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Bariatric Surgery and Pregnancy

As the rate of obesity increases, it is becoming more common for providers of women's health care to encounter patients who are either contemplating or have had operative procedures for weight loss, also known as bariatric surgery. The counseling and management of patients who become pregnant after bariatric surgery can be complex. Although pregnancy outcomes generally have been favorable after bariatric surgery, nutritional and surgical complications can occur and some of these complications can result in adverse perinatal outcomes. The purpose of this Practice Bulletin is to provide a summary of the risks of obesity in pregnancy, review the available literature regarding outcomes of pregnancy after bariatric surgery, and provide recommendations for the care of the patient during her pregnancy and delivery after bariatric surgery.

This Practice Bulletin was developed by the ACOG Committee on Practice Bulletins—Obstetrics with the assistance of Michelle A. Kominiarek, MD. The information is designed to aid practitioners in making decisions about appropriate obstetric and gynecologic care. These guidelines should not be construed as dictating an exclusive course of treatment or procedure. Variations in practice may be warranted based on the needs of the individual patient, resources, and limitations unique to the institution or type of practice.

THE AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS
WOMEN'S HEALTH CARE PHYSICIANS

Background

Incidence

Obesity is an epidemic in the United States—66% of adults were either overweight or obese in 2004 (1). The prevalence of maternal obesity, defined as a body mass index (BMI) of 30 or more in the United States has been reported to range from 10% to 36% (2–6). BMI is calculated as weight in kilograms divided by height in meters squared. The prevalence of adult obesity increased dramatically (from 16% to 26%) in the past decade, with 30 states reporting prevalences greater than 25% (7, 8). Furthermore, the prevalence of obesity in reproductive-aged women (20–39 years) was 29% in 2004, affecting a greater proportion of Mexican American (36%) and non-Hispanic black (50%) women (1). A prepregnancy BMI of more than 30 or a prepregnancy weight of more than 200 lbs can be used to stratify risk during pregnancy (2, 9, 10). In a population-based study of obesity trends in the United States, there was a 70% increase in prepregnancy obesity from 1994 to 2003 (11).

Maternal Effects of Obesity on Pregnancy

Obesity is associated with reduced fertility primarily as a result of oligo-ovulation and anovulation (12). Therefore, obese women are less likely to respond to ovulation induction, even with higher doses of gonadotropins (13, 14).

In pregnancy, additional risks occur in obese patients. The increased risks for gestational diabetes, preeclampsia, cesarean delivery, and infectious morbidity associated with obesity are well established (6, 15–18). In addition, operative morbidity increases as a result of difficulty in establishment of and recovery from regional and general anesthesia (19, 20), prolonged operating times, increased blood loss (21), and thromboembolism (22). Obese patients also are less likely to have a successful vaginal birth after cesarean delivery (23–26). Although obese patients have a higher incidence of preterm birth for maternal or fetal indications, they are less likely to have spontaneous preterm labor (27–29). Obese patients are more likely to be admitted earlier in labor, need labor induction, require more oxytocin, and have longer labor (30).

Fetal and Neonatal Effects of Obesity in Pregnancy

Maternal obesity can have effects on the fetus, including increased risks of congenital anomalies, growth abnormalities, miscarriage, and stillbirth (31–34). The most common types of obesity-associated birth defects are related to the neural tube, cardiac systems, and facial clefting, even after controlling for diabetes (35, 36). In addition, increased body mass impairs visualization of ultrasound images and can compromise prenatal diagnosis of fetal anomalies, such as neural tube or cardiac defects (37, 38). However, increased maternal BMI does not appear to compromise fetal weight estimations (39). Although some studies have reported an increase in small for gestational age infants, most studies report an increase in large for gestational age and macrosomic infants among women who are obese during pregnancy (40, 41). The risk for stillbirth is 2.1–4.3-fold greater in obese compared with normal weight women (5, 42). The pathophysiology behind the increased risk for birth defects and stillbirth in this population is not known. Maternal obesity also has been associated with an increase in subsequent childhood obesity (43, 44).

Bariatric Surgery

Nonsurgical approaches to weight loss include behavioral changes, diet, exercise, and pharmacotherapy. Bariatric surgery, first performed in the 1960s, may be available to patients with a BMI of 40 or more or those with a BMI of 35 or more and other comorbidities. Bariatric surgery is the most effective therapy available for morbid obesity and results in improvement or complete resolution of comorbidities and improved quality of life (45, 46).

