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Preparing for and Managing a Pregnancy After Bariatric Surgery

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ABSTRACT

The number of bariatric surgeries performed in the United States has risen exponentially. Given that the majority of patients are female and of reproductive age, it is important for clinicians who manage women's health issues to be aware of the surgery, its long term goals, and the potential effect on future pregnancies. Most pregnancies after bariatric surgery have successful outcomes with decreased occurrences of gestational diabetes and hypertension and lower birth weight compared with controls. Adherence to nutritional guidelines and supplementation in the event of deficiencies are critical in the provision of prenatal care to this unique population. Other important issues include a multidisciplinary team management, a different approach to screening for gestational diabetes, careful evaluation of any gastrointestinal complaints, and appropriate counseling for gravidas who still remain obese during pregnancy. Further research should investigate the long-term maternal outcomes in pregnancies after bariatric surgery as well as the effect on the offspring.

Obesity in the United States: An Epidemic

The prevalence of obesity has increased dramatically over the past several decades. This has led to a greater morbidity and proportion of deaths attributed to obesity. It is known that women have higher rates of obesity than men - 35.5% versus 32.2% in 2007-2008.[1] Obesity also complicates pregnancies with greater numbers of miscarriages, malformations, fetal growth problems, hypertension, gestational diabetes, and cesareans. The greatest concern of all is a propagation of the cycle as childhood or adolescent obesity. Offspring of obese mothers are also at risk for obesity along with type 2 diabetes and cardiovascular disease later in life.[2-6]

What is Bariatric Surgery?

Although lifestyle changes, diet, exercise, and medical therapy are considered the first line treatment for obesity, they frequently do not result in successful long-term weight loss. Bariatric or weight loss surgery is considered the most successful treatment for morbid obesity in obese adults.[7] Not only does bariatric surgery promote weight loss, it also impacts obesity-related co-morbidities. For example, it is not uncommon for diabetes to improve following surgery to the point that insulin or other medications are no longer needed.[8] Surgery also has been shown to improve or resolve other obesity related problems such as hypertension, high cholesterol, nonalcoholic steatohepatitis, obstructive sleep apnea, and infertility. Bariatric surgery procedures in the United States increased by 800% between 1998 and 2005 (from 12,480 to 113,500 cases).[9] Patients are eligible for weight loss surgery if they have a body mass index (BMI) > 40 kg/m^2 or a BMI > 35 kg/m^2 with other co-morbid conditions. The patient also must demonstrate a history of failed sustained weight loss on supervised weight-reduction programs.

Bariatric surgery promotes weight loss via restriction (limits the amount of food ingested), malabsorption (bypasses parts of the small intestine) or a combination of both. In the United States, the most common procedures performed today are the Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB), vertical sleeve gastrectomy (VSG), and biliopancreatic diversion (BPD). These can be performed either via laparoscopy or laparotomy. The RYGB (a combined procedure) divides the stomach and creates a gastric pouch that holds <30 mL (restrictive portion). The jejunum is then divided distal to the ligament of Treitz with the distal segment anastomosed to the gastric pouch. In AGB (restrictive surgery), an inflatable band is placed below the gastroesophageal junction and connected with a tube to an injection port, leaving a gastric pouch of 50 mL. The bariatric team is multidisciplinary and includes surgeons, psychologists, nutritionists, nurses, patient educators, endocrinologists, and cardiologists. A significant portion of the success from weight loss surgery is attributed to this team foundation.

Contraception and Pregnancy Planning after Bariatric Surgery

Women accounted for 83% of bariatric procedures in the reproductive (18-45 years) age group between 1998 and 2005.[9] Future pregnancies were important to 30% of women planning to have bariatric surgery in one survey.[10] Infertility problems, one of the obesity related co-morbidities, commonly improve after weight loss from bariatric surgery procedures.[11-14] As such, clinicians who specialize in women's health should not only be familiar with the surgery and understand the long-term goals for weight loss, but also provide appropriate counseling regarding contraception and pregnancy after bariatric surgery, regardless of whether they desire a future pregnancy. The optimal time for this counseling is prior to the bariatric surgery.

Chronic medical diseases such as obesity create barriers to contraceptive counseling. Specific to bariatric surgery, studies suggest that oral contraception may not be as effective after bariatric surgery as a result of decreased absorption.[15-18] Continued obesity after bariatric surgery also plays a role in planning contraception.[19] Unfortunately, current practice is limited due to lacking evidence regarding the effectiveness and safety of contraception after bariatric surgery, but it is unlikely that there is a significant decrease in efficacy for oral contraceptive pills according to a recent systematic review.[20]

Because the greatest weight loss occurs in the first 12-18 months after surgery, this has prompted several societies and authors to recommend waiting at least 12 months prior to conception.[21-23] This is based on the theory that a pregnancy occurring during a period of malnutrition could lead to adverse outcomes such as low birth weight or malformations. However, the recommendation to delay conception can place limitations on family planning for those who are either older or have infertility.

