASMB) (2). It was suggested that candidates for bariatric surgery should avoid pregnancy preoperatively and for 12 to 18 months postoperatively. These recommendations about pregnancy after bariatric surgery were grade D, reflecting the important lack of data about early and late effects of BSurg on maternal and fetal outcomes. These clinical guidelines also recommend that women who become pregnant after BSurg should be counselled and monitored for appropriate weight gain and nutrition supplementation and for fetal health (Grade C). Unfortunately, little is known about whether outcomes for fetal health are different depending on the timing between BSurg,

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conception and pregnancy, the periods of active weight loss or the stability of weight and optimal nutritional support needed.

Recently, these considerations have been gaining more interest, and studies involving a growing number of patients and various outcomes are increasingly available to help clinicians manage this particular population adequately. This review focuses on recent available data concerning fetal and maternal safety of pregnancy after BSurg and on the risks and benefits of BSurg in maternal and neonatal outcomes.

Methods

We reviewed recent literature using the following PubMed keywords: *bariatric surgery*, *sleeve gastrectomy*, *biliopancreatic diversion*, *RYGB*, *Roux-in-Y Gastric Bypass*, *Gastric Bypass*, *gastric banding*, *LAGB, weight loss surgery and pregnancy*, *neonatal outcomes*, *maternal outcome, newborn,* and specific keywords for each described outcome. Articles in French and English were evaluated and are included in the present review, depending on overall literature results.

Obesity and Pregnancy: What are the Risks?

Multiple studies have assessed the risks of obesity in maternal and fetal health in comparison to the risks in normal-weight and lean women. These studies allowed quantification of the risks in pregnancy according to the large spectrum of increasing body weight, from overweight to severe obesity.

Fertility is clearly affected by obesity, which is associated with menstrual irregularities and oligo-anovulation. Even obese women with regular menstrual cycles may have subfertility and increased time to conception (3,4). Beyond preconception, fertility issues associated with obesity, excess weight before pregnancy (body mass index [BMI] ≥25 kg/m^2) is also associated with an increased risk for spontaneous miscarriage before 20 weeks of gestation (odds ratio [OR] 1.67; 95% confidence interval [CI] 1.25 to 2.25) (5) and recurrent miscarriage (OR 3.51; 95% CI 1.03 to 12.01) in obese women (BMI ≥30 kg/m^2) (6). Mechanisms explaining these poor reproductive outcomes are still unclear, but multiple factors may contribute, including increased adipokines and inflammatory cytokines secreted by adipose tissue; lipotoxicity, hypothalamo-pituitary-ovarian axis and hormonal changes (3).

Obesity is also associated with an increased risk for maternal and fetal complications. First of all, obesity is associated with a strongly increased risk for gestational hypertension and pre-eclampsia (OR 4.82; 95% CI, 4.04 to 5.7) (7). Prepregnancy overweight or obesity also substantially increases the risk for gestational diabetes mellitus (GDM). Meta-analyses of 70 studies in more than 670 000 women have confirmed that the risk for GDM increases with higher BMI in comparison to normal-weight women, with an OR of 1.97 in overweight, 3.01 in obese and 5.55 in severely obese women (8). Obesity or severe obesity is a more important risk factor for GDM than maternal age or ethnicity (9). Furthermore, it is well known that maternal hyperglycemia per se increases the risk for many maternal and fetal outcomes, including pre-eclampsia, assisted or caesarean delivery, large-for-gestational-age (LGA) newborn, shoulder dystocia or birth injury, premature delivery, neonatal intensive care, hyperbilirubinemia and neonatal hypoglycemia (10).