Two primary approaches to bariatric surgery weight loss are restrictive and a combination of restrictive and malabsorptive operations. The types of procedures commonly performed today include the Roux-en-Y gastric bypass (a combination of restrictive and malabsorptive effect) and adjustable gastric banding (restrictive). The Roux-en-Y gastric bypass creates a roux limb (or straight limb) connected to the gastric pouch and the "Y" portion is downstream as the enteroenterostomy. The proximal stomach is separated from the remaining part of the stomach with staples. In the banding procedure, a fluid-filled band is placed around the stomach near the fundus, reducing functional stomach volume. Both techniques can be performed by laparoscopy or laparotomy. Vertical banded gastroplasty (restrictive) and biliopancreatic diversion (malabsorptive) are now less commonly used, and jejunoileal bypass (purely malabsorptive) is no longer performed.

The number of bariatric surgical procedures performed annually has dramatically increased from 12,480 in 1998 to 113,500 in 2005 (47). The majority of these patients are female (more than 80%) and one half of the bariatric procedures in 2004 were performed in reproductive-aged women with a mean age of 40 years (48, 49). Bariatric surgery also is being used increasingly to treat adolescents with morbid obesity (50).

Effect of Surgery on Future Fertility

Rapid weight loss follows bariatric surgery, resulting in improvement of conditions such as polycystic ovary syndrome, anovulation, and irregular menses, thus leading to higher fertility rates (51–54). However, bariatric surgery should not be considered a treatment for infertility (55).

Several studies have discussed the potential for compromised absorption of oral contraceptives (OCPs) after bariatric surgery (56, 57), given the number of unintended pregnancies that occurred after the procedures. There may be decreased absorption of OCPs as a result of the anatomic and physiologic alterations from malabsorptive surgery (58, 59). The effect of bariatric surgery on miscarriage rates is difficult to evaluate because of small numbers in studies (51, 53, 54, 60).

Effect of Surgery on Maternal Morbidity and Mortality

Weight loss outside of pregnancy, whether achieved via surgical or nonsurgical methods, has been shown to be the most effective intervention to improve medical comorbidities, especially diabetes and hypertension (45,

46). However, in the studies of pregnancy after bariatric surgery many patients are still obese, with a reported prevalence as high as 80% in one series (61–63). The possibility of continued obesity after surgery is important to consider when interpreting studies about this population.

In a study comparing 298 women who had bariatric surgery to the general obstetric population of 158,912 women, patients who had bariatric surgery were more likely to have had a prior cesarean delivery (15.4% versus 10.5%, $P=0.006$), develop gestational diabetes (9.4% versus 5.0%, $P<0.001$), and give birth via cesarean delivery (25.2% versus 12.2%, $P<0.001$) (64). In one study comparing pregnancies before and after a Roux-en-Y gastric bypass, the rate of hypertension (including chronic and gestational hypertension and preeclampsia) (45.6% versus 8.7%, $P<0.001$) was decreased after surgery (65). Similarly, the occurrence of pregestational diabetes was decreased (OR, 0.42; 95% CI, 0.26–0.67) after bariatric surgery of several types (66). A systematic review of pregnancy after bariatric surgery also described decreased rates of gestational diabetes and preeclampsia (67).

Average weight gain during pregnancy also was decreased in several studies after bariatric surgery (62, 65, 68–71). Although preterm premature rupture of membranes was increased in patients after bariatric surgery compared with the general population (64), preterm delivery in other studies with more similar control groups was unchanged (62, 63, 66). One study reported higher cesarean delivery rates after bariatric surgery compared with rates for nonobese women who had not undergone bariatric surgery (61.5% versus 36.2%, $P< 0.05$). In this study, cesarean delivery rates for women after bariatric surgery compared with obese (46.5%) and severely obese controls (43.5%) was not significantly different (71). The increase in cesarean delivery after bariatric surgery may be attributed to previous cesarean deliveries in this obese population (66).

Several case reports and small studies have identified significant late complications of previous bariatric surgery that have occurred during pregnancy, including maternal intestinal obstruction and gastrointestinal hemorrhage (61, 63, 69, 71-74). Exploratory surgery during pregnancy may be required to treat these complications from bariatric surgery. Maternal deaths have been reported (75, 76). There should be a high index of suspicion for gastrointestinal surgical complications when pregnant women who have had these procedures present with significant abdominal symptoms.

Effect of Surgery on Fetal and Infant Morbidity and Mortality

The number of congenital anomalies after bariatric surgery is not increased compared with the general population (64, 77). Some reports suggest a trend towards lower mean birth weights indicating more appropriately grown infants, fewer large for gestational age infants, and more small for gestational age infants (53, 60, 65, 66, 69–71). After bariatric surgery, maternal weight gain during pregnancy is likely a predictor of birth weight (68, 78). Macrosomia (birth weight greater than 4,000 g) also was decreased after Roux-en-Y gastric bypass (70, 71, 79). Previous bariatric surgery is not associated with an increase in perinatal death (60, 64, 65). The data are limited on other neonatal outcomes.