Several studies have compared outcomes between pregnancies conceived early (i.e. < 12 months after surgery) vs. late (i.e. >12 or >18 months after surgery.[23-27] These studies have not found significant differences in perinatal outcomes between the two time periods. The largest of these studies (104 pregnancies conceived during and 385 conceived after the first postoperative year) determined that hypertension, diabetes, or bariatric complications were not different between the two groups.[27] This also included neonatal outcomes such as malformations and mean birth weight [3048g (< 12 months) vs. 3123g (> 12 months), p=0.181]. Interestingly, a small

percentage of early pregnancies occurred after infertility treatments (4.8% after clomiphene and 1.9% after in-vitro fertilization), suggesting that clinicians who manage infertility in these patients do not wait 12 months until attempting conception.[27]

Other authors do not recommend waiting if a pregnancy is ultimately desired. Because nutritional deficiencies are less common compared to RYGB, Haward et al do not advise their patients to postpone a pregnancy after AGB.[28] In the first year after bariatric surgery patients adjust to new dietary regimens and body images and may have difficulty in separating post surgical symptoms from common pregnancy symptoms such as nausea and abdominal pain. Given these important adaptations, the majority of opinions urge to delay conception 12–18 months after bariatric surgery to minimize complications from nutritional deficiencies and optimize weight loss. Alternatively, in the event of an early pregnancy, patients can be counseled that overall the outcomes are reassuring, based on limited studies.

What to Expect in a Pregnancy after Bariatric Surgery

Perhaps the greatest concern for a pregnancy after bariatric surgery is maternal nutrition. In general, anemia is a common complication after RYGB surgery (10.2% in one report).[29] and iron deficiency is a common etiology for this. Nutritional deficiencies are also common in pregnancies after bariatric surgery. One report of 39 pregnancies described the following protein and micronutrient deficiencies – 53.4% vitamin B_{12}, 16.1% folic acid, 6.7% iron, 41.7% ferritin, 16.7% calcium, and 10.3% albumin.[23]

Most literature on other pregnancy outcomes after bariatric surgery supports the concept that risk in pregnancy is not significantly increased after bariatric surgery. However, the published articles usually have small numbers (largest to date is 298 deliveries after bariatric surgery) and varying control groups including obese women without prior bariatric surgery[30,31] vs. matching to their most recent pregnancy before surgery[30,31,24] vs. a comparison by BMI vs. a comparison to a normal BMI or the general population.[31,33] Common themes among these reports are less hypertension (gestational and preeclampsia combined) and diabetes in pregnancies after bariatric surgery with lower occurrences when compared to obese cohorts that did not have bariatric surgery, but higher compared to a general or non-obese cohort.[34]

Cesarean delivery data are conflicting but the overall trend is that of increased cesareans after bariatric surgery. For example, more than two-thirds of 39 pregnancies conceived after bariatric surgery in a single center were delivered by cesarean.[23] In another study, cesareans after bariatric surgery increased even after controlling for prior cesareans, continued obesity, infertility, and macrosomia.[33] Furthermore, Lapolla et al reported 28.2% cesareans in 858 normal-weight pregnancies, 65.8% cesareans in 120 obese pregnancies, and 45.9% cesareans in 83 pregnancies after AGB.[34] However, several studies have reported no difference in cesareans.[25, 26, 30, 35] There is not a known physiologic reason for performing more operative deliveries among patients after bariatric surgery. The findings may be related to a care-giver bias and should also be interpreted in the context of the increasing cesarean section rate nationwide.[36]

An improvement in obesity related co-morbidities during a pregnancy after bariatric surgery is not surprising assuming that weight loss has occurred. However, the impact on neonatal

outcomes is less clear as the presence of nutritional deficiencies and anatomical changes might impact placental and fetal development and manifest as abnormal fetal growth or congenital abnormalities.