Independent of the effect of GDM on fetal outcomes, obesity per se also increases the rate of congenital anomalies, including spina bifida (OR 2.24; 95% CI, 1.86 to 2.69); neural tube defects (OR 1.87, 95% CI, 1.62 to 2.15); hydrocephaly (OR 1.68; 95% CI, 1.19 to 2.36); anorectal atresia (OR 1.48; 95% CI, 1.12 to 1.97); limb reduction anomalies (OR 1.34; 95% CI, 1.03 to 1.73); cardiovascular anomalies (OR 1.30 95% CI,1.12 to 1.51); cleft palate (OR 1.23; 95% CI, 1.03 to 1.47); cleft lip and palate (OR 1.20; 95% CI, 1.03 to 1.40); and septal anomalies (OR 1.200; 95% CI, 1.09 to 1.31) (11). The risk for prematurity, including giving birth to an extremely preterm infant (22 to 27 weeks) is approximately tripled in severely obese women (BMI >40 kg/m^2) (12).

In comparison to lean women (BMI <20 kg/m^2), the risk for stillbirth (≥28 weeks of gestation) in obese women is doubled (OR 2.0; 95% CI, 1.2 to 3.3) in parous women and approximately quadrupled (OR 4.3; 95% CI, 2.0 to 9.3) in nulliparous women in a population-based cohort study from Sweden (13). The same group also reported an increased risk for infant mortality from 2.4 infant deaths per 1000 deliveries for normal-weight women (BMI 18.5 to 24.9 kg/m^2) to a rate of 3.4 per 1000 for obesity grade 1 (BMI 30 to 35 kg/m^2) and 5.8 per 1000 for obesity grade 3 (BMI ≥40 kg/m^2) independently of GDM or hypertensive disorders (14). Excess risk for infant mortality in obese women was attributed to an increased risk for preterm deliveries (12), birth asphyxia, congenital anomalies, sudden infant death syndrome and other neonatal morbidities (14). The fraction of infant mortality that could be attributed to BMIs 25 kg/m^2 or above was 11% within this cohort, and 45% of excess death occurred in preterm infants. A meta-analysis and systematic review of 38 studies that did not include this last study also concluded that obesity confers an increased risk for fetal mortality, stillbirth and neonatal mortality (15).

Regarding birth weight, macrosomia and LGA, newborns are clearly more commonly at risk in cases of maternal obesity. This risk is at least doubled, and a meta-analysis showed that maternal obesity (BMI ≥30 kg/m^2) increased the risk for macrosomia, which is defined as a birth weight ≥4000 g (OR 2.17, 95% CI 1.92, 2.45); birth weight ≥4500 g (OR 2.77, 95% CI 2.22, 3.45) and LGA, which is defined as a birth weight ≥90 percentile for gestational age (OR 2.42, 95% CI 2.16, 2.72) (16). The increased risk persists when prepregnancy BMI is considered independently of GDM (17,18).

Furthermore, excessive gestational weight gain is also deleterious for the health of mother and child, including an increased risk for caesarean delivery, postpartum weight retention, LGA infants, increased fat mass in the newborn and childhood obesity (19). Lifestyle intervention during the antenatal period through diet or physical activity has been shown to decrease gestational weight gain but, unfortunately, was only associated with a significant decrease in the risk of hypertensive disorders and shoulder dystocia in the newborn (20).

Indications for Bariatric Surgery

Severely obese women (BMI ≥40 kg/m^2 or BMI ≥35 kg/m^2 and comorbidities) who have tried to lose weight through lifestyle intervention but do not attain or sustain objectives are eligible for BSurg. An increasing number of these women are now seen in clinical practice because significant weight loss is rarely attained through lifestyle intervention (1,21).

Pregnancy after Bariatric Surgery: Published Evidence

Literature concerning the effects of BSurg on pregnancy outcomes is very conflicting because most publications consist of small-cohort studies (generally no more than 150 subjects) that often include both restrictive and malabsorptive procedures. Furthermore, highly heterogeneous control groups have been studied, from women with comparable early pregnancy BMIs or pre-surgery BMIs to comparison of the same women before and after the surgery or to general population controls or obese populations. Even if some conclusions appear to be consistent, this has led to confusion about most pregnancy and neonatal outcomes. In the most recent literature, 2 systematic reviews and meta-analyses examined the effects