Clinical Considerations and Recommendations

▶ *How should contraception and preconception be approached in patients after bariatric surgery?*

Contraception and preconception counseling should be a component of the overall counseling for any reproductive-aged woman undergoing bariatric surgery. Contraceptive counseling is especially important for adolescents because pregnancy rates after bariatric surgery are double the rate in the general adolescent population (12.8% versus 6.4%) (80). In addition, because there is an increased risk of oral contraception failure after bariatric surgery with a significant malabsorption component, nonoral administration of hormonal contraception should be considered in these patients (55).

Some authorities have recommended waiting 12–24 months after bariatric surgery before conceiving so that the fetus is not exposed to a rapid maternal weight loss environment and so that the patient can achieve full weight loss goals (81). Should pregnancy occur before this recommended time frame, closer surveillance of maternal weight and nutritional status may be beneficial. Use of ultrasound for serial monitoring of fetal growth also may be useful and should be considered.

▶ *What are effective strategies for addressing nutritional status during pregnancy in women who have had bariatric surgery?*

The most common nutritional deficiencies after Roux-en-Y gastric bypass surgery are of protein, iron, vitamin B_{12}, folate, vitamin D, and calcium. Several groups have recommended a broad evaluation for micronutrient deficiencies at the beginning of pregnancy for women who have had bariatric surgery, and it should be considered (79, 82–84). If there is a proven deficit, then appropriate treatment should be instituted and monitored. In the

absence of a deficiency, monitoring the blood count, iron, ferritin, calcium, and vitamin D levels every trimester may be considered.

Beginning supplementation with oral forms is appropriate, but parenteral forms should be considered if laboratory studies do not improve. It is not known if women require higher doses of folic acid (greater than 0.4 mg/d) after weight loss surgery to decrease the risk of birth defects. Only 14–59% of postoperative bariatric surgery patients continue to take the prescribed multivitamin supplement long-term; therefore, patients without appropriate preconception care may not have adequate supplement levels at the start of pregnancy (85, 86). The daily recommendation for protein intake of 60 g is the same regardless of bariatric surgery status (9). Limited evidence shows that caloric and protein restriction during pregnancy may impair fetal growth and is of no benefit in reducing other pregnancy comorbidities (87). Consequently, even if patients continue to be overweight after bariatric surgery, there is no recommendation for caloric restriction during pregnancy.

Several studies have suggested that women who become pregnant after bariatric surgery should take a prenatal vitamin in addition to a multivitamin (79, 88). It should be noted that an excess of vitamin A consumption during pregnancy is associated with birth defects, so supplemental dosages of vitamin A should be limited to 5,000 international units per day during pregnancy. Consultation with a nutritionist after conception may help the patient adhere to dietary regimens and to cope with the physiologic changes of pregnancy. One study reported that if the bariatric surgery team monitored the patient throughout the pregnancy, the weight gain was optimal and similar to the Institute of Medicine (IOM) recommendations (9.2 plus or minus 8.4 kg), compared with patients who were not seen at all, not seen until after the first trimester (poor weight gain of 4.8 plus or minus 9.0 kg), or seen only in the first trimester (excessive weight gain of 13.0 plus or minus 9.7 kg, $P=0.009$) (68). Close surveillance should continue postpartum because there are several case reports of nutritional deficiencies in infants who were breast-fed by women who had under-gone bariatric procedures (89, 90).

Nutrient deficiencies also can occur after restrictive surgical procedures (eg, adjustable gastric banding procedure). Patients may experience decreased food intake, intolerance to certain foods, or both because the gastric opening is narrowed after such procedures. Several authors have described "active band management" whereby fluid from the gastric band is removed or lessened during a pregnancy allowing for less gastric constriction and an increase in oral intake (62, 63, 69, 91). Removing fluid from the gastric band also has been described to relieve nausea and vomiting during the first trimester (62, 63, 70, 91). There is no consensus on the management of patients during pregnancy who have undergone an adjustable gastric banding procedure, but early consultation with a bariatric surgeon is recommended.

▶ *Are there special considerations in the antenatal period for women who have had bariatric surgery?*

In pregnancy, there may be a delay in the diagnosis of bariatric-related operative complications. These complications include anastomotic leaks, bowel obstructions, internal hernias, ventral hernias, band erosion, and band migration. All gastrointestinal problems such as nausea, vomiting, and abdominal pain, which occur commonly during pregnancy, should be thoroughly evaluated in patients who have had bariatric surgery. Early involvement of the bariatric surgeon in evaluating abdominal pain is critical because the underlying pathology may relate to the weight loss surgery.