Reports of infant birth weight should be interpreted with caution. In general, there is a trend for more small for gestational age (SGA) infants and fewer large for gestational age (LGA) infants with a lower mean birth weight in pregnancies after bariatric surgery.[11, 26, 31, 37] This could be concerning given the potential for smaller infant weight being due to nutritional deprivation. However, the findings often did not reach statistical significance[31, 37] and the reported occurrences of SGA were still lower than what would be expected in the normal population.[11, 31, 37] Furthermore, Lapolla et al reported no differences in SGA infants when pregnancies after bariatric surgery were compared to obese and normal weight groups.[34] This was also true in a group of patients that lost weight during the pregnancy – 0% SGA in the weight loss group compared to 2.9% in the group that gained 0-10 kg.[34] If a decrease in birth weight represents a loss of nutrition from metabolic changes or it increases risk for future complications (i.e. adult chronic diseases such as hypertension or diabetes in the offspring), then this would have an important consequence. However, it is possible that the reported changes in birth weight profiles represent a redistribution to the normal population. Further study is needed to determine the long-term consequences of a pregnancy after bariatric surgery. Although the numbers are limited, bariatric surgery does not alter perinatal mortality or congenital malformations.[33]

The perinatal outcomes after bariatric surgery should also be interpreted in the context of the patient's BMI at the time of pregnancy. Many patients are still obese after bariatric surgery. For

example, LaPolla et al report a mean prepregnancy BMI of 35.0 kg/m^2 and 41% of patients were still obese in the pregnancy that followed bariatric surgery.[34] This finding may explain the persistent high rates of complications such as hypertension and diabetes, and also impact pregnancy counseling regarding the risk for adverse outcomes.

How to Manage a Pregnancy after Bariatric Surgery

Similar to management in preparation for and after bariatric surgery, the approach during pregnancy should continue to be multidisciplinary with an emphasis on consultations from the nutritionist and surgeon. Patient education regarding nutrition and clinical management to prevent and detect nutritional deficiencies is key.[38] Furthermore, bariatric surgery is not a guarantee for weight loss, so many of these patients continue to require medical care for co-morbidities.

There are several case reports of unexpected vitamin deficiencies (i.e. vitamin K after RYGB leading to neonatal hemorrhage, vitamin B_{12} leading to failure to thrive in a breastfed infant) and adverse pregnancy outcomes.[39-40] For these reasons, ensuring appropriate maternal nutrition before and after delivery takes precedence in prenatal care. The etiology for deficiencies vary from decreased intake of certain foods due to intolerance (i.e. red meat), decreased gastric acid secretion (attributed to fewer parietal cells), and duodenal exclusion (bypass of absorption site).[41-44] Folic acid deficiency can occur as a result of decreased gastric production of hydrochloric acid which ordinarily allows for absorption of folic acid in the upper third of the intestine.

There is no standard approach to screening and treating deficiencies during a pregnancy after bariatric surgery. As such, the approach mirrors what is recommended for the non-pregnant bariatric population. These guidelines also differ according to the type of bariatric procedure with a closer surveillance of nutrient deficiencies after malabsorptive (i.e. RYGB) procedures. Selective nutritional deficiencies are less common after AGB.

The following recommendations are evidence-based recommendations for the nutritional management of the post-bariatric surgery patient from a task force of the American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic and Bariatric Surgery.[45]

For the non-pregnant population, at least 60g of protein daily are required. The recommendations also state that a daily long-term vitamin and mineral supplement be considered, with malabsorptive procedures (RYGB, gastric sleeve, BPD) requiring more replacement. Furthermore, according to best practice guidelines, a daily multivitamin and calcium with vitamin D is recommended for all bariatric surgery patients.[46] Calcium carbonate is available in chewable forms but should be taken with meals to enhance absorption. Calcium citrate preparations are preferred in bariatric surgery patients because they are better absorbed when gastric acid production is diminished.[47-49] Iron deficiency is thought to increase over time with >50% of patients having low ferritin levels several years after bariatric surgery.[38] It is also more common in women with menorrhagia. As such, empiric iron supplementation is recommended. Modified guidelines from Mechanick et al for supplementation in the pregnant population are summarized in Table 1.[45] Of note, the majority of the supplements are contained

within a single prenatal vitamin. Recent guidelines for non-pregnant patients after bariatric surgery have also been suggested by The Endocrine Society. The goals for nutrition and supplementation along with laboratory monitoring are similar.[38]

Periodic clinical and biochemical monitoring is recommended after malabsorptive types of bariatric surgery even if patients tolerate their diet well without vomiting or diarrhea. This is so that subclinical nutritional deficiencies can be detected prior to the development of overt deficiencies. Testing includes a complete blood count, glucose, electrolytes, and creatinine every 3 months for the first year after surgery and tests for nutritional deficiencies (albumin, iron, vitamin B_{12}, folate, calcium, and vitamin D) every 6 months in the first year and then repeated yearly. Restrictive procedures such as the AGB may also require testing and supplementation if there is decreased intake or poor tolerance to certain foods or food groups. Modified guidelines for laboratory testing in the pregnant population are summarized in Table 1. In pregnancy, one option is to perform these tests once a trimester if the levels are normal. Abnormal levels or persistent deficiencies despite supplementation would require additional testing and management in consultation with the bariatric surgery team.