Dumping syndrome can occur after gastric bypass procedures. It is related to the ingestion of refined sugars or high glycemic carbohydrates that the stomach rapidly empties into the small intestine. Fluid shifts from the intravascular compartment into the bowel lumen result in small-bowel distention. Symptoms include abdominal cramps, bloating, nausea, vomiting, and diarrhea. Hyperinsulinemia and consequent hypoglycemia can occur later, resulting in tachycardia, palpitations, anxiety, and diaphoresis. Patients with dumping syndrome may not tolerate the 50-g glucose solution commonly administered at 24–28 weeks of gestation to screen for gestational diabetes. Alternative measures to screen for gestational diabetes should be considered for patients who have undergone malabsorptive-type surgery. One proposed alternative is home glucose monitoring (fasting and 2-hour postprandial blood sugar) for approximately 1 week during the 24–28 weeks of gestation (73, 92).

Other concerns for patients who have had bariatric surgery relate to medication dosages. After operations such as the Roux-en-Y gastric bypass, the absorptive surface of the intestine is decreased, leading to decreased time for absorption. Extended-release preparations are not recommended in these patients; instead oral solutions or rapid release formulations are preferred (93). In addition, the gastric pouch is smaller and bariatric surgeons have cautioned against using nonsteroidal anti-inflammatory drugs postpartum to avoid gastric ulceration (94, 95). In using medications in which a therapeutic drug level is critical, testing drug levels may be necessary to ensure a therapeutic effect.

▶ *Are there special considerations during labor and delivery for women who have had bariatric surgery?*

Bariatric surgery should not alter the course of labor and delivery, and as such does not significantly affect its management. However, many patients remain obese after bariatric procedures and, as with obese women without bariatric surgery, may be admitted earlier in labor, need labor induction, require more oxytocin, and have longer labor (30). Cesarean delivery rates are higher after bariatric surgery, as high as 62% in one study (65, 66, 71, 79, 88). Similarly, in one study, even after controlling for confounders (previous cesarean delivery, obesity, and fetal macrosomia), bariatric surgery was found to be an independent risk factor for cesarean delivery (64). There is no known physiologic reason for performing more cesarean deliveries in women who have had bariatric surgery. Therefore, the bariatric surgery itself should not be considered an indication for a cesarean delivery. If a patient has had extensive and complicated abdominal surgery from weight loss procedures, prelabor consultation with a bariatric surgeon should be considered.

Summary of Recommendations and Conclusions

The following conclusions and recommendations are based on limited or inconsistent scientific evidence (Level B:)

- Contraceptive counseling is important for adolescents because pregnancy rates after bariatric surgery are double the rate in the general adolescent population.
- Because there is an increased risk of oral contraception failure after bariatric surgery with a significant malabsorption component, nonoral administration of hormonal contraception should be considered in these patients.
- In using medications in which a therapeutic drug level is critical, testing drug levels may be necessary to ensure a therapeutic effect.

The following conclusions and recommendations are based primarily on consensus and expert opinion (Level C):

- There should be a high index of suspicion for gastrointestinal surgical complications when pregnant women who have had these procedures present with significant abdominal symptoms.
- Bariatric surgery should not be considered a treatment for infertility.
- Bariatric surgery should not be considered an indication for cesarean delivery.
- There is no consensus on the management of patients during pregnancy who have had an adjustable gastric banding procedure, but early consultation with a bariatric surgeon is recommended.
- Alternative testing for gestational diabetes should be considered for those patients with a malabsorptive-type surgery.
- Consultation with a nutritionist after conception may help the patient adhere to dietary regimens and cope with the physiologic changes of pregnancy.
- A broad evaluation for micronutrient deficiencies at the beginning of pregnancy for women who have had bariatric surgery should be considered.

Proposed Performance Measure

Documentation of counseling about weight gain and nutrition in pregnancy

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The MEDLINE database, the Cochrane Library, and ACOG's own internal resources and documents were used to conduct a literature search to locate relevant articles published between January 1975 and November 2008. The search was restricted to articles published in the English language. Priority was given to articles reporting results of original research, although review articles and commentaries also were consulted. Abstracts of research presented at symposia and scientific conferences were not considered adequate for inclusion in this document. Guidelines published by organizations or institutions such as the National Institutes of Health and the American College of Obstetricians and Gynecologists were reviewed, and additional studies were located by reviewing bibliographies of identified articles. When reliable research was not available, expert opinions from obstetrician–gynecologists were used.

Studies were reviewed and evaluated for quality according to the method outlined by the U.S. Preventive Services Task Force:

- I Evidence obtained from at least one properly designed randomized controlled trial.
- II-1 Evidence obtained from well-designed controlled trials without randomization.
- II-2 Evidence obtained from well-designed cohort or case–control analytic studies, preferably from more than one center or research group.
- II-3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments also could be regarded as this type of evidence.
- III Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Based on the highest level of evidence found in the data, recommendations are provided and graded according to the following categories:

Level A—Recommendations are based on good and consistent scientific evidence.

Level B—Recommendations are based on limited or inconsistent scientific evidence.

Level C—Recommendations are based primarily on consensus and expert opinion.

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