One of the routine recommendations after bariatric surgery is to minimize or eliminate the intake of simple carbohydrate-dense foods and beverages after RYGB as these can precipitate dumping syndrome (a group of symptoms including abdominal pain, cramping, nausea, diarrhea, lightheadedness, flushing, tachycardia, and syncope). It is thought that these symptoms occur as a result of gut peptides released when food bypasses the stomach and enters the small intestine directly.[50] As such, an alternative method to the 50g glucola for gestational diabetes screening is

recommended. One example includes home glucose monitoring with fasting and post-prandial values during one week in the 24-28 week period.

For pregnancies after AGB, one of the issues that arises is how to manage the band. Common practice is to deflate the band either prior to or early in the pregnancy to lessen complications such as band migration and nausea and vomiting in pregnancy.[22, 51-53] Some groups do not routinely release the band except when complications develop such as vomiting or lack of weight gain.[27,34] In these cases, it is common for the practice to be individualized and performed in consultation with a bariatric surgeon.

The literature continues to describe case reports of surgical complications during pregnancies after bariatric surgery including adhesions, internal hernias, small intestine ischemia, and band slippage.[54-56] Unfortunately there are no preventive measures to avoid these complications and they are known to occur in a small percentage of patients after bariatric surgery. Two maternal deaths, attributed to a delay in diagnosis and management of complications, have been reported.[58,59] As such, early recognition and treatment is key. Abdominal pain in a bariatric surgery patient is considered an emergent condition, regardless of a pregnancy. Other common complaints during pregnancy such as nausea and vomiting should be carefully evaluated. Table 2 summarizes the recommendations for prenatal care in a pregnancy after bariatric surgery.

Conclusion

Pregnancy outcomes after bariatric surgery tend to approach those of the general obstetrical population. Special considerations are necessary in the management of a pregnancy after

bariatric surgery. Further research should consider a greater role for bariatric surgery in improved pregnancy outcomes along with the long-term impact on offspring.

Table 1. Guidelines for Supplementation and Laboratory Testing in a Pregnancy after Bariatric Surgery

Deficiency	**Laboratory Testing**	**Treatment if Deficient or Not Responsive to Oral Supplements**	**Routine Supplementation in Pregnancy**
Protein	Serum albumin	Protein supplements	60g protein/day in balanced diet
Calcium	Total and ionized calcium, Parathyroid hormone		1200 mg/d calcium citrate in addition to prenatal vitamin
Folic acid	Complete blood count, folic acid level	Oral folate 1000 μg/d	400 μg/d contained in prenatal vitamin
Iron	Complete blood count, serum iron, ferritin, total iron binding capacity	Parenteral iron; Consult with nutritionist or hematologist	Ferrous sulfate 300mg 2-3 times/day with vitamin C in addition to prenatal vitamin
Vitamin A	Vitamin A levels	Vitamin A supplements should not exceed 10,000	4000 IU/d contained in prenatal vitamin

		IU/d in pregnancy	
Vitamin B_{12}	Complete blood count, vitamin B_{12} levels	Oral crystalline B_{12} 350 μg/d or 1000-2000 μg IM every 2-3 months; Consult with nutritionist	4 μg/d contained in prenatal vitamin
Vitamin D	25-hydroxy vitamin D	Calcitriol oral vitamin D 1,000 IU/d	400-800 IU/d contained in prenatal vitamin

* **Adapted by permission from Macmillan Publishers Ltd:** Mechanick JI, Kushner RF, Sugerman HJ, et al. American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic and Bariatric Surgery Medical Guidelines for Clinical Practice for the Perioperative Nutritional, Metabolic, and Nonsurgical Support of the Bariatric Surgery Patient. Perioperative bariatric guidelines. Obesity. 2009;17:s1-s70.

Table 2: Summary of Recommendations for Prenatal Care in a Pregnancy After Bariatric Surgery

Recommendation	**Suggested Approach**
Continue multidisciplinary approach to treatment of obesity	Consultation with bariatric surgeon, nutritionist, and others members as needed
Assessment of baseline nutritional status	Refer to Recommendations in Table 1
Micronutrient supplementation as needed	Refer to Recommendations in Table 1
Counseling on risks of obesity in pregnancy, if still obese	Risks of obesity in pregnancy: Birth defects, gestational diabetes, preeclampsia, fetal growth abnormalities, stillbirth, cesarean delivery, operative infectious morbidity
Alternative screening for gestational diabetes for pregnancies after malabsorptive-type surgeries	One week of home glucose monitoring (fasting and 2-hour post-prandials) during the 24-28 week period